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**Serious and Adventure Video Games as Tools in the Deaf
Education of Children**

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Abstract

Deaf education is characterized by specific challenges and needs. Studies showed, that deaf and hard-of-hearing children experience special difficulties in two fields – in learning a national verbal language, and in problem-solving. At the same time, video games are popularized in schools. However, in the education of deaf children, the use of games is hampered by accessibility issues.

The main purpose of this master's thesis will be to verify whether video games could prove to be a proper additional method of teaching in the case of deaf and hard-of-hearing children, and what features should an educational video game have to meet the availability conditions. The research will be done on both serious and adventure games and will show which genre works better for developing which skills. Particular attention will be given to design guidelines for deaf-accessible games.

Two research methods will be used for the purposes of this work. Qualitative research and discourse analysis of games. The qualitative research will consist of an open-ended questions survey among English-speaking and Polish-speaking teachers who work with deaf children, in order to get to know their attitudes towards games, main obstacles, and needs. The discourse analysis will be focused on two serious games, *Prodigy* and *Wordwall*, and on one adventure ASL-accessible game *Deafverse*.

Based on the research, it will be explored, how, through using video games, modern education can meet the challenges of young deaf students and make learning more absorbing and effective.

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- Patrycja Maria Pankau

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Chapter One: Research Overview

1.1. Introduction

As a primary school teacher's daughter, I had the opportunity to grow up in an educational environment. My mother has been working at the same primary school for deaf and hard-of-hearing children in Gdynia (Poland) for thirty years. Throughout her work experience, she has noticed significant changes in children's behavior, communication, and learning skills. One of her main observations is that, in general, children in the 1990s were more calm, patient, and focused on lessons, while children who started their education in the 2010s and 2020s seem to be hyperactive, having problems with concentration and learning. Compared to 1990s students, today's children are more distracted, disorganized, and bored while studying. However, some educational challenges have become universal – deaf children have always been struggling the most with two issues – language and problem-solving.

At the same time, from the 1990s till now, an extremely dynamic technological development has been observed. The entertainment of the youngest generation has been increasingly dominated by smart technology, social networks, and streaming services. Digital space has become a natural environment for modern children. However, although children are well-versed in video games for entertainment, the aspect of video games in their education is still being ignored.

Knowing the observations of a teacher with thirty years of experience, bearing in mind the technological development observed over the last thirty years, and remembering how familiar digital technology is for the newest generation, I began to think about possible solutions for deaf children's educational problems. Perhaps, modern children seem to be less focused on lessons conducted in a traditional form, because their natural environment – the world of digitality, is characterized by more stimuli. This supposition led me to wonder if the use of video games tailored to the needs and cognitive abilities of deaf children, could help them learn in a more effective and absorbing way. Considering the considerable impact of digital technologies and believing that despite many threats, they can also bring many benefits to mankind, I would like to verify whether video games could prove to be a valuable addition to traditional teaching in the case of deaf and hard-of-hearing children. I state that the use of

interactive digital media such as video games in the education process can be an effective pedagogical method for teaching the youngest generation of deaf and hard-of-hearing people.

In this master's thesis, I will focus on the two main educational problems of deaf and hard-of-hearing children, thus on language learning and problem-solving skills, and I will present two genres of video games to contribute towards solving these problems. Specifically, I will propose serious games can be used to help deaf and hard-of-hearing children learn a national verbal language, and adventure games can develop their problem-solving skills. The games are not currently being used in deaf education as much as they could be, as the majority of the games available on the market do not meet all the needs of deaf children (Cano et al. 2021, p. 2).

1.2. Statement of the Problem and Significance

The problem of learning difficulties among deaf children, being a result of disability, is not relatively new. However, the idea that video games can be a solution to this problem, is not very popular. Moreover, the field of video games for people with disabilities, especially for deaf players, still has not been very well-researched and remains a niche area. Even though this issue has started to be described in the scientific literature in recent years, there are still some gaps in this field. The offer of games intended for deaf users, both educational and entertaining, is very limited. Therefore, there are many gaps in research regarding these kinds of games, and games are often not considered effective tools for teaching hard-of-hearing children. Thus, I would like to extend the currently existing research on this phenomenon with my own work. I would like to devote this paper to help resolve these problems. As my main goal was to create a thesis helpful not only for digital culture studies but also for pedagogy, I want to contribute at least to a small extent to solving the problems with learning among hard-of-hearing children. Believing that humanity can benefit from new technologies, I decided to propose video games as an effective learning method for deaf children – under the condition that the games meet certain criteria researched and discussed in this work.

I hope my research will be useful for people working in special education and will help them choose adequate methods to teach children with hearing disabilities in a more effective way. Also, I hope that in the future my thesis will be extended by further research by me or

other researchers, in order to contribute to improving the deaf part of society through using new technologies. I believe that thinking about the development of technologies and their impact on the generations of humanity, one cannot forget about groups with special needs. One such group is the Deaf community and I would like to focus on its members in this master's thesis. Digital tools, in particular video games, will be presented as a solution for the educational problems of deaf youth. Deaf people should not be excluded from technological possibilities of self-improvement and entertainment. Moreover, specific tools designed to meet their needs should become a norm in digital culture.

1.3. Research Questions

The main purpose of this master's thesis will be to verify whether video games could prove to be a proper additional method of teaching in the case of deaf and hard-of-hearing children. Finding the advantages of new technologies, as well as checking the effectiveness of video games in learning and cognitive processes will be also important. Therefore, the main research questions are:

1. How, through using video games, can modern education meet the challenges of young deaf students and make learning more absorbing and effective?
2. What features should a game have to be accessible to deaf and hard-of-hearing players?

It will be also necessary to ask the following sub-questions:

1. How to create a video game that would be useful for deaf and hard-of-hearing students?
2. Can elements of games designed for people without disabilities be helpful for deaf and hard-of-hearing people? How?
3. Can adventure games be considered a tool helpful in the education of deaf and hard-of-hearing students? Why?
4. What is more efficient? Serious or adventure games? In which aspects?

1.4. Methodology

The methodology used in my master's thesis will consist of two methods: qualitative research in the form of open-ended questions surveys and discourse analysis of selected video games. The combination of these two methods will make it possible to identify current needs and challenges in the education of deaf and hard-of-hearing children. I will check the status of using games in schools, analyze the characteristics of existing video games, and identify the level of games' accessibility. I hope that the research will lead not only to identifying problems but also to finding solutions and making video games more popular in deaf children's education. Then, in Chapter Five of this master's thesis, I will discuss the results of my research and contrast them with the theoretical framework presented in Chapter Two. The discussion conducted in Chapter Five will lead to finding a solution to the educational problem of deaf youth, and to answering research questions present in this chapter.

1.4.1. Qualitative Research

According to Juliet Corbin and Anselm Strauss (2008, p. 11), "qualitative research allows researchers to get at the inner experience of participants, to determine how meanings are formed through and in culture, and to discover rather than test variables". One of the qualitative research methods is an open-ended question survey. Hamed Taherdoost (2019, p. 2) defines an open-ended question as "one in which the respondent does not have to indicate a specific response". As he adds, "open questions have a tendency to generate lengthy answers. Often, respondents see open questions as an opportunity to respond to a question in detail. The advantage of open questions is that they allow the respondent to provide an answer that is not restricted to a select view" (Taherdoost, 2019, p. 2). As my goal was to get to know as much as possible about the use of video games in deaf children's education, teachers' preferences, as well as their possible concerns and limitations, I decided to conduct an open-ended questions survey among the teachers who are specialized in working with deaf children. I asked eight open-ended questions to teachers working with deaf children. The surveyed teachers have one important thing in common – they are all specialists in the education of the deaf. But there is also one difference between them. Half of them are English-speaking teachers who answered the survey via a link posted by me on specific Facebook groups. The other half are Polish-

speaking teachers who work at the same school dedicated to deaf children in Poland and received the survey directly.

The research process and outcomes will be presented in detail in Chapter Three of this master's thesis. As a result of the observations of the respondents, it will be possible to get to know the perspective of experienced workers of schools for deaf and hard-of-hearing children. The survey will show the teacher's attitude toward using video games as a teaching method and their possible effects on teaching. Knowing the answers, I will have an overview of the needs of both deaf players and their educators, which will be helpful in proposing problem solutions.

1.4.2. Discourse Analysis of Selected Video Games

Although a video game may seem to be a medium that does not have any linguistical connections, it is possible to identify some features of the game that can be compared to the characteristic of language. As James Paul Gee (2015, p. 19) explains, if a game has grammar, semantics, packaging, sequence or flow, and situated meanings, determined by social and cultural knowledge, it becomes similar to a language. It therefore can be analyzed through the prism of discourse analysis. However, it is important to note that in the case of video games, language is not understood literally – as a system of sound signs used by members of a given nation or society to communicate. Rather, as Gee highlights, “we are talking about games as multimodal forms of digital-human interaction within a system with syntax and semantics and open to discourse analysis in a linguistic sense” (Gee, 2015, p. 21). Moreover, as Gee argues, the ways of packing and sequencing things, as well as the kind of reference of situated meanings toward context and culture in video games, work in similar ways to language (Gee, 2015).

Therefore, discourse analysis of video games can be explained as “a language-like analysis of the structure and meaning of video games” (Gee, 2015, p. 24). It is used to explore how situated meanings work in games, and if the shapes and actions adopt comprehensive meanings in contexts of play, especially in the contexts of the order, sequences, and flow of screens. Playing the game, through choices and actions, the users create sequences and contexts in their minds, and then they take on meanings. The player interacts with the game, and the process is similar to having a conversation with someone, where both sides respond to each other. What is worth noting, in the case of video games, a goal and affordances are very

important aspects of interaction with the world. But the willingness to accomplish specific goals appears also in conversations, which makes games even more similar to language (Gee, 2015).

In Chapter Four of this master's thesis, I will conduct a discourse analysis of selected video games (*Prodigy*, *Wordwall*, *Deafverse*) in order to verify their effectiveness in educating deaf children. The purpose of the analysis will be to demonstrate how a deaf player's relationship with a game can serve educational purposes. Analyzing the video games' structure and meanings, I will show how these games can be considered effective and absorbing educational tools for hard-of-hearing children, and what elements still need to be improved. I will look at the games' elements, such as grammar, semantics, packaging, sequence, and meanings situated in social and cultural contexts (especially in the context of a deaf community), and then find what features of a video game make it accessible to deaf players. A very important part of the analysis will be to show the game's usefulness in teaching language and developing problem-solving skills, as these two issues are considered deaf and hard-of-hearing children's most important educational challenges. As the analyzed games include both those designed specifically for hard-of-hearing players and those that are intended for universal use and not focused on deaf players, it will be possible to answer the question: How can elements of games designed for people without disabilities be helpful for deaf and hard-of-hearing people? Moreover, two of the games are serious games, and one of them is an adventure game, which makes it possible to verify if adventure games can also be considered a tool helpful in education, and what kind of game is more effective in the case of teaching deaf and hard-of-hearing children.

In addition, I will enrich the analysis of the games by looking at their features through the prism of accessibility. It is necessary, as the tools used in the education of deaf children (in this case, video games) should be accessible and designed to meet specific needs caused by players' disabilities. The point of reference, in this case, will be the video game design guidelines discussed in section 2.9. of this master's thesis.

1.5. Defining Deaf, deaf, and hard-of-hearing

Writing about a specific group of people requires the use of professional nomenclature accepted by that group. Therefore I need to highlight that in this master thesis, I will use three terms: *deaf*, *Deaf*, and *hard of hearing*. The term *deaf* means the audiological condition of not hearing. The uppercase *Deaf* is used to describe a particular group of deaf people who share a

language (sign language) and a culture (Padden and Humphries, 1990). The term *hard of hearing* “can denote a person with mild-to-moderate hearing loss. Or it can denote a deaf person who doesn’t have/want any cultural affiliation with the Deaf community. Or both. The HOH dilemma: in some ways hearing, in some ways deaf, in others, neither” (National Association of the Deaf 2019). The selection of terms is justified by the official position of the deaf and hard of hearing community which can be found on the official website of The National Association of the Deaf (NAD), “the nation’s premier civil rights organization of, by and for deaf and hard of hearing individuals in the United States of America” (National Association of the Deaf 2019). As it can be read on the website:

“Deaf and hard of hearing people have the right to choose what they wish to be called, either as a group or on an individual basis. Overwhelmingly, deaf and hard-of-hearing people prefer to be called *deaf* or *hard-of-hearing*. Nearly all organizations of the deaf use the term *deaf* and *hard-of-hearing*. (...) Over the years, the most commonly accepted terms have come to be *deaf*, *Deaf*, and *hard-of-hearing*” (National Association of the Deaf 2019).

However, I need to highlight that some academic sources that I will refer to in this work, misuse the term *hearing-impaired*. Misuse of this term in many academic papers is caused by good intentions – it is a term that was at one time much preferred by hearing people because it seemed to be politically correct (National Association of the Deaf 2019). Considering it a euphemism, academics wanted to show respect to a group of deaf people by using this word. For this reason, this concept may appear in some of the sentences I quoted. It was a well-meaning term, however, was not accepted by deaf and hard-of-hearing people. I would like to point out that the term *hearing-impaired* is incorrect and can be considered offensive. According to the official position of NAD,

“for many people, the words *deaf* and *hard of hearing* are not negative. Instead, the term *hearing-impaired* is viewed as negative. The term focuses on what people can’t do. It establishes the standard as *hearing* and anything different as *impaired*, or substandard, hindered, or damaged. It implies that something is not as it should be and ought to be fixed if possible” (National Association of the Deaf 2019).

Therefore, in this work, I will use the terms *deaf*, *Deaf*, and *hard of hearing*, depending on the specifics of the described problem. The term *hard of hearing* may appear only in some cited quotes, for reasons explained above.

Chapter Two: Theoretical Framework

2.1. Introduction

This master's thesis is focused on problem-solution, where the problem is defined as deaf and hard-of-hearing children's educational struggles and video games are specified as a solution. However, before I start proposing video games as a solution for deaf and hard-of-hearing children's educational problems, it is necessary to specify the main issues related to this topic. It is not possible to propose an educational video game for potential deaf players without knowing their needs and challenges. Therefore, first, in this chapter, I will address the main obstacles in the education of deaf and hard-of-hearing children, such as learning a language and developing problem-solving skills. Second, I will present the ludological background in two genres of video games considered in this thesis as a solution for educational problems – serious and adventure games. Then, I will recall theories related to cultural texts for deaf audiences, including sign narrative and game design. I will address all of these issues because without understanding them, it is impossible to work on improving them.

This chapter is a literature review and a presentation of the theoretical framework in the field of deaf children's education and video games. Its' main purpose is to define the main educational struggles in the deaf community, as well as show an overview of game theories. A practical implementation of the theories presented in this chapter can be found in the next parts of this master's thesis: especially in Chapter Four (games analysis) and Chapter Five (discussion).

2.2. Deaf Children and School Challenges

A lack of the sense of hearing causes challenges in the learning process, as in some areas pupils cannot gain knowledge using the same methods as their hearing peers and they need an alternative. Marc Marschark and Peter C. Hauser (2011, p.4), authors of the book *How Deaf Children Learn: What Parents and Teachers Need to Know*, note that “deaf children are often seen as part of a linguistic-cultural minority”. As the main reason for seeing deaf children as a minority having their own linguistics and culture, they point out the fact that “they are part of a community that shares a language, culture, values, and a view of the world that in many ways is different from the hearing majority” (Marschark and Hauser, 2011, p. 4). This is a key

observation, as Deaf communities very often highlight their own separateness and uniqueness. That is why I will argue that cultural texts directed to deaf audiences, and thus also video games aimed at deaf children, should meet specific design and narrative requirements.

As Marc Marschark and Peter C. Hauser highlight, “the deaf children are not just hearing children who can’t hear. Research has shown that their knowledge, cognitive abilities, and learning styles are somewhat different than those of hearing children of the same age” (Marschark and Hauser, 2011, p. 13). Therefore, agreeing with this statement, in this master’s thesis I will try to find an additional learning way for them, in the form of video games designed especially for their needs. Moreover, Marschark and Hauser (2011, p. 55) point out that young children’s knowledge comes naturally from play and interaction with their environment, which supports my hypothesis about using video games as an educational problem-solution –play is an obvious feature of every video game, and every video game has its’ own (in this case digital) environment. The rest of their knowledge, according to the researchers, comes from mental experimentation, for example from thinking about things, understanding how things work and the relations between them, or trying to apply things to real life. The observations of Marschark and Hauser seem to be inspiring to explore the field of video games for deaf and hard-of-hearing young users. As play is considered a natural source of knowledge, it is obvious that video games may be a useful teaching tool. The question, however, is: how? There is no doubt that a good educational game should meet the specific needs of deaf players. What needs and in what ways? I will try to answer these questions further in this thesis, proposing that, as language and problem-solving are the two most important challenges for deaf children, video games can contribute to developing these skills.

2.3. Language

The most important challenge in the education of deaf children is learning the language. The sign language used by most deaf people is non-verbal and has its own grammar structure that is often different from the national verbal language. Therefore, it is challenging to teach deaf children the national verbal language used by hearing people. According to Magdalena Zdrodowska (2014, p. 182), deaf people are subjected to educational activities which are often focused on competencies in the national verbal language. In the case of deaf pupils, the national spoken language is very often taught as a foreign language. It is proven that “when deaf children find a new word they will not understand its meaning until it is visualized” (Cano, et

al., 2021, p. 5), therefore teachers should use visual methods, such as symbols, graphics, images, and physical elements in order to help pupils relate concepts to words (Cano et al., 2021, p. 5).

Learning a verbal language in the case of deaf children requires more time than in the case of hearing children, and very often this process is supported by specialist speech therapy and revalidation classes. Usually, programs are tailored to the needs of students and are conducted on different levels. The spoken language is taught through the use of varied methods, such as individual letter sounds and syllables, or, at a more advanced level, whole-word pronunciation methods. Speech training sessions usually take the form of individual meetings with a therapist who models the correct articulation and gives feedback to the student (Cano, et al., 2021). As Marschark and Hauser point out, “the goal of speech and speechreading training should be to allow deaf children to take advantage of the most information possible and have access to the full range of opportunities offered to hearing children” (Marschark and Hauser, 2011, p. 51). Thus, although sign language is a basic communication tool in the case of deaf children, the willingness to develop verbal language skills should remain, as it gives them more possibilities and makes the surrounding world more understandable. When it comes to the eventual role of video games in this matter, it would be worthwhile to design a game that could be used as a supportive tool in speech therapy. For example, the game would consist of tasks involving saying aloud the name of an item seen on the screen. When an item appeared on the screen, the player would have to use a microphone and say the word aloud.

Nevertheless, challenges appear not only in teaching deaf and hard-of-hearing children a verbal language, but they exist also in the case of teaching sign language. The complexity of sign language is well described by Marschark and Hauser:

“Almost every country has its own sign language. Some countries have more than one, corresponding to their multiple spoken languages. Like spoken languages, signed languages vary widely, having their own accents and dialects (...). In any case, deaf children’s exposure to a natural sign language is very different from exposure to signs systems, which are based on spoken language grammars and usually designed to help deaf children learn to read” (Marschark and Hauser, 2011, p. 44-45).

Sign language is a basic communication tool used by deaf and hard-of-hearing people. However, in the case of teaching many sign languages, there can be found many impediments. As the authors of the article *Serious Game as Support for the Development of Computational*

Thinking for Children with Hearing Impairment pointed out, “there is a lack of technological artifacts to support teaching and learning of the Brazilian Sign Language (Libras) for the Deaf, their families, and their teachers. This shortage is observed at all levels of formal education” (Cano et al., 2021, p. 2). Although the scientists focus on the communication of deaf people living in Brazil, their observations can be considered universal and applicable to the rest of the world. As they add, this is not an isolated problem affecting only users of niche sign languages, but this gap exists even for American Sign Language, despite the fact that ASL is, as they say, “the language that has the greater variety of technological support tools” (Cano et al., 2021, p. 2). This is a complex problem that needs concrete solutions. Creating serious games for learning sign language would be an attractive and effective tool.

One of the reasons for the lack of sufficient tools for learning sign language is the fact that sign language became the subject of scientific research in the second half of the 20th century. Before that time, no attention was paid to sign language in the scientific community. In 1960, William Stokoe released the *Sign Language Structure*. In *A Dictionary of American Sign Language on Linguistic Principles*, published five years later, the name American Sign Language (ASL) appeared in official use for the first time. Since then, sign languages have started to be treated as independent systems with their own vocabulary, idioms, and (spatial) grammar, and not as a simple translation of verbal languages (Zdrowska, 2014, p. 179). It then can be said that since attention to sign language began only a few decades ago, the devices that could support its learning have not yet been refined. However, this argument can easily be disputed. Similar to sign language studies, many scientific fields are relatively new, including digital culture and game studies, but despite it, these fields have been fastly developed. I believe that it is possible to combine relatively new studies on sign language with new studies on video games, and on this basis, create a new tool that benefits both disciplines – a video game teaching sign language. However, one problem can appear – due to the diversity of sign languages, each country would need its’ own version of a game. In the case of sign language, preparing a translation is more difficult than in the case of written or verbal language. For instance, if the main character of a game was a human-like avatar using sign language with hands, it would be difficult to replace the avatar with a new one in a different language version.

As Magdalena Zdrowska (2011, p. 178) pointed out, the main feature of sign language is the use of gesture and face, which does not refer to sounds, but visualize objects, persons, and activities. Thus, sign language calls primary forms of communication, both from an individual (gestures and facial expressions) and collective (the oldest forms of communication-

based on gestures) perspective. Despite its innovation, I consider the medium of video games a tribute to primary forms of communication, and therefore a thing similar to sign language in this matter. One of the main features of video games is their visuality. Going more into detail, video games, similar to sign language, make connotations and denotations by visuality. Moreover, in the case of multiplayer games, a collective form of communication appears. Equipping a multiplayer video game with sign language would make the aspect of primary communication even stronger. This kind of game would be therefore not only an educational tool, but also a communication tool for deaf people, and a cultural property of their community.

2.4. Problem-Solving Skills

The fact that deaf children's language skills are limited, makes their computational thinking skills development more challenging, and many differences between hearing and non-hearing children in problem-solving ability have been found (Cano et al., 2021, p. 3). The authors of the article *Serious Game as Support for the Development of Computational Thinking for Children with Hearing Impairment* have conducted research on serious games for deaf and hard-of-hearing children between 7 and 11 years old. They pointed out that “children with a hearing impairment have a visual–spatial–perceptual deficit, in which the acquisition of reading, writing and social development skills is delayed. They have low scores in evaluations such as problem-solving, logical thinking, and reasoning” (Cano et al., 2021, p. 2). This research leads to the conclusion that, next to language problems, undeveloped problem-solving skills are the main obstacle for deaf and hard-of-hearing children.

Moreover, as the researchers highlight, deaf children experience particular difficulties with communication, socializing, and planning. It is very important to mention that even children who use a cochlear implant have specific problems with knowledge acquisition. Due to the fact that they encode and process information through the implant, they struggle with information processing and with other areas, among which the following can be mentioned: perception, learning, memory, attention, language processing, and even emotional control, planning, and organization (Cano et al., 2021, p. 2).

According to Ian Bogost, “playing a role constrained by a model in a credible world allows video games to make complex problems relevant and put them in the context” (“Ian Bogost on Serious Games (Full)” n.d.). Therefore, it is undeniable that video games, especially adventure games consisting of many tasks, lead to developing problem-solving skills. If a user,

in that case, a deaf child, plays an adventure game, by identifying herself/himself with the main character, she/he encounters various problems that need to be solved. Thus, adventure games can be proposed as an effective and attractive tool for developing problem-solving skills among deaf youth. This issue is explored in more detail in part 2.6.2. of this chapter.

2.5. Cognition and Interaction

The absence of one sense makes it difficult not only to learn a language or to develop computational thinking, but it also impairs general cognitive abilities. As a result, the acquisition of knowledge by deaf children requires much more effort than in the case of hearing children. However, the role of experience in a learning process is very meaningful and teaching methods considering experience can be very effective. As Marschark and Hauser highlight, “exposure to a variety of experiences and environments is an essential part of children’s development, both their hardware (brain) and software (knowledge and strategies)” (Marschark and Hauser, 2011, p. 92). Some research committed that stimulation for many toys or other kinds of engaging entertainment, as well as active exposure to the environment, supports neuron development (Marschark and Hauser, 2011, p. 92). In a lecture on serious games, Ian Bogost (“Ian Bogost on Serious Games (Full)” n.d.) also pays attention to the role of experience in a teaching process. He introduces the concept of *performance before competence* and explains it as trying things out not knowing how to do them, and not knowing possible right strategies and solutions, but discovering them through the given experience to experiment. This is exactly a phenomenon of incidental learning, described below in this subsection.

Thus, it can be said that play experience supports greatly aids the process of getting knowledge. During the play, kids play different roles and experience many stimuli. When it comes to video games, the experience is even stronger, as while playing, the phenomenon of immersion in the world presented in the game occurs and flow also intensifies. Therefore, in this master’s thesis, I will propose video games as a very important and useful educational tool, that leads to the acquisition of knowledge through experience.

When it comes to learning through experience, it is necessary to mention two terms: intentional and incidental learning. As Marschark and Hauser explain, “intentional learning is what happens in situations in which a child either is given information by someone else or gets it for herself (for example from a book, a game, or another person) with the goal of remembering or using the information later” (Marschark and Hauser, 2011, p. 67). I would suggest that

serious games are a tool of intentional learning. Meanwhile, incidental learning, according to the researchers, “refers to the *accidental* learning that goes on all the time simply by virtue of being awake and interacting with the world (for example, when reading a book for pleasure)” (Marschark and Hauser, 2011, p. 67). Thus, I am leaning towards the theory that adventure games are the medium of incidental learning.

As in this master’s thesis, I want to propose the statement that video games can be considered effective learning tools for deaf and hard-of-hearing children, at this point I would like to specify my main assumptions. First, after identifying two main challenges in deaf children's education, which are learning language and developing problem-solving skills, I would like to suggest that serious games can be supportive tools in teaching a language (both verbal and sign), while adventure games may be an effective support for developing problem-solving skills. Second, I believe that serious games can do so by being directly related to intentional learning, while adventure games do so by having features conducive to incidental learning.

Moreover, human brain research indicates several cognitive activities. It points out executive functioning as the highest level of cognitive ability, and then activities of the lower level, that are controlled by executive functioning: attention, learning, and memory (Marschark and Hauser, 2011, p. 72). However, scientists point out language fluency as the thing that is absolutely necessary for the development of executive functioning, and because of it, deaf children should be early immersed in the language (Marschark and Hauser, 2011, p. 72-74). At that point, we come back to the problem that has been already signaled earlier in this chapter – the importance of language skills in the process of getting knowledge is extreme, and its correlation with developing other skills, including problem-solving, is fundamental. At the same time, language and problem-solving skills remain the biggest educational struggles of deaf children. However, there is hope to resolve this problem. I would like to propose the statement that language and problem-solving education through video games, both serious and adventure (on intentional and incidental levels) can bring significant educational and cognitive benefits to deaf and hard-of-hearing children. That is because a fictional environment created in adventure games can help children immerse and learn problem-solving in a natural, incidental way. Simultaneously, a serious game that provides tasks purposefully designed to meet specific learning needs, for example, language learning, implements the assumptions of intentional teaching. In addition, it can be considered if adventure and serious games can be combined into

one and thus achieve even better educational results, both in the field of language and problem-solving skills.

2.6. Video Games for Deaf Players in Education

In the article *Video Games in Education of Deaf Children. A Set of Practical Design Guidelines*, the authors state that electronic games are one of the technological artifacts needed for the Deaf, as they are not only a form of entertainment characterized by extensive commercial and cultural success, but they may also be seen and used as efficient educational tools. According to the researchers, “educational video games have the potential to, besides ensuring the advantages of entertainment electronic games, support the teaching-learning process at virtually every subject in any field of knowledge” (Canteri et al., 2015, 122). Therefore, in this master’s thesis, I am arguing that video games can be an effective and helpful tool for teaching deaf and hard-of-hearing children. As Barbara E. Martinson and S. Chu observed, “games are effective tools for learning because they offer students a hypothetical environment in which they can explore alternative decisions without the risk of failure. Thought and action are combined into purposeful behavior to accomplish a goal. Playing games teaches us how to strategize, to consider alternatives, and to think flexibly” (Martinson and Chu, 2008, p. 478). In this master thesis, I am proposing the statement that two different genres of video games can be used in education – serious games and adventure games. Despite many differences in general features, both of the mentioned game genres can serve the same purpose of education, just in different ways explained below.

2.6.1. Serious Games

Robert Picard defines serious games are defined as an “educational application, whose initial intention is to combine, coherently and at the same time, serious aspects, in a non-exhaustive and non-exclusive way, teaching, learning, communication, or even information with the fun aspects of video games” (Picard, 2018, p. 75). Meanwhile, Patrick Felicia sees serious games as a movement that “aims to use new gaming technologies for educational or training purposes. It investigates the educational, therapeutic and social impact of digital games

built with or without learning outcomes in mind” (Felicia, 2009, p. 6). As Felicia adds, “this movement has emerged to meet the needs of a new generation of learners, often referred to as the digital natives, whose distinctive characteristics should be acknowledged in order to ensure successful learning outcomes and motivation on their part” (Felicia, 2009, p. 6). A new generation described by Felicia corresponds to what I mentioned in Chapter One of this thesis – modern children whose natural environment is a digital space. Agreeing with Felicia, and still defending the statement that video games are tools that meet the needs of the modern world and the youngest generation, I will show how important serious games can be in education.

However, despite the awareness of the potential of serious games in education, one cannot be uncritical towards them. Ian Bogost, the author of the book *Persuasive Games: The Expressive Power of Videogames*, lays out three gripes against serious games. Firstly, he observes that serious games try to separate entertainment and seriousness into a simple binary one. He does not agree with this tendency, stating that entertainment can tackle complex and important issues in meaningful ways and at the same time titillate and excite players. Secondly, he accuses serious games of seeming to represent solely the goals of institutions. Thirdly, in his opinion this kind of game issues a drive toward external influence and validation, it is supposed to have a direct, measured, and predictably repeated impact on the world (“Ian Bogost on Serious Games (Full)” n.d.). Recognizing these allegations as accurate, I would suggest that especially in the case of young deaf users (not mentioned by Bogost), serious games should balance educational values with attractiveness and entertainment, as deaf children tend to have attention problems and can get bored if the task or its form is too serious. Regarding the institutional goals mentioned by Bogost, I agree that games should not be under the pressure of any ideology. However, I think that a possible representation of the goals of the Deaf community in a serious game would not be a bad thing. As this community can actually be called absent from the public debate, it would be useful to have an official representation, even if it meant institutionalizing certain features or postulates and including them in a game for young users.

Meanwhile, in the book *Critical Play: Radical Game Design* Mary Flanagan argues that serious games are one of the hardest genres to design, as while meeting educational goals, they must remain enjoyable at the same time (Flanagan, 2009, p. 249). This observation is very relevant when it comes to serious games designed for children, and even more adequate in the case of deaf and hard-of-hearing children. In their situation, serious games need to be tailored to their special needs. As the authors of the paper *Serious Game as Support for the Development*

of *Computational Thinking for Children with Hearing Impairment* (mentioned earlier in this chapter) state, “a balance is required between meeting these needs and the mechanics of the game” (Cano et al., 2021, p. 2). They conducted detailed research on serious games’ features adequate to deaf children's necessities. As a result of their findings, they created a video game *Perdi-Dogs*, and tested its usefulness in developing computational thinking among children. Although in this work, I do not intend to focus on a thorough analysis of this specific game, I consider it necessary to recall general scientific findings of the *Perdi-Dogs* creators. They highlight that it is extremely important to “construct a representation of a task to solve a problem” (Cano et al., 2021, p. 3), as it concerns four issues, such as: understanding the problem; recognition of the goal that should be achieved after solving the problem; considering the possible actions for task solving; and awareness of prohibited elements and the consequences of taking actions which are not allowed (Cano et al., 2021, p. 3). Hereby, they suggest guidelines for a video game that would be useful in developing problem-solving skills among deaf children, which in this thesis is considered the main challenge in deaf children's education.

However, there is no doubt that the most important features of computer games are interaction and immersion. Patrick Felicia highlights that “one of the foremost qualities of digital games is their capacity to motivate, to engage and to immerse players. Digital games include a rich variety of auditory, tactile, visual and intellectual stimuli that make them both enjoyable and, to some extent, addictive” (Felicia, 2009, p. 12). In the case of the effectiveness of a serious game as an educational method, interaction and immersion are extremely important. That is because interaction requires the active participation of the player and his involvement in contact with the game world. This, in turn, entails immersion, which makes the serious game (and thus the entire educational process) more engaging and effective.

The issue of interaction was also mentioned by *Perdi-Dogs* authors. As they observed, currently, children grow up immersed in technology, so this kind of experience is not unfamiliar to them. Therefore, using technology as a learning tool can contribute to an increase in their motivation. Moreover, contact with tangible devices can lead to a significant improvement in children’s working memory and inhibition skills (Cano et al., 2021, p. 7-16).

Bearing in mind all the issues described above, it can be concluded that serious games, although they require some improvements, can definitely be considered an educational tool of the future. In the case of deaf children, they would help develop problem-solving skills, and, as

I state in this thesis help teach other challenging skills, such as language. However, it should be noted that video games for the education of deaf children must be appropriately designed to meet their needs. Such design guidelines will be presented in Section 2.9. of this work.

2.6.2. Adventure Games

The usefulness of games in education is still underestimated and especially forgotten in the case of teaching deaf children. In order to change this trend, I will devote a large part of this master's thesis to adventure games and try to prove that, just like serious games, adventure games can also be an effective and legitimate tool supporting the development of various skills of students.

First, it is necessary to define adventure games. According to Michele D. Dickey, “the adventure genre can be characterized as a problem-solving environment. Players are placed in scenarios in which they must synthesize diverse information and analyze strategies. Within the adventure game genre, the narrative provides two main functions: both motivation and a cognitive framework for problem-solving” (Dickey, 2006, p. 250-251). Reading this quote, one can get the impression that adventure games are an ideal medium for developing problem-solving skills. This problem, next to language, is considered the most important challenge in the education of deaf children. Therefore, it can be said that adventure games can be considered a useful tool in helping deaf children to work on their main struggles.

Reflecting on the adventure game narrative, Dickey distinguishes “two primary literary techniques integrated into the narrative, which provide motivation: plot hooks and emotional proximity” (Dickey, 2006, p. 251). As she explains, “plot hooks are unanswered questions that keep the reader guessing; they are uncertainties that focus the attention of players by planting questions that the player feels compelled to answer” (Dickey, 2006, p. 251), while “emotional proximity is characterized as empathy and identification the player feels toward his or her character in a game” (Dickey, 2006, p. 251). As these two features support the motivation of a player, they definitely are reasons for making a game more enjoyable. An enjoyable play, in turn, strengthens the whole process of getting knowledge and developing skills.

A very important part of Dickey’s paper is the reflection on the informative role of narrative in adventure games. She draws attention to the informative aspect of the narrative that “serves as a cognitive framework for problem-solving” (Dickey, 2006, p. 252). Therefore, in

the case of designing adventure games that can be used to develop problem-solving skills among young deaf players, not only motivational aspects are important, but creating a clear and informative narrative must be also considered. Dickey highlights the connection between the narrative and the player's motivation for the game, concluding that the narrative leads to assigning meanings to the player's experiences, and thus makes players not only read the story but also forces them to take active actions (Dickey, 2006, p. 251). This observation is compatible with the observations described in Chapter Four of this master's thesis, where I conduct a discourse analysis of the adventure game for deaf teenagers *Deafverse*.

Even though adventure games are designed mostly for the purpose of entertainment, not learning, they can be used in education and give satisfactory results. As the authors of the article *Video Games in Education of Deaf Children. A Set of Practical Design Guidelines* write, "even non-educational games ensure several benefits to the children that play them, as improving the physical, mental and creative abilities of the players" (Canteri et al., 2015, p. 122). Patrick Felicia has similar conclusions, believing that even adventure digital games can help deaf and hard-of-hearing people develop some skills. He points out that many popular commercial digital games which were not designed especially for people with an auditory disability may actually be used by them without particularly troublesome difficulties, and notes universal features of commercial games that prevent the exclusion of deaf players: "to make auditory information available to people with an auditory disability, closed captioning is sometimes available in digital games, enabling people to see the meaning of auditory information such as text or sound effects (...). Some other commercial digital games make extensive use of text for dialogues, feedback, or tutorials and are therefore also suitable for people with an auditory disability" (Felicia, 2009, p. 26). This gives an optimistic outlook, that despite the very limited offer of adventure games designed especially for deaf users, it is still possible for hard-of-hearing players to find titles to play. In Chapters Four and Five of this thesis, I will take a closer look at what features of such games work well for deaf players, and which are a limitation and should be redesigned in order to make the play more accessible.

2.7. Culture Texts for Deaf Audiences

When trying to understand the culture of the Deaf community, it is necessary to recall the concept of *face-to-face tradition*, formulated by Benjamin Bahan, that defines the way in

which the Deaf community communicates – in face-to-face situations, in direct interaction (Bahan, 2006, p. 22). Analyzing Bahan's theory, Magdalena Zdrodowska (2014, p. 182-183) notes that the *face-to-face tradition* reflects the type of experience that sign language creativity brings, emphasizing its performative, social, and event character. That is because sign art is realized in a direct meeting, in a situation of collective participation, and in a visual-kinesthetic form. This fact can be considered a hint in designing a game specially dedicated to deaf players – it should be collective, as the Deaf culture is. It is possible to achieve this goal, for example by adding the multiplayer option.

In the article on the forms of linguistic creativity of the Deaf, Zdrodowska (2014, p. 184) draws particular attention to the medium of video and its democratic potential. According to her, the widespread availability of the video medium resulted in an expansion of creativity and reformulated the culture. That is because what had so far been implemented collectively, in public situations, in shared spaces, moved to the sphere of private reception: individualized, media-mediated reception at home in front of a TV or computer screen. However, Zdrodowska focuses mainly on video movies, not video games, which makes it problematic to extend her reflection to the field of video games. Her main point is that through video recording, dynamic and changeable sign artifacts (and performances) take on one final form, and are stabilized, frozen in a form resistant to both the author's and the audience's intervention. She believes that sign art, through its event-like character, is realized in social situations and resembles a theatrical event rather than a written text – no two realizations are the same precisely because of the lively relationship between the performer and the viewers. Zdrodowska (2014, p. 185) believes that this element of spontaneity, reaction to the audience's expectations, and modification of the speech under their influence are deprived by the video recording. In her opinion, video seals the work in the same way that speech stabilizes writing. When thinking about video in a broader context, not only about video movies but extending video theory to video games, I cannot agree with Zdrodowska. Video games, as they are interactive, never have one final save. Moreover, when multiplayer options are available, there is an interaction with other players (including deaf players), and that is where a new form of interaction happens. I am aware that is not a typical *face-to-face tradition*, but rather a remodeled form of primary communication. However, I state that online interaction with other players can be considered returning to the primary form of culture, because the player participates in the game narrative, co-creates the game story, and takes active interactions with other players. I will try to prove it in the next chapter of this master's thesis – the game analysis of selected video games.

Meanwhile, Zdrodowska (2014, p. 187) states that it is easy to imagine animated avatars (created in the likeness of avatars from video games) which would be able to use or imitate sign language. However, she states that this eventual creation would not be successful, as the meaning in the sign language depends too much on the facial expression, body position, and not just the sign of the hand. Thus, the researcher believes that the use of video animation in sign narrative is an issue of the distant future. At the same time, Zdrodowska (2014, p. 187) concludes that sign narratives depend on four features: space, placement, direction, and motion, which I find very close to video game features. Moreover, sign language is regarded as having a non-linear narrative, showing features similar to cinematic language, such as close-ups, departures, flashbacks, and changing points of view (Sacks, 1990, p. 90). The same features can be found in video games. Therefore, I will defend the statement that the medium of video games is adequate space for the realization of the sign narrative and can become a field for the implementation of Deaf culture.

2.8. The Significance of *Flow* in a Learning Process

Earlier in this chapter, the importance of immersion in the educational process and using serious games by deaf children was highlighted. I believe that no phenomenon is as directly related to immersion as the emergence of *flow*. *Flow*, which is a Mihály Csíkszentmihályi's concept, is described as "a condition in which one concentrates on the task at hand to the exclusion of other internal or external stimuli" (Csikszentmihalyi and Larson, 1978, p. 327). As the main factors leading to the state of *flow*, Csikszentmihályi (1978, p. 327) distinguishes: merging action with awareness; clearness of goals; coordinating means to the goals; and immediate and unambiguous feedback to a performance. The fact that clearness of the goal strengthens *flow* should be considered by all designers working on educational video games. As clear goals and immediate feedback make the player more engaged in the game, it results in greater involvement in the performance of tasks, and thus, can make the educational process more effective.

Moreover, the Hungarian-American psychologist writes that a person who experiences *flow* "has a strong feeling of control or personal causation-yet, paradoxically, ego involvement is low or nonexistent so that one experiences a sense of transcendence of self, sometimes a feeling of union with the environment" (Csikszentmihalyi and Larson, 1978, p. 327). According

to Csíkszentmihályi and Larson, the *flow* experience is the main reason of games being “so enjoyable as to be intrinsically rewarding” (Csikszentmihalyi and Larson, 1978, p. 327). At the same time, the scientists point out that “all kinds of serious, work-related activities can also produce *flow* and therefore be intrinsically rewarding” (Csikszentmihalyi and Larson, 1978, p. 327). That is why I defend the statement that *flow* can appear in a learning process. Moreover, I argue that if a learning process takes the form of entertainment (like playing a video game), the probability of the *flow* appearance may be considered even higher.

The *flow* theory has become well-known in the field of game studies and is very often recalled by scientists researching the relationship between the player's involvement in the game and his/her development. For example, Patrick Felicia highlights the importance of *flow* in a learning process, writing that “in this state, provided that they possess sufficient skills, players will strive to achieve their goal, regardless of the challenges” (Felicia, 2009, p. 12). Therefore, it can be stated that *flow* strengthens the whole process of playing a video game, and thus, in the case of educational games, the learning process. In the case of deaf children’s education and play, I find the issue of flow extremely significant, as mentioned in this paper, deaf children tend to be easily distracted and bored, which may cause giving up tasks. The appearance of *flow* prevents a lack of motivation and therefore leads to completing tasks and achieving educational goals.

2.9. Design

As deaf children have special needs, both in education and in the reception of games, it is necessary to consider how game design can make a video game responsive to the needs of the deaf and thus make the learning process more efficient.

Brazilian researchers from the Federal University of Paran and the National Institute of Deaf Education in Rio de Janeiro, authors of the article *Video Games in Education of Deaf Children – A Set of Practical Guidelines* proposed over thirty guidelines for the design of an educational video game for deaf children between 0 to 6 years old. They classified the guidelines into three categories: interface, gameplay, and educational content. In order to clearly present the results of scientists' research, I selected the most relevant guidelines and presented them in the table below:

Interface	Gameplay	Educational Content
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<ul style="list-style-type: none"> • Associating the written language with an illustration. 		
<ul style="list-style-type: none"> • Making the objectives clear. The objectives have to be directly connected to the taught content. • Containing a system of player evaluation and performance records. • While the gameplay task may be difficult, the interface must be simple. 		
<ul style="list-style-type: none"> • Playing tutorials. • Understandable and fast feedback for the players. • The feedback has to be customized to the deaf players. • Meaningful grades or quantifiers of the evaluation system. • The interface elements should be discrete, to not distract players from the main task. • Customization. • Avoiding texts. • Using bold and bright colors. Highlighting the main task. • Using simple language. • Animations and highlights that can 	<ul style="list-style-type: none"> • Making sure that the genre of the game suits the target audience and the taught content. • Various levels of difficulty. • Parting complex tasks into simpler tasks. • Delivering rewards at the appropriate times. • Increasing the required workload over time. • One task at a time. 	<ul style="list-style-type: none"> • Defining what the game is supposed to teach. • Constructing the game from semantic triples (national language, sign language, and illustration).

help pay attention to relevant information.

Table 1. Guidelines for the design of an educational video game for deaf children (Canteri, et al., 2015, p. 124-126).

As can be seen above, the authors of the guidelines draw special attention to the issues of clarity, simplicity, and visibility. Their main goal is to design an educational game with a simple interface, that is easy to use. None of the game elements should be distractive, and adding any extra items should be justified. When it comes to the visual form, it is recommended to use bright colors and highlight the main messages. Other important suggestions apply to feedback, which is supposed to appear at appropriate intervals, be fast, understandable, and customized to the special needs of deaf children.

Meanwhile, Italian academics from the Free University of Bozen-Bolzano and the University of L'Aquila, also conducted research on a game design accessible to a young deaf audience. However, contrary to the researchers whose findings were presented above in this chapter, they were not focused on educational games, but on video games in general. Their findings can therefore be applied to adventure games, for instance. However, as they highlight, video games designed according to their guidelines, may be helpful in the case of improving deaf children's specific skills. They distinguish five areas of the guidelines for designing digital games that are accessible for deaf children: "words; other characteristics and position of textual elements; choices and interaction; feedback; game devices, avatars, and genres" (di Mascio et al., 2013, p. 231). Their findings result from research on deaf children's reading skills, visual attention, focus and social interaction, and memory. Analyzing deaf youth's needs and specific difficulties, they found out what features should the video game have to be accessible. For example, if their studies showed that deaf children generally prefer human-like avatars to others, they suggested that video games designed for the deaf audience should contain this kind of avatar (Vittorini et al., 2013, p. 87). Based on such correlations, the Italian researchers proposed the following guidelines:

1. Words on the Screen

As deaf readers may struggle with identifying unfamiliar words without contexts or introductions, and have problems with recognizing letters and creating representations of abstractive words, the texts in video games should be constructed of familiar words, and draw attention to neighboring words. If it is necessary to use some abstract words, there must be found an easy inference from the context.

2. Other characteristics and position of the text

Key textual messages should be constructed of short and simple sentences. The text should be kept to a minimum and contain only necessary information. Visual clues or animations should be used in order to draw the player's attention to relevant textual information.

3. Choices and interaction

Children with hearing disabilities have difficulties with dividing and recovering attention, as well as with serial recall. Therefore, the offer of choices in a game should not be too wide, and items should remain in the same position and order. Any kind of stimuli on the screen that may distract players from the main task should be avoided. Moreover, there must be no more than one task at a time.

4. Feedback

In the case of educational games for young deaf players, the issue of feedback is very important, as children are generally impatient and can get unmotivated quickly if they are not informed about their progress in proper time. The lack of feedback can cause confusion, and children can repeat their actions, waiting for something to occur on the screen. Therefore, the feedback should appear immediately, and it is a good idea to enrich its' form with additional functions attractive for deaf players, for example, vibrations or motioning objects. At the same time, it is necessary to consider that deaf children are more impulsive than hearing children. Thus, the feedback must be well-balanced, not leading to players' overreaction.

5. Game devices, avatars, and genres

Single-player games are recommended for the deaf audience, due to communication and interaction issues. Moreover, deaf children prefer mobile devices and console

games to other electronic devices. As the games which are especially attractive to young deaf players, researchers point out games with movement, action games, and brain-teasing games. Due to the increased distractibility, impatience, and specific attention needs of deaf children, it is very important to determine the appropriate timing and adapt the game to the age of the player. Moreover, in the case of video games for deaf children, it is very valuable and useful to design cooperating and configurable human-like avatars that guide players through the game tasks. In addition, graphical elements and illustrations and highly recommended use, but they should be informative, coherent with textual information, and suited to the game genre (Di Mascio et al., 2013, p. 231-234).

To divide the guidelines into thematic subgroups, the Brazilian researchers used different criteria than the Italian scientists. The first group of academics presented a broader overview and drew attention to many different aspects assigned to three broad categories, while the second group of researchers based on more specific categories and mentioned fewer issues, but in more detail. However, many observations and conclusions drawn by both groups of researchers are similar. For example, they agree on the matter of feedback, which has to appear immediately, and in an attractive, but at the same time well-balanced form. They also share a similar point of view when it comes to the clarity and simplicity of textual information, postulating that texts should be short and kept to a minimum. Also, visuals and animations are needed, but due to deaf children's problems with focus, their form and ways of use should be well-balanced, to avoid eventual side effects, such as distraction or irritation of the player. Moreover, valuable illustrations can be used to make textual messages more clear and more understandable. When it comes to the issue of clearance, it is worth keeping in mind that the objectives of the game should be clearly defined, and only one task should appear at a time. Any kind of unnecessary elements, that could distract the player from the main task, must be avoided, because of deaf youth's attention problems.

To summarize, it can be said that in the case of video games directed to deaf users, the design guidelines are strict, due to the special needs of the players. Although there are some differences between game genre's that the authors of the articles proposed the guidelines for (the main focus of the first text was an educational game design, while the second paper was about video games in general, including adventure games), the main points remain similar. The guidelines presented in this section are considered a key issue in designing a video game for

the deaf audience and will be recalled further in this thesis, especially in Chapters Four and Five.

2.10. Conclusion

The purpose of this chapter was to present an overview of the existing literature and current research on the educational challenges of deaf youth and video games. First, I identified the main challenges in deaf children's education, what are language learning and problem-solving skills development. Then, as the goal of this master's thesis is to propose the statement that video games can be an effective educational tool for deaf children, I described the features of serious and adventure games and put them in the context of designing games for deaf players. As the summarization of this chapter, it can be said that a serious game designed for the special needs of deaf children could support their acquisition of knowledge, especially when it comes to language skills development. However, the role of adventure games, which are primarily designed to provide entertainment, also turns out to be significant in the educational context. As adventure games are constructed of tasks to complete, and their play requires constantly facing different challenges, they can be considered an effective tool in problem-solving skills development. In the next parts of this thesis, the theories presented in this chapter will be discussed and implemented to demonstrate how, through using video games, modern education can meet the challenges of young deaf students and make learning more absorbing and effective.

Chapter Three: Qualitative Research

3.1. Introduction

As the main goal of this master's thesis is to propose video games as a teaching tool that can be used in deaf children's education, I wanted to expand my research with the opinions of specialists working in the education of the deaf on a daily basis. Conducting surveys among teachers of deaf children was intended to verify the main challenges that teachers observe at work, specify the needs of the teachers and pupils, and get to know about the reality of using video games at schools. I consider this part of research necessary, as before discussing the educational features of games for deaf children, voices from the community concerned must first be heard.

3.2. Surveys

The qualitative research took the form of surveys conducted among teachers working with deaf children. The focus of the survey was put on their experiences with teaching deaf and hard-of-hearing children, its' biggest challenges, and the use of computer games as a teaching method. The questions were open-ended, in order to obtain qualitative and broad answers, unbiased by any suggestions.

The research was conducted in the hope of providing new information about using video games in schools for the deaf. This study aimed to obtain high-quality responses, and quality was prioritized over quantity. Therefore, although I managed to obtain only 12 respondents, the quality of their answers can be considered high. That is because all respondents are specialists in the subject – they work as teachers of deaf children. The answers obtained in the survey may help understand teachers' attitudes toward video games and reasons for using or not using games as educational tools. The answers will be used to gain the perspective of people involved in the education of deaf children and to broaden the current state of knowledge about the use of video games in schools. Knowledge of teachers' opinions and experiences is also a clash of theoretical assumptions with reality. Getting to know the observations of people dealing with the problem on a daily basis, may result in a valuable extension of knowledge about the phenomenon of using video games in deaf children's education.

The survey was done among users of the relevant Facebook groups listed below:

1. Teachers of the Deaf and Hard of Hearing
<https://www.facebook.com/groups/179491645401600>
2. Teacher of the Deaf Community
<https://www.facebook.com/groups/teacherofthedeaf>
3. Itinerant Teachers of the Deaf
<https://www.facebook.com/groups/163744303979326>
4. Multicultural Teachers of the Deaf
<https://www.facebook.com/groups/mctod>
5. Deaf Education Teachers
<https://www.facebook.com/groups/214439172555496>
6. Teachers of the Deaf and Hard of Hearing – DHH
<https://www.facebook.com/groups/787392268054231>
7. Teachers of the Deaf
<https://www.facebook.com/groups/teacherofdeaf>
8. Deaf Education Professionals Tackling Language Deprivation
<https://www.facebook.com/groups/376278379682157>

The data was collected from the 21st of January 2023 to the 15th of March 2023. I asked the groups' members the following questions:

1. How many years is your professional experience as a teacher of deaf children/deaf youth? Do you teach in a special school dedicated to deaf children or in an integration school?
2. What subject(s) do you teach and what age groups are your students in?
3. What is your opinion on the use of serious games* in teaching?
*serious games are defined as an “educational application, whose initial intention is to combine, coherently and at the same time, serious aspects, in a non-exhaustive and non-exclusive way, teaching, learning, communication, or even information with the fun aspects of video games” (Connected Healthcare for the Citizen, 2018)
4. Have you used any games in your teaching? Which games and how?
5. If you rarely or not at all use games, what are the reasons why you don't?
6. How would you describe your own playing ability?

7. Do you play any games casually yourself? What games?
8. How would you describe your school's access to computer games?

Moreover, I contacted the school for deaf and hard-of-hearing children in my hometown, Gdynia, Poland (original name of the school: Zespół Szkół Ogólnokształcących nr 6: Szkoła Podstawowa nr 49 dla Dzieci Niesłyszących, XV Liceum Ogólnokształcące dla Niesłyszących). I asked the teachers working there exactly the same questions, as those listed above. However, as the teachers working in Gdynia are Polish-speaking (and Polish is my native language as well), I translated the questions to Polish and received answers in Polish. For the purposes of this work, in this chapter, I will present the answers translated by me into English. However, the original script in Polish is available in the Appendix of this master's thesis.

3.3. Results

Getting survey responses from teachers of deaf children was a difficult process, as there are relatively few such specialists. After a nearly two months-long process of data collection, I received 6 answers from the Facebook groups' members. Although the amount of received answers is small, it remains high quality, as all of the interviewed persons are professional teachers working with deaf and hard-of-hearing children. At the school for deaf and hard-of-hearing children in Gdynia, Poland, I also received 6 answers of equally high quality – answers given by specialists in this field. Engaging with these groups informed some of my research and provided valuable leads into new possible research directions.

This gives 12 quality answers in total. Given that the answers come from two environments – an English-speaking Facebook group and a Polish school, I will first present the results of the surveys in separate subsections. However, bearing in mind that both teachers from Facebook groups and a visited school share a similar background and the same industry, later I will put their answers together and compare the results.

The answers of the teachers who answered the survey will be presented below in the following order: first, the question will be presented. Below each question, there will be found answers from the interviewed teachers. The answers are divided into two groups – in order to distinguish between the teachers who found the survey on Facebook groups and the teachers

from the Polish school who received the survey by email. For the purposes of ordering the results, I assigned a number from 1 to 12 for each respondent (R1, R2, etc.). Numbers 1 to 6 are assigned to the teachers who used Facebook groups, while numbers 7 to 12 represent the teachers working at the Polish school.

Q1: How many years is your professional experience as a teacher of deaf children/deaf youth? Do you teach in a special school dedicated to deaf children or in an integration school?

R1	3 years, mainstream (integration)
R2	5 years; 3 in a private OPTION ¹ school and 2 in a public school as an itinerant
R3	3 years as a teacher. 5 years as a paraprofessional. Dedicated school - Residential/Day School for the Deaf.
R4	20+ and I work in a public school DHH program
R5	2 years, integration
R6	7 years, in a dedicated school

R7	30 years, a special school dedicated to deaf and hard-of-hearing children
R8	1,5 year
R9	28 years
R10	23 years. A school specially dedicated to deaf and hard-of-hearing children
R11	-
R12	3 years

Q2: What subject(s) do you teach and what age groups are your students in?

R1	DHH Expanded Skills class, high school
R2	Private: 4th/5th grade and Kindergarten – all subjects (math, writing, reading, science, social studies) Public: ECI - High School - subjects vary regarding the needs of the students

¹ “OPTION Schools, Inc. is an international, non-profit organization comprised of listening and spoken language programs and schools for children who are deaf or hard of hearing in Canada, South America, and the U.S. OPTION Schools, Inc.” <https://optionlsl.org/>

R3	Self-Contained all academic subjects (Math, Science, Social Studies, Reading, English Language Arts). I taught 3-4 year old preschool for 2 years. This year I have a combined class with 4th, 5th, and 6th grade.
R4	9-12, I teach mostly ELA and History
R5	Science, 4-6th grade
R6	Math

R7	Speech therapy, 5-18 years
R8	Daycare teacher, sign language teacher and revalidation. Sign language teacher for grades 1-3, revalidation 10-13 years old.
R9	Speech therapy, Polish language, children from 5 to 18 years old
R10	Early childhood education, speech therapy, revalidation (group and individual classes). Students aged 6-15.
R11	-
R12	revalidation classes designed for the development of communication - age 6-16

Q3: What is your opinion on the use of serious games* in teaching?

***serious games are defined as an “educational application, whose initial intention is to combine, coherently and at the same time, serious aspects, in a non-exhaustive and non-exclusive way, teaching, learning, communication, or even information with the fun aspects of video games” (Connected Healthcare for the Citizen, 2018)**

R1	I think it is a potential tool/resource if proven to be accessible to ALL Deaf/hard of hearing students with varying language/reading levels
R2	Love it when the game is great! My only concern is doing so in moderation.
R3	I think play is the best way for students to learn and video games are the way many kids play these days. I think games should be incorporated in all teaching, whether it be table-top games, physical movement games, or video/computer games.
R4	I think can be very useful if the students can use them independently and use ASL
R5	I think it is a good idea but there are NOT many games accessible to deaf pupils
R6	I think it can be a good supportive tool

R7	I am convinced of the great importance of computer games in teaching /while maintaining computer health habits/; they are not only a full-fledged educational tool, but they respond to the needs of time - better access to current knowledge, faster education, in the case of people with disabilities, they are a good tool for equalizing educational opportunities, compensation for a given disability, complementing delays or deficiencies.
R8	Mixed opinion.
R9	They are very useful.
R10	A computer game well constructed in terms of methodology and content would find application in teaching and could be helpful.
R11	I think it's a good idea because children use smartphones and play inappropriate games in their free time. Through educational games, they can learn something and gain skills for the future.
R12	They can be helpful but should not be the primary tool in therapy.

Q4: Have you used any games in your teaching? Which games and how?

R1	Not many, as most are not accessible for all.
R2	iPad apps (<i>Prodigy, Quiziz, IXL, etc.</i>)
R3	I use <i>Prodigy Math, Prodigy English, Dreamscape, Super Mario Maker (Nintendo Switch), Typing.com, Reading Eggs, Touch Math game apps.</i>
R4	Very few, there aren't many
R5	No
R6	<i>Prodigy</i>

R7	Specialist games for teaching speech, Polish and sign language; general development games in the field of shaping and developing and improving cognitive, hearing, visual, motor, and coordination functions. In addition to special speech therapy programs, I use educational platforms available on the Internet. Games have a wide spectrum of use depending on the creativity of the speech therapist and the abilities of the students. The student performs tasks independently or with the help of the teacher.
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R8	Often <i>Wordwall</i> . I don't use typical computer games.
R9	Yes, I have used them many times, but they were profiled, educational games, e.g. on the <i>Superkid</i> platform or those created by speech therapists or Polish-language teachers on <i>Wordwall</i> or speech therapy websites; and <i>Logo-gry</i> a package of speech therapy games; or <i>Sfonem</i> for listening exercises, etc. (various types of quizzes, match-ups, word puzzles, word searches, sentence completions, texts with gaps, etc.)
R10	Rarely. It was, for example, a game, or rather the entire interactive package <i>Logopedia</i> of Polish specialists at Digital Young Planet. It was used individually. The student had to perform various tasks, e.g. combine a picture with a caption or repeat words after a game character (under the teacher's guidance), etc. I also used games from <i>ito.hg</i> - e.g. you had to label pictures, etc., but for some time this site is no longer active.
R11	Yes, https://www.gov.pl/web/edukacja-i-nauka/kurs-polskiego-jezyka-migowego-pjm Maybe they are not typical games, but they can be useful tools for children
R12	Online games on the platforms <i>Printoteka</i> , <i>Superkid</i> , <i>Brain</i> , training auditory memory, mazes combined with emission and breathing exercises, PJM ² textbooks available on <i>men.gov</i>

Q5: If you rarely or not at all use games, what are the reasons why you don't?

R1	Accessibility
R2	-
R3	-
R4	They do not use ASL. I teach mostly ELA and my student need language practice that they can do independently
R5	Accessibility
R6	-

R7	the question does not apply to me - I often use a lot of computer games
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² PJM (Polski Język Migowy) – Polish Sign Language

R8	I don't use them, I wouldn't want children to misuse school time in such a way that they want to play. I'd rather use games on something else.
R9	I use.
R10	I do not know good educational games, they are not widely distributed. In addition, I prefer personal contact with the student - sign language, pictures, illustrations, and worksheets. When a deaf/hard of hearing child is staring at a computer screen, they lose eye contact with the teacher, which cuts them off from their most important sense of cognition.
R11	I rarely play due to a lack of time.
R12	Games stimulate the right hemisphere of the brain and often children spend too much time with screens anyway, so it is worth stimulating the left hemisphere responsible for speech development (Brock and Wernicki centers in the brain)

Q6: How would you describe your own playing ability?

R1	Intermediate
R2	Love to when I need to wind down
R3	I grew up playing tabletop and video games. I am an avid video gamer now, and play nightly. I met my husband on an online video game, so it is very much a family affair. I have extensive knowledge of a variety of games and a high player ability in most.
R4	None existent
R5	Low
R6	Intermediate

R7	Average, after training I am able to play computer games
R8	It depends on what kind of game it is
R9	Great
R10	A rather basic ability. I rarely play computer games and they are quite simple games.
R11	7/10
R12	I can play but I don't like it, I prefer other activities

Q7: Do you play any games casually yourself? What games?

R1	Yes, varying PC/PS5 games
R2	Currently playing games on the Switch console
R3	<i>World of Warcraft</i> , Story-based RPGs, (<i>Final Fantasy</i> , <i>Octopath Traveler</i>) Massive multiplayer online games, platformers (<i>Mario</i> , etc.), survival games (<i>Ark</i> , <i>Icarus</i> , etc.), Shooter games that are team based (<i>Back for Blood</i> , <i>GTFO</i> , etc.). Honestly, I'm pretty open to most games. I prefer story-driven games and/or games I can interact with other real people in.
R4	None
R5	No
R6	No

R7	yes - language games in the field of Polish, "knowledge" quizzes, skills development: e.g. memory, perceptiveness, thinking, logical games, entertainment (e.g. solitaires), etc.
R8	None
R9	I don't play
R10	Rarely, I prefer reading books or watching movies in my free time. These are the games: <i>2048</i> , <i>The Craft</i> , <i>Candy Crush Saga</i> . I also use <i>Duolingo</i> .
R11	Yes, <i>AE Mysteries</i> , <i>Bloons</i> , <i>Among Us</i> or shooting games, for example <i>Fortnite</i> or <i>Call of Duty</i> , <i>The Last of Us</i>
R12	dictionary games, <i>Scrabble</i> , <i>Wow</i> with dictionary puzzles, games exercising the brain and memory

Q8: How would you describe your school's access to computer games?

R1	Each student is given a laptop and can access games easily from their individual device
R2	Limited due to funding. Biggest issue is having devices that are compatible with students' hearing aids.

R3	We have an esports club with at least 10 gaming computers, computer controllers. A PS4, working on getting a Nintendo Switch or another PS4. All students have 1-1 Chromebooks (most games are blocked, but we can individually unblock many educational games). All classrooms have smart panel TVs for smart boards. I can easily bring my Nintendo Switch and hook it up to the smart board. I sometimes use Super Mario maker to create levels for math or sentence structure where students have to pick the correct tubes that make the expressions correct to beat the level. If they pick the wrong one they fall into a pit and die. They enjoy this.
R4	Limited; especially at the High School level
R5	Limited
R6	Limited - not enough computers in the classroom

R7	moderate, depending on the creativity of teachers, there is a possibility of mutual sharing. There could be more games for independent use in the free time of students / under the care of teachers, e.g. in the common room
R8	No access.
R9	Good.
R10	Satisfactory - each classroom has a computer with Internet access, and you can use free games offered by the Internet. You can't download anything because you need the administrator's permission. You can't buy much, because there is no money. The school is also not equipped with sets of games, e.g. on CDs - there are no such things. So all that remains is what the Internet offers online and for free.
R11	It is developing.
R12	It is enough.

3.4. Analysis and comparison of the results

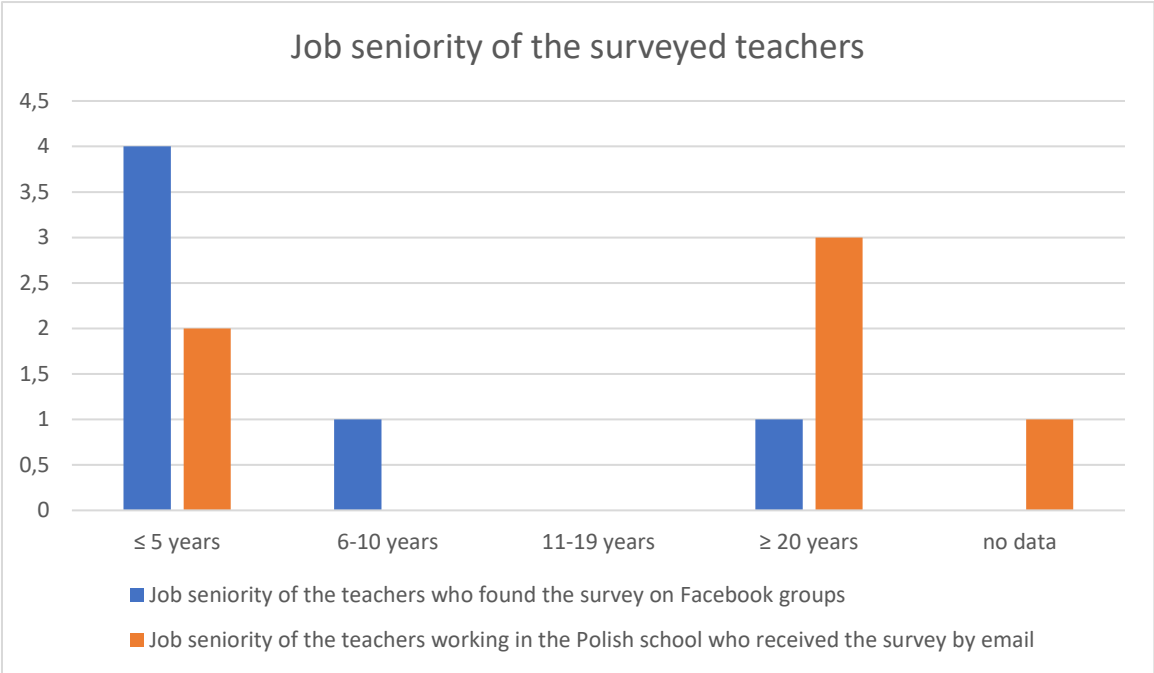
After reviewing the answers to the surveys, I decided to divide the analysis of the results into three parts: exploring the dependence between job seniority and attitude toward video games; focusing on the correlation between taught subject and a type of preferred game; and pointing out reasons for not using video games at schools. A factor that needs to be emphasized is the difference between the sources of information. One group of respondents (R1-R6)

consists of English-speaking teachers working in different schools, while the other group (R7-R12) consists of Polish teachers working in the same school. This may (although not necessarily) be reflected in the results.

Although the survey is open-question based and the research has a qualitative form, some of the received answers are similar enough to be presented in the form of graphs. This applies to questions about the teachers' work experience and reasons for not using video games. The rest of the answers to open questions are varied and broad, thus it requires a detailed, descriptive analysis.

3.4.1. Job seniority and attitude towards video games

As can be seen in the diagram presented below, half of the surveyed teachers have 5 or fewer years of professional experience (two Polish teachers and four English-speaking). However, the second largest group of respondents are teachers with over 20 years of experience. It is also worth mentioning that half (three) of the interviewed Polish teachers have been working for more than 20 years. The purpose of collecting this data was to verify if there is a relationship between job seniority and attitude to using video games in teaching.



1. Job seniority of the surveyed teachers

The main observation is that, in general, both novice and advanced teachers, express an optimistic attitude toward the use of serious games in teaching. There cannot be said that older teachers prefer using traditional teaching methods. On the contrary, teachers with long experience showed a kind of fascination with the idea of using games. At the same time, they shared possible concerns and described the conditions that such a game would have to meet. Only one (R8) of the youngest teachers, Polish-speaking with 1,5 years of professional experience, has an ambivalent opinion on using serious games in education but does not specify why.

The main obstacle mentioned by the English-speaking teachers was accessibility. They highlight that serious games should be accessible to all deaf and hard-of-hearing students with varying language and reading levels. R4 argues that a game that uses American Sign Language would contribute to students' playing independence. At the same time, R7 (a Polish teacher with 30 years of professional experience) shares her/his reflection on the role of video games in equalizing educational opportunities, believing that computer games can compensate for a given disability and make up for delays and deficiencies.

3.4.2. Taught subject and a type of preferred game

As a part of this research, it is also important to look at the relationship between a school subject and the characteristics of a game used as a teaching tool.

The main observation is that while most interviewed English-speaking teachers deal with teaching specific subjects such as math, science, social studies, etc., the majority of surveyed Polish teachers work with language, communication, or speech therapy. All of the Polish teachers mention some video games that they have used (some of the games have been used frequently, some rarely), while as many as three out of six English-speaking teachers admit that they almost do not use video games, and unavailability was mentioned as the main reason. Thus, it can be suggested that the availability (or teachers' knowledge of the availability) of video games helpful in deaf education is greater in the case of the language/communication field than in the case of traditional school subjects.

What remains interesting, among the answers of those three English teachers who confirmed using video games in education, repetition of one game title can be observed –

Prodigy was mentioned by all three of them. Therefore, due to recognizing this game as a particularly important case, in Chapter Four of this master's thesis, a detailed analysis of this game will be conducted. The main focus of the analysis will be on verifying the usefulness of *Prodigy English* and *Prodigy Math* in the language and math education of deaf and hard-of-hearing children.

As was written above, the classes conducted by interviewed Polish teachers who show a willingness to use video games as a supportive tool, are focused on language, communication, or speech therapy. This is important to emphasize because, in Chapter Two of this master's thesis, language was presented as the greatest difficulty in learning as to result of hearing disability. Among the titles of games indicated by Polish teachers as helpful tools in education, one title - *Wordwall* - was mentioned three times. Therefore, as in the case of *Prodigy* - the most popular game indicated by English-speaking teachers, a detailed analysis of *Wordwall* will be carried out in Chapter Four. In the case of the analysis of this game, the aspect of relevance in language and speech therapy will be particularly important.

3.4.3. Reasons for not using video games at schools

When reflecting on the use of video games as educational tools, it is also necessary to identify possible reasons for the abandonment of using them. Surveyed teachers were asked what are the reasons why they do not use video games as teaching tools (Q5). In addition, they had to describe their schools' access to computer games (Q8). Based on the answers to these two questions, the following conclusions can be drawn:

1. English-speaking teachers identified inaccessibility as a major obstacle while Polish-speaking teachers revealed a personal aversion to the medium of video games.
2. English-speaking teachers who do not use video games as teaching tools described their schools' access to games as limited, while Polish-speaking teachers who do not use video games as teaching tools described their school's access to games as satisfactory.
3. Inaccessibility is understood by most teachers as a limited offer to video games that would meet the needs of deaf and hard-of-hearing users. School access to electronic

devices is a secondary issue in this case. The lack of existing games adapted to the needs of deaf players is foregrounded.

Moreover, based on a broader overview of the survey and confronting the conclusions from the answers to Q6 and Q7 with the conclusions from Q5 and Q8, the following statement can be made:

4. Factors such as teachers' low playing ability and not playing games casually by teachers can be interpreted as reasons for teachers' reluctance to use games.



2. Factors causing the lack of use of video games at schools.

As can be seen in the graph above, the main factors causing the lack of use of video games at schools are: the limited offer of games adapted to the needs of the deaf and teachers' dislike of the games as a medium. Schools' access to video games is a factor with a smaller but still significant impact. Teachers' low playing ability and not playing games by teachers in their free time are identified as possible causes of teachers' personal objections to the use of games at schools. The above conclusions were drawn from the responses to Q5, Q6, Q7, and Q8.

The statement of the lack of enthusiasm for games as a medium was determined from the responses to Q5. Three out of six Polish teachers gave reasons for using the games other than inaccessibility. R8 labeled playing games as misusing school time, meanwhile, R10 and R12 are of the opinion that playing games weakens the educational process. According to R10, when a deaf child is focused on a computer screen, she/he loses eye contact with the teacher, and therefore cannot participate in a lesson properly, as “is cut off from his/her most important sense of cognition”. Meanwhile, R12 pays attention to the brain’s work and observes that the medium of video games stimulates the right hemisphere of the brain too much, and thus school classes should be focused on stimulating the left hemisphere of the brain. R12 believes that in the case of deaf children, it is very important to be focused on the left hemisphere, as it is responsible for speech development (which is the main challenge in deaf children's education). The negative attitude of the surveyed teachers towards games is also evident in their answers regarding their own playing abilities and casual gaming – the teachers who are not enthusiastic about using games at school, describe their own playing ability as basic and declare that they rarely play games in their free time.

English-speaking teachers who found the survey on Facebook groups were more enthusiastic about video games than Polish teachers. Among their answers to the same Q5, comments against the medium of video games were not found. The only reasons for not using games pointed out by English-speaking teachers were limited accessibility and the lack of games that use sign language. Thus, accessibility can be identified as the main obstacle to using video games at schools. School access to games is a problem, but an even bigger problem is the lack of games aimed at the deaf. Therefore, even if the school has technological facilities, it is not guaranteed that the equipment will be used because there are not many games adapted to the needs of the deaf.

While it is not possible to influence the personal beliefs of Polish teachers and their objections to games, it is possible to propose solutions to the obstacles regarding the unavailability of games indicated by English-speaking teachers. The problem of inaccessibility of games can be solved if the video game industry takes into account the situation of deaf players and starts designing games tailored to their needs. I hope this master's thesis can be helpful in this matter by paying attention to the problem, identifying the needs of deaf players, and proposing design solutions for future video games. For this purpose, in the next chapter of this thesis (discourse analysis of existing video games), I will indicate the features of video games with the potential for use by deaf players, and identify the features that limit accessibility.

3.5. Additional research

To extend my research, I tried to ask deaf and hard-of-hearing players nine questions about their attitude toward video games. I formulated the following questions:

1. What kind of video games do you play?
2. Do you play games designed especially for deaf players? What games?
3. To what extent and why are you satisfied/unsatisfied with the current offer of video games for deaf and hard-of-hearing players?
4. What features you are looking for and why? Do you have any recommendations for game companies to design games that would meet the needs of deaf people?
5. Are there any games that you find specifically difficult to play because of being deaf/hard-of-hearing?
6. Do you know/have you played any games that specifically address/consider hard-of-hearing players? Please list them and describe why you like/dislike them.
7. Have you used games for educational purposes? If yes, was it at school or outside school?
8. Have you played any games as your school activity?
9. Would you recommend any games for an educational context for 10-15 years old deaf and hard-of-hearing players? Why?

As in the case of the survey addressed to teachers, I created a Google Form with the questions and posted it on the relevant Facebook groups:

1. Deaf and Hard of Hearing
<https://www.facebook.com/groups/deafhohgroup>
2. Community for the Deaf and Hard of Hearing
<https://www.facebook.com/groups/deafandhoh>
3. Deaf Gamer's Network
<https://www.facebook.com/groups/deafgamers>

I also tried to share the survey with the group mentioned below. However, my membership or/and post were not accepted by admins, which made sharing my questions impossible.

1. Deaf World

<https://www.facebook.com/groups/923985810997467>

The most important purpose of this survey was to give a voice to the group of people to whom this work is dedicated. I hoped it would help me understand deaf and hard-of-hearing players' needs. Through the survey, I wanted to familiarize myself with the general perspective of a deaf gamer and get to know what to pay attention to when designing games.

Unfortunately, I received only two answers. The answers of two deaf players that had the willingness to help me in the research are presented below. To avoid confusing the results with the teachers' answers, I assigned numbers to the respondents: R13 and R14. However, as the amount of received answers is not enough to conduct a professional analysis, I will not draw conclusions based on them. Nevertheless, I will briefly comment on the results, as I believe that deaf players' voice is extremely important and has to be heard in this master's thesis, and it can lead to future extended research.

Q1: What kind of video games do you play?

R13	Ps4 and cell phone video games
R14	Rpj, horror, open world, action

Q2: Do you play games designed especially for deaf players? What games?

R13	Didn't know there was any so no
R14	O don't know of any personally

Q3: To what extend and why are you satisfied/unsatisfied with the current offer of video games for deaf and hard of hearing players?

R13	You can turn subtitles on all the ps4 games
R14	There should be more accessibility and representations for us. I only know of deaf characters but sadly no games themselves.

Q4: What are the features you are looking for and why? Do you have any recommendations for game companies to design games that would meet the needs of deaf people?

R13	If it's not subtitled/cc they need to be
R14	More accurate subtitles. Many have trouble keeping up with the dialogue within the games. More comfortable headphones that accommodate hearing aids. Maybe add other ways to alert plays of nearby enemies, collectibles, ect through vibration, color changes, or something of the like.

Q5: Are there any games that you find specifically difficult to play because of being deaf/hard of hearing?

R13	Not really - example rocksmith (it's a game that teaches you to play a real bass or guitar) even if you can't hear it , it visually shows you what string to hit and when.
R14	Team based games can be difficult without the use of chat. Most of the strategy is lost to us because there usually isn't away to communicate without setting down your controls and typing it out. Horror games are usually built for audio scares so I tend to miss the warnings of the monsters

Q6: Do you know/have you played any games that specifically address/consider hard-of-hearing players? Please list them and describe why you like/dislike them.

R13	Not sure
R14	Borderlands and Marvel: Spiderman have wonderful descriptive captions and the settings are pretty easy to change if you need to

Q7: Have you used games for educational purposes? If yes, was it at school or outside school?

R13	I guess rocksmith cuz it teaches you how to play a real instrument (outside of school). But without the video game playing it's impossible. I'd never actually be able to learn to play without being Hooked up to the video game.
R14	When I was younger I remember play a winterscape math game in middle school as well as a typing game in junior high

Q8: Have you played any games as your school activity?

R13	Yes once we played snood in biology in 1996 it's like bubble pop you don't have to hear anything
R14	Nothing really outside of sports and Improv for drama studies

Q9: Would you recommend any games for an educational context for 10-15 years old deaf and hard-of-hearing players? Why?

R13	Word games to help vocabulary and spelling . I guess
R14	Sadly I don't know of any educational ones that I could share

As can be seen, surveyed deaf and hard-of-hearing players do not know any video game designed especially for them. R14 player draws attention to the lack of representation of the deaf community in the game industry. This leads to the question: how can it be fixed? I will try to answer it in Chapter Five of this master's thesis.

As satisfying video game features, the surveyed players point out the availability of subtitles, descriptive captions, and easily changeable settings. However, the list ends with these three examples. Much still needs to be improved and added to meet the needs of deaf players. Respondents suggest game companies, in addition to accurate subtitles, also consider equipping games in headphones that accommodate hearing aids, as well as additional options such as vibration, color changes, etc. Elements that appeal to hearing can be replaced with those that

turn to other senses, such as touch and sight, especially in situations when the player needs to pay particular attention to something.

When it comes to playing games for educational purposes or as a school activity, the surveyed players mentioned some basic math and typing games, which is similar to the examples given by surveyed teachers. However, as can be seen among the answers to Q9, they do not know any educational games that could be especially recommended for deaf and hard-of-hearing youth. This may indicate the inaccessibility of educational games for deaf students.

3.6. Conclusion

There are ubiquitous gaps in video game offerings for deaf players. Most of the games available on the market are not accessible to people with hearing loss. As was presented in the results of the survey, some of the teachers, through their creativity, use video games originally intended for hearing children, and by properly selecting and moderating tasks, they make the games understandable for deaf students. However, there is a need to create video games designed especially for deaf children. The most important factor of such games, contributing to accessibility, would be to equip the game with a human-like avatar using sign language.

Chapter Four: Games Analysis

4.1. Introduction

As has been already signalized in Chapter One, in this chapter I will conduct an analysis of selected video games that may be considered effective in deaf children's education. The chosen games are: *Prodigy English*, *Wordwall*, and *Deafverse*. The choice of the games was dictated by factors such as popularity, effectiveness in education, and accessibility. *Prodigy English* was mentioned by 50% of English-speaking teachers interviewed for Chapter Three, and *Wordwall* was used by half of surveyed Polish teachers. Therefore, both of the platforms can be considered popular and usable at school, however, their effectiveness and accessibility need to be deeply verified, as they are not games dedicated especially for deaf users. The third game chosen for the analysis, *Deafverse*, remains unknown to all the surveyed teachers and was found through my own research. However, *Deafverse* seems to be the most accessible game of all those mentioned above, as it was designed especially for young deaf players.

The main goal of the analysis of mentioned games is to verify which features of video games make them accessible to deaf and hard-of-hearing users, as well as to indicate video games' usefulness in deaf education. In the case of the analysis of *Prodigy English* and *Wordwall*, the main focus will be put on their effectiveness in developing language skills, while in the case of *Deafverse*, the main issue will be verifying the game's contribution to problem-solving skills development.

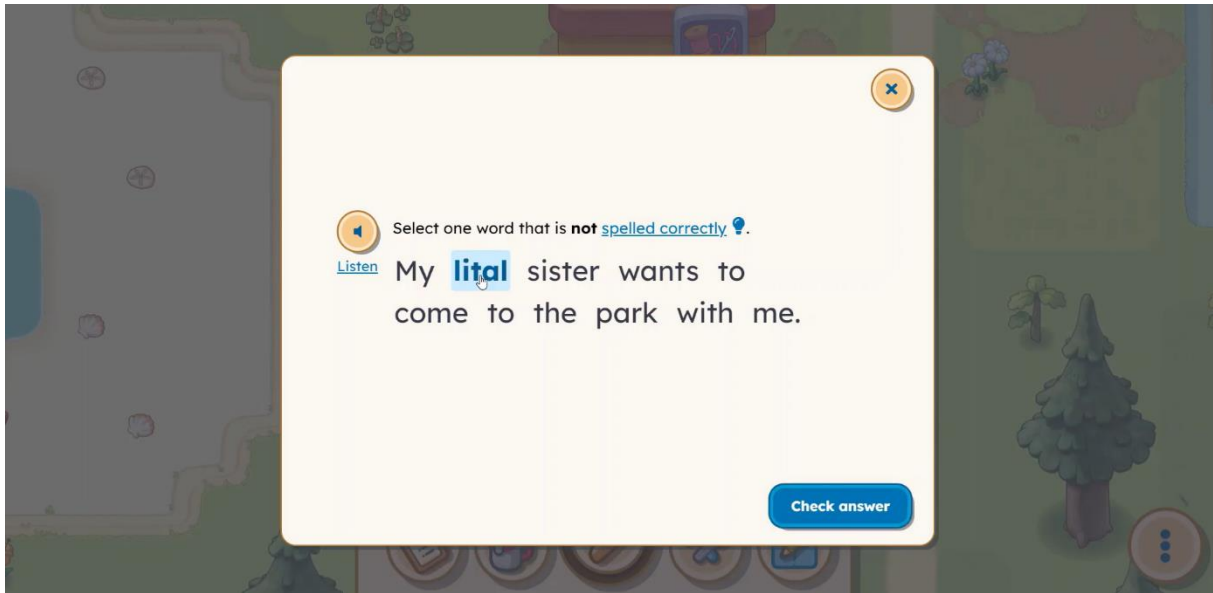
While *Prodigy English* and *Wordwall* are platforms that are not dedicated to hard-of-hearing users, *Deafverse* is a game designed especially for deaf players. *Deafverse* is a new and relatively unexplored game (there are currently only two scholarly articles on this topic, see Millen et al., 2022 and Stasiński et al., 2021). Therefore, the main focus of this chapter will be put on a deep analysis of this particular game. While the analysis of the first two games will be concise, the part about *Deafverse* will be deeply explored – both through the prism of discourse analysis and through accessibility criteria.

4.2. *Prodigy* – analysis

Prodigy was mentioned three times in the survey presented in Chapter Three of this master's thesis, by half of the teachers who answered the English-speaking questions published on Facebook. This educational platform was designed to educate children in general, mostly hearing children, therefore the issue of its' accessibility to deaf users is debatable. However, it is used by the interviewed teachers in deaf education, mainly due to the lack of accessible alternatives (see Chapter Three). In this section, I find it necessary to analyze *Prodigy*'s structure, mechanics, and accessibility, in order to verify if and how elements of a game designed for people without disabilities can be helpful for deaf and hard-of-hearing people.

Prodigy is a web-based game available online for English speakers. It was developed by a Canadian company Prodigy Education. It can be used by children both at home (with the parent's support) and at school (under the teacher's supervision). There exist two versions of the game: *Prodigy Math* (developed in 2011) which teaches math on the levels of 1st to 8th grade, and *Prodigy English*, (developed in 2022), which develops reading, writing, and language skills on the levels of 1st to 6th grade. In this work, I will focus on *Prodigy English*, as language skills were pointed out in Chapter Two as the main challenge in deaf children's education.

The main advantage of *Prodigy English* is that educational tasks appear next to fun-focused activities. The young player creates her/his own avatar and is focused on building a unique, fictional world. Identifying herself/himself with the avatar, the player collects items needed to build creative constructions and develop the game's world. When the avatar loses energy, it becomes impossible to take more actions, until the player does language educational tasks. When the player answers English-related questions, which are mostly focused on grammar or catching misspellings, she/he receives more tokens, which can be used to buy more items needed to develop the created world or to change the avatar's image, by buying new outfits. In this way, the game remains absorbing, and the child's motivation to answer educational questions is strong.



3. *Prodigy English* - screenshot from the game (Prodigy English, 2022)

The screenshot above presents a sample task that has to be done in the game, in order to receive more tokens and load the avatar's energy level. This particular task is to indicate which of the words in the sentence is spelled incorrectly. The answer is *lital*, as this is an incorrect spelling of the word *little*. This kind of question stimulates students to focus on spelling words correctly and detecting errors. However, it is therefore a tool contributing to the development of language skills, which are the main problem in the education of deaf children. Nevertheless, it is worth noting that the language tasks themselves are not very absorbing. They need to be done to continue the fun part of the game focused on creating the world. The very form of language tasks may not be interesting for a student, especially a deaf one who struggles with reading. Moreover, the lack of visualization of the written words may make it difficult for the deaf player to understand them, especially if some concepts in the sentence are abstract.

The authors of the article *An Evaluation of Prodigy: A Case-Study Approach to Implementation and Student Achievement Outcomes* observed that one of students' "favorite aspects of the game is the feeling of achievement or *leveling up*" (Morrison et al. 2020, p. 25). Indeed, the game's mechanics supports the player's feeling of achieving more and more, as the game progress. As the researchers explain, "the program identifies gaps in students' understanding and works with them by reinforcing prerequisite skills and then progressing to more difficult concepts" (Morrison et al. 2020, p. 6). Therefore, the level of difficulty arises, students need to meet new challenges, and their skills are constantly developed. Moreover, the educational content of the game is "customizable by teachers, and data are delivered to teachers

regarding student performance and progress” (Morrison et al. 2020, p. 25), which makes it possible for teachers to modify tasks according to the needs of their pupils. Furthermore, the scientist conducted research on a group of students and discovered that children “displayed authentic emotional responses to the plight of their avatar and pet and they engaged in dynamic social interactions with their in-class peers with whom they battled” (Morrison et al. 2020, p. 25). This observation may indicate that during the game students achieve a state of flow (see Chapter Two), and therefore they are more involved in the game and its educational content.

However, reflecting on the educational values of *Prodigy English* in the context of deaf children, it is necessary to remember, that, as has been already pointed out, the game was not designed especially for deaf users, but for children in general, including hearing pupils. Moreover, there are not many academic texts about that game, and when it comes to putting the game in the context of deaf education, academic articles cannot be found. Nevertheless, bearing in mind that the teachers interviewed for the purposes of this master’s thesis (see Chapter Three) use *Prodigy* in the education of deaf children, it can be assumed that *Prodigy* is a game at least partially accessible to deaf users. At this point, it is worth verifying which features of the game can be considered accessible and which of them should be improved in order to meet deaf players’ needs. The criteria used for this analysis were presented in section 2.9. of Chapter Two of this master’s thesis. The *Prodigy*’s features that, according to the guidelines (see Chapter Two) can be considered accessible to deaf users are:

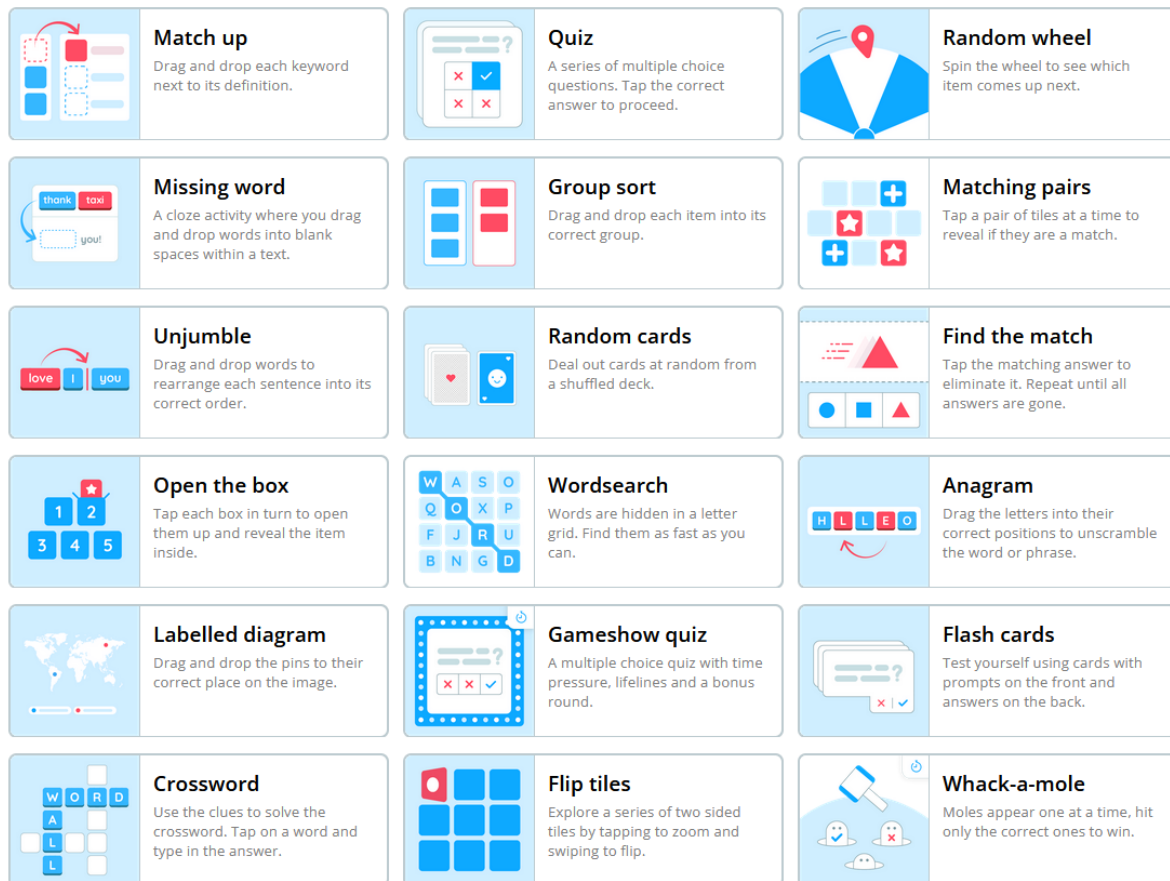
1. The possibility of task customization by a teacher. The teacher can modify the task content following the needs of students.
2. The avatar is human-like and customizable. The player can choose the avatar’s look, including outfit, hairstyle, and skin color. Human-like image is well-balanced and not too abstractive, which prevents possible distraction of the player.
3. The feedback is immediate and understandable. The player receives it straight after finishing the task. Moreover, tokens and other kinds of bonuses additionally strengthen the power of positive feedback. Moreover, the required workload increases over time and the system of player evaluation strengthens the player’s feeling of leveling up. This guarantees the constant maintenance of the child's involvement, especially the deaf child, who needs frequent motivation.

However, *Prodigy English* does not follow some of the guidelines described in section 2.9. First of all, the game is not customized for deaf players, and the issue of accessibility to hard-of-hearing users was not the issue of the creators' focus. The game lacks sign language, which can be considered a problematic issue. Moreover, the language tasks lack illustrations that would visualize words. Sometimes written language may be difficult for deaf people to understand until abstract words are visualized or contextualized (see Chapter Two).

As *Prodigy English* is not a game dedicated by its creators to deaf education, it can be concluded that any adherence to the guidelines is rather a positive side effect than a deliberate effort for accessibility to deaf users.

4.3. Wordwall – analysis

Wordwall is an online platform available in 43 languages. It is a tool that allows teachers to create their own didactic, interactive tasks for students. The platform offers 18 templates that can be customized by teachers. Among templates, there can be found interactive activities such as: matching up, word search, or crossword. The teacher can use a selected template and add selected educational topics. As on the platform, there are available game templates with simple mechanics, teachers can create exercises themselves, therefore they can customize tasks to their student's needs. In the survey presented in Chapter Three of this thesis, *Wordwall* was mentioned twice by teachers working in a Polish school for deaf and hard-of-hearing children. Again, as in the case of *Prodigy* described earlier in this chapter, *Wordwall* is not a game especially dedicated to deaf children. However, it can be used in deaf children's education, if a teacher can use templates available on the platform to create customized tasks, adequate for deaf pupils.



4. Templates available on *Wordwall*. (Screenshot of the platform, <https://wordwall.net/>)

Joanna Jakubowicz (2023), in her article about educational games, points out that the main advantage of the platform is that the game can be used on various items. She observes that integrating *Wordwall's* mechanism into the program base is generally simple, quick, and uncomplicated, but on the other hand, it can be time-consuming. Meanwhile, Hanna Lewandowska (2022, p. 239) notes that *Wordwall* is a tool generally well-received by students because it creates a sense of learning through play and conveys the prepared content clearly and understandably. However, both researchers who are mentioned in this paragraph, analyze the educational values of *Wordwall* in education in general, without paying attention to the problem of deaf users. Again, as it was in the case of *Prodigy*, the field of application of such online platforms for deaf education is not explored. Therefore, I find it necessary to start a discussion on this topic in this master's thesis. To reflect on *Wordwall's* effectiveness in the education of deaf children, it is worthy to verify its' compatibility with the accessibility guidelines that were presented in Chapter Two.

As the features that make *Wordwall's* templates accessible, there can be pointed out:

1. Simple interface & clearness of objectives – as the templates have a simple structure, the main goals of the tasks can be identified easily and fast.
2. Understandable and fast feedback – the feedback appears immediately after the activity ends, which contributed to keeping attention and strengthening motivation.
3. The possibility of customization tasks by a teacher – it can be considered the most important feature of the platform, as it allows the teacher to avoid possible inconveniences and adapt the game to the needs of deaf pupils.

The elements that need improvement to make the platform accessible for young deaf players are:

1. Sign language – adding the sign language option to the game would make the gameplay more accessible for deaf players, as well as would have a bigger impact on their content understanding.
2. Illustrations and visualizations – although the templates are visual themselves, most of the games which are used to develop language skills, would need some additional illustrations in order to support abstractive word understanding.

As can be seen, most of the features mentioned above, coincide with the accessible and non-accessible features outlined in the previous section of this chapter, dedicated to *Prodigy*. On this basis, it can be concluded that *Prodigy English* and *Wordwall* show a similar level of use in teaching deaf children. They both can be effective if game tasks are customized by a qualified teacher and if the teacher supervises kids during the gameplay. However, both platforms themselves are not fully deaf-accessible and need improvement in issues such as sign language options or visual effects.

It is important to note that a big advantage of *Wordwall* is the fact that it is available in 43 languages. Language variety extends the reach of the platform and makes it accessible to schools in many countries of the world. Due to this fact, *Wordwall* can be used in the education of the verbal national language not only in English-speaking countries, as in the case of *Prodigy*. Thus, the platform has the potential to contribute to solving the main challenge in the education of deaf children, which is language skills, also in countries with niche languages. Many

Wordwall templates, such as, for example, Wordsearch, Crossword, and Missing Word can effectively serve the development of language competencies of deaf students if they are correctly adapted to their needs by a competent teacher.

4.4. *Deafverse* – analysis

One of the reasons for not using video games in teaching deaf children identified in the survey presented in Chapter Three of this thesis, was the observation that video games are not equipped with sign language. It was suggested by Respondent 4 in the answer to Question 5. This issue is also discussed in the literature (Ocker, 2017). However, there can be found a game that was specially designed for deaf teenagers and its' main feature is sign language. *Deafverse* is the first-ever ASL-accessible game, launched in 2019 (“Deafverse” n.d.), and developed by a team of deaf creators and educators at the National Deaf Center on Postsecondary Outcomes in the USA (“Deafverse” n.d.). It is an adventure game, however, it has many educational features. It can and even should be used in schools, as its main purpose is to develop deaf teenagers' self-advocacy skills, teach them their rights and prepare them for life after high school graduation. The creators describe the world presented in *Deafverse* as “a safe environment to apply critical thinking skills while engaging problem-based learning” (“Deafverse” n.d.), and they highlight its supportive role in self-advocacy skills development, mentioning that “players respond to challenges and conflicts that are part of the deaf experience” (“Deafverse” n.d.). Indeed, challenges and problems that appear in the game, are similar to those that deaf players may face in real daily life, due to their disability. Therefore, due to problem-based learning, which is an element of *Deafverse*, the game can be considered a tool helpful in developing one of the main deaf children's struggles – problem-solving skills. Although the game is not designed for young children, but for teenagers attending high school, its characteristics may be a valuable guide to creating an educational adventure game for younger children.

For this reason, I consider this game essential and worth mentioning in this thesis. In this section, I will analyze *Deafverse*'s features, with special attention to its structure, meanings, narrative, and design features that make the game accessible. All of it is to verify the effectiveness of this game in developing deaf youth's problem-solving skills.

What is important to note at this point, is the fact that *Deafverse* is an unexplored game. There are only two scientific publications that mention this title (there are currently only two scholarly articles on this topic, see Millen et al., 2022 and Stasięńko et al., 2021), but none of them analyzes the game deeply. For this reason, my analysis cannot be contrasted with the observations of the game made by other researchers.

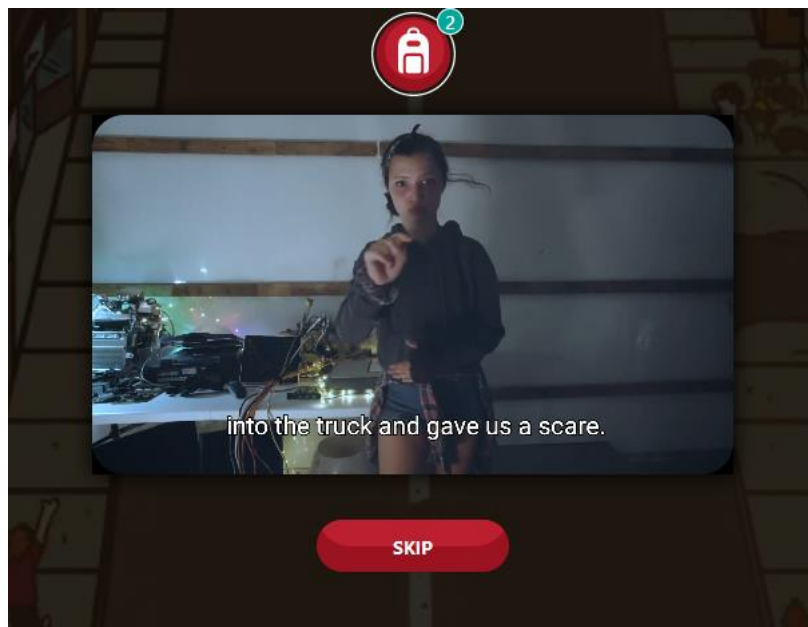
4.4.1. Structure and meanings

The game's name itself, *Deafverse*, transfers meanings. As it is a combination of the words *deaf* and *universe*, it can be interpreted as a space for deaf people. A space, where hearing people are not the majority anymore, and thus, where deaf culture may be realized in every aspect. Seeing the name *Deafverse*, one can expect the game to be completely accessible for deaf players, and at the same time, even unavailable to hearing players. Therefore, based on the game's name itself, and its' first impression, it can be deduced that the game is intended to represent the deaf and a world created for the deaf, corresponding to all their needs.

In *Deafverse*, there are two worlds available to play – World One: *Duel of the Bots*, and World Two: *Revenge of the Deep*. In both worlds, players are navigated by game narrator Justin who communicates with them using sign language. The action of World One is placed in a town where the character the player identifies with attends high school classes and visits public places, such as stores and cinemas. World One is inhabited mostly by hearing characters, which causes many challenges in communication and requires finding solutions to many problems that a deaf person can have in real life. Meanwhile, World Two is located on an island inhabited by mostly deaf characters, therefore the kind of challenges is completely different than in World One. While in World One, the player struggles mostly with communication problems, caused by differences and misunderstandings between deaf and hearing people, in World Two she/he must face challenges existing inside the deaf community. Moreover, there are some differences between the kinds of support that the player receives. In the first world, he/she is accompanied by a sidekick named Catbot, a cat-like robot who gives hints about possible problem solutions. Meanwhile, in the second world, Catbot disappears, and the player has to find it, being supported by a new character, Kat. Thus, in World Two the player has to become more independent in making decisions. Both worlds are set in an adventure background, but you can find differences between them. Although World One seems to be a real-like environment, the

main mission to complete through meeting life-like challenges is to stop a rogue robot from wreaking havoc in the city. World Two is a much more fictional environment than World One, such it is an island filled with ravenous sea monsters. However, many of the tasks done in World Two remain life-like (for example having a job interview).

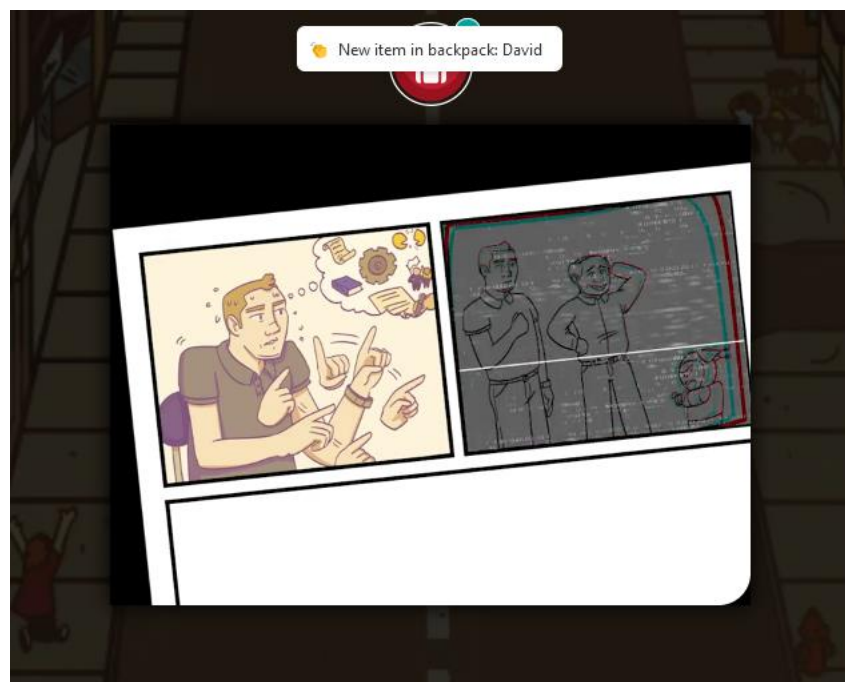
World One is opened and closed by film sequences. Two deaf girls, Violet and Enza, introduce the player to the mission and help her/him go through the portal to the game's universe. They are not visible through the playing process, as narrator Justin and sidekick Catbot take over as the player's guides. However, after the player is done with tasks and disconnects from World One, Violet and Enza appear again on the screen. Their role is therefore not significant during the gameplay, as it does not help the player in developing problem-solving skills. However, it is important when it comes to the game's stylistic structure and enhances the adventure dimension of the game.



5. *Deafverse* - screenshot from the game (Deafverse, 2019)

Another variety of the game structure, other than film sequences, is comics. The gameplay in World One consists of six chapters. Each chapter is represented by several comic scenes. Each game's sequence is opened with a comic scene that represents what the next part of gameplay will be about. A particular comic scene appears on the screen before the game scene happens. It gives an overview of the story and potential problems that will appear in the next game scene. However, it does not suggest solutions, as the player has to find them

herself/himself. A game sequence is constructed by several scenes. Usually, in the first scene, the narrator Justin introduces the player to the story. In the second scene, Justin presents the problem. Then, in the next scenes, the player is given two or three options to choose from. Later on, depending on the player's decision, the story continues in a certain way. The comic scenes show how far the game scenes have been realized. First, when a particular comic scene appears on the screen, it looks like a black-and-white sketch. Then, after the player has passed part of the game scene, the comics appear again and the comic scene corresponding to the game scene takes on one color. After the player finishes playing the whole scene, the elements of the comic scene are painted in different, already-targeted colors. The picture placed below represents a part of a chapter. The first scene of the game sequence was already finished by a player, therefore it is fully colored. The second scene is still in the process, the player has begun but has not finished playing it yet, therefore it is grey-colored. After being fully played, the second scene will be colored the same way as the first scene, and in the white space below it, a new sketch will appear.

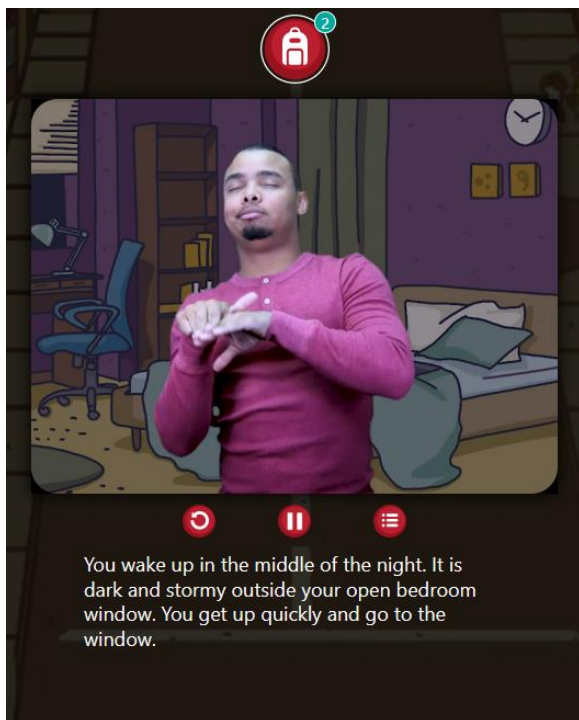


6. *Deafverse* - screenshot from the game (Deafverse, 2019)

The scenes that make up the story presented in the game represent the experience of living as a deaf person. As can be seen in the screenshot above, comic illustrations are a means of representing deaf culture. The drawn character is shown during using sign language – this is

indicated by the sixfold drawing of his hand. In the cloud above the character's head, various objects are visible, and based on them, the topic of the man's speech can be deducted. But, what is worth noting, in the case of the medium of video games, the player creates contexts through her/his choices and actions. Then, sequences and contexts take on meanings (Gee, 2015). Thus, in the comics shown above, only denotation of the elements mentioned by the character is suggested, while their connotation depends on the player's choices made during the gameplay. For instance, the comic scene denotes that the game character thinks about a book, written sheets of paper, a cogwheel, and two people holding a white flag. It does not have a clear meaning yet, as it does not have a situated context. It is the player who, by playing the game and making choices, decides about the context in which the objects seen in the comics will finally be situated. Depending on the player's choice and action, objects will start to connote specific meanings.

The mechanics of *Deafverse* and its' impact on situating contexts and constructing meanings can be explained by using another example from the game. The pictures below present one of the first game sequences. In both of them, the narrator Justin can be seen. In the first picture, Justin plays the role of a game's main character, as evidenced by his clothes and the background on which he is placed. In the second picture, the narrator is more integral to the game's mechanics, he does not play the role of the game's main character but only uses sign language to tell what options the player has to choose from. Similarly, as in the first screenshot, this can be read from his costume.



7. *Deafverse* - screenshot from the game (Deafverse, 2019)



8. *Deafverse* - screenshot from the game (Deafverse, 2019)

As can be seen in picture 6., the narrator uses sign language. He is deaf. It would be said that he represents the main character of a game, as he is in the main character's bedroom, dressed in casual clothes, while the bed is empty and unmade. It looks like Justin just got up from this bed. However, the game's narrative is second-person, as it uses the word "you", addressing the player directly and implying that the player is the protagonist of the game. Nevertheless, the player can identify herself/himself with the narrator, as both Justin and the player share common characteristics. They both are deaf and involved in the game's story (although in the case of the player, it is an active, action-oriented involvement, while in the case of Justin, it is passive, focused on telling the story). Justin's facial expression, necessary for the denotation of sign language signs, at the same time, connotes emotions. Therefore, it can be read from Justin's face how he feels about the situations he talks about. Seeing emotions on Justin's face, the player, as she/he identifies herself/himself with him, can take over these emotions.

According to James Paul Gee, the emotions of games' characters are attributed as deeper meanings by considering the contexts they are situated in. To attribute meanings to characters, it is necessary to analyze words on the screen, the positions of the characters, and the situations they are in (Gee, 2015). However, it is important to remember that Justin is not a protagonist of the game, as he does not take any actions. The player should be considered the main character of the game, because of the second-person narrative. Nonetheless, as the player takes over

Justin's emotions, Justin's expression can be identified with the possible reactions of the player. Therefore, meanings assigned to Justin can be transferred to the player, which means that the interpretation of Justin's emotions, can be implied to the player. In the case of the sequence from *Deafverse* presented in the screenshots above, it is worth looking at Justin's background, his monologue, and the problem that he is explaining. Justin is in the bedroom, awake in the middle of the night, and explains the situation: the window is open and it is very windy and stormy outside. Based on this message, it can be understood that the weather makes the main character uncomfortable and is the main reason for his being awake. In the next scene, the player has to make a choice, and thus decide about the way the action continues. She/he can choose between three options: *go back to bed*, *close the window*, or *look outside*. Thus, by taking the action, the player has an impact on the story, and thus, also on its' meaning. After choosing the option *look outside*, which was chosen for the needs of this research, as it seems the most relevant to lead to an interesting story development, the protagonist (the player) finds and meets Catbot – the helper that has been introduced earlier in this chapter. Then, the sequence of events continues and the adventure begins for the player.

What remains interesting in *Deafverse*'s narrative, it's the fact that the story is told in three ways: by sign language (used by narrator Justin), text printed on the screen, and text read loudly by a voice-over. The sign narration comes to the fore - if the player is deaf and does not use a hearing aid, she/he will be focused on looking at Justin and following the story through the sign narration, without hearing the voice-over. Looking at Justin's gestures requires much involvement of sight sense, which makes it impossible to read the text at the same time. The fact that the main narrative feature of *Deafverse* is sign language contributes to the accessibility of the game and the fact that the game can be considered representative of deaf culture.

4.4.2. (Sign) narrative

In section 2.7. in Chapter Two, I described Benjamin Bahan's concept of *face-to-face tradition*, and I reflected on the sign narrative, addressing Magdalena Drozdowska. These concepts are important when it comes to Deaf representation in cultural texts. Therefore, in this section, I will verify the adequacy of these concepts for *Deafverse*.

In Chapter Two of this master's thesis, the importance of spontaneity and modification of sign language speech under the audience's influence was pointed out. In the case of *Deafverse*, the player is not only a game protagonist, but at the same time, he is also an audience.

Bearing in mind, that in the case of the interaction between the player and Justin in *Deafverse*, *face-to-face tradition* cannot be understood literally. It rather is a remodeled form of primary communication. The player has constant interaction with the game, through making choices. Thus, she/he has an impact on the game narrative and becomes the narrative's active participant and co-creator of the game story. In a sense, the player becomes part of the world presented in the game. Therefore, it can be said that *Deafverse* player returns to the primary form of culture. However, *face-to-face tradition*, the way of communication among the Deaf community, realizes itself in face-to-face situations and direct interactions (Zdrodowska, 2014). In the case of *Deafverse*, the interaction between Justin and the player cannot be called *face-to-face* literally. This is because the player does not use a web camera and therefore is not visible to Justin. Moreover, the issue of dialogue between the game narrator and the player can be also questioned. On the one hand, it can be said that the player and the game narrator interact with each other, because the player can decide what she/he wants to reply to Justin (by choosing one of three available options). On the other hand, it has to be kept in mind that the player has only minimal influence on the way the conversation goes. The development of the dialogue depends on the top-down scenario, so the player cannot be completely spontaneous and make an arbitrary statement. He can only steer the conversation in one direction chosen from three options. However, each of these options is already provided by the developers of the game. Therefore, the player seems to be rather an actor in the game than an active, spontaneous spectator who has an impact on a live performance.

Moreover, sign narrative and *face-to-face tradition* require collectiveness (Zdrodowska 2014). As I stated in Chapter Two, the deaf culture is collective, therefore a game designed for deaf players should be collective as well. *Deafverse* does not offer a multiplayer option, so its mechanics itself does not provide for collectivity. However, there is a possibility to play *Deafverse* in a classroom, together with classmates, under the teacher's supervision. Nevertheless, even when players play the same game simultaneously while being in the same room together, it still turns out that the game, due to its mechanics, is intended for individual use. Players can therefore consult each other about their choices in the form of *face-to-face* (by talking in person), discussing the course of the game in the class forum, but each student must go through their gameplay individually on the computer. Therefore, it is hard to consider *Deafverse* a collective space.

One of the most important aspects of narrative accessible for deaf video recipients is the issue of the avatar that should transmit messages to the player. Both in section 2.7. and 2.9. in

Chapter Two of this master's thesis, it was suggested that the avatar in a video game designed for deaf players should be human-like, and definitely not animated (see Chapter Two). This is argued by the fact, that a potential animated avatar would not be capable of imitating sign language, because communication in this specific language requires advanced facial expression, gestures, and body position, that for now, only a human can express. That is why the presence of narrator Justin in *Deafverse*, who is a human, turns out to be extremely useful in conveying specific meanings understandable to a deaf player. The expression on the narrator's face connotes emotions and therefore enriches the message and the power of the meaning coming from the hand gesture. The hand gesture denotes a word, but it will acquire full, intense meaning only when accompanied by a specific face mimicry.

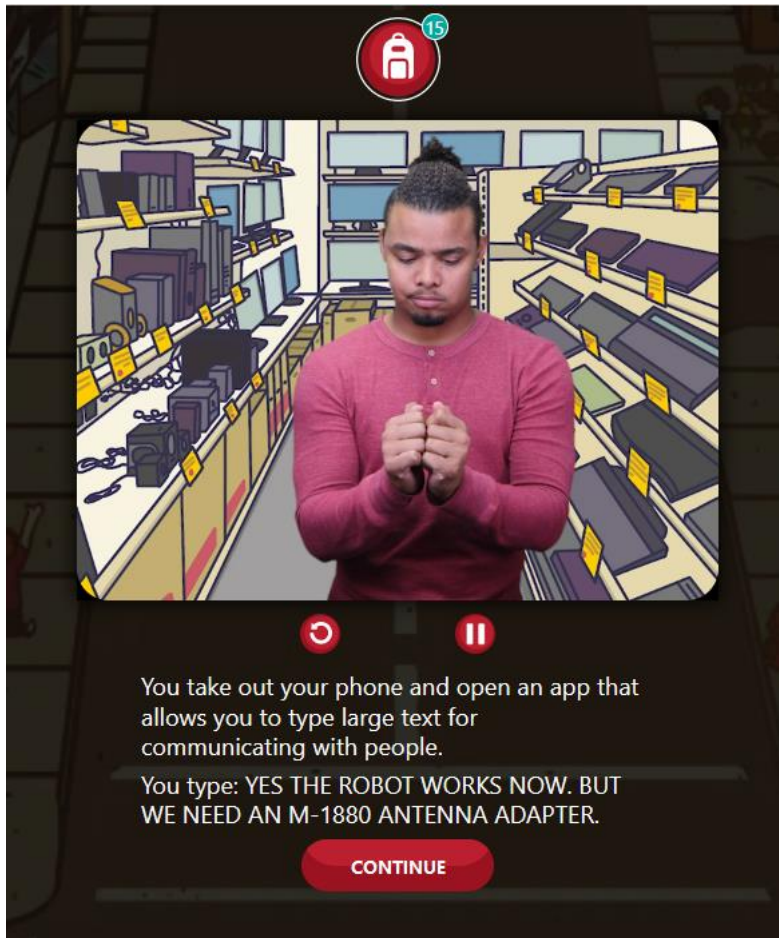
The game could potentially be accused of being too simple in the form. Narrator Justin tells all the events using sign language. His narrative is only slightly aided by comics, costumes, and background changes. The story is not shown by any other means. What could be shown, is told instead. For example, Justin explains in sign language “Peter is wearing an old, worn baseball cap with headphones around his neck” (Deafverse, 2019). Peter is not shown on the screen, the player cannot see him. The only knowledge, that the player gets about Peter, comes from Justin's sign language descriptions. It can be argued whether this is a disadvantage or an advantage of the game. However, there is more justification for this form than objections. As was stated in section 2.9. of Chapter Two, a game designed especially for deaf children and youth's needs, should be as simple as possible and avoid any kind of distractions. In *Deafverse*, the player can focus on the most important part of the game – the story. The development of the game story depends on the player and her/his choices, which is for the development of problem-solving skills. Therefore, the player should follow the story and be completely focused on it, to make the best possible decisions and learn a lot. If the player would be distracted by additional elements, such as multiple game characters and stylistic variations, this might distract him from the game's main quest.

4.4.3. Effectiveness in developing problem-solving skills

Deafverse has clearly specified educational goals. As the game's creators say, “Deafverse is an opportunity for deaf teens to practice self-determination — the process by which people make their own choices and decisions — and build self-advocacy skills by

allowing them to make mistakes in a safe environment. Research shows these skills and self-beliefs are essential for success during and after high school” (“Deafverse” n.d.). The main action space in World One is a fictive town where deaf people are a minority, and the player has to meet the challenges caused by the inadequacy of places such as schools, shops, or cinemas to the needs of deaf people, as well as overcome problems in communication with hearing people who do not know sign language. Meanwhile in World Two, which is placed on a fictitious island, where deaf people make up the majority of the population, playing challenges are focused on looking for a job, raising qualifications, and practicing job interviews.

Visiting the electronics store in World One, the player meets a worker who does not know sign language. The player needs to communicate with the cashier, as his help is necessary to solve the player’s problem – repairing Catbot. In this situation, a goal and a problem are simple to identify. The player’s goal is to get help from the cashier, which means giving necessary information or taking action that can start the robot. The problem to solve is the communication problem caused by the fact that the cashier does not speak sign language, while the player does not hear the verbal language. The player has to find a way to communicate with the cashier. However, some challenges appear. Among the options that the player can choose from, there are responses with varying degrees of effectiveness, and even with varying degrees of politeness (from nice to rude). Also, the cashier's character tends to be quite impulsive, which can lead to an increase in communication problems. However, it is possible for the player to resolve the communication problem reasonably. As can be seen in the screenshot below, the player can choose to communicate with the cashier through a special application that enables a deaf person to write the message he wants to convey.



9. *Deafverse* - screenshot from the game (Deafverse, 2019)

Then, after the protagonist types the message in the app, the cashier begins to understand the player's problem, and therefore they both can work on its solving.

Visiting the game's representation of a store can happen twice in the game – first, when the player tries to fix Catbot, just after finding it in the garden, before going to school. Then, after spending a day with Catbot at school, the player may need to come back to the store, as Catbot needs improvement. In both situations, the game teaches the player problem-solving skills, such as defining a problem, searching for adequate help, describing the problem, solving communication problems, and getting the answer / receiving help.

Another situation within the game, that also causes the player to face a problem that needs to be solved, is when she/he goes to a representation of the cinema in the game. The game protagonist wants to watch a movie, but it is not accessible to deaf audiences – it does not have a sign language interpreter or subtitles. This situation teaches the player to fight for her/his rights as a deaf person, as well as negotiate potential compensation offers. After being informed that the movie screening is not accessible to deaf audiences, the player can choose between a

mEEK withdrawal from the interaction with the ticket seller, a polite request for compensation, or an argument. The most successful solution turns out to demand compensation in a firm and assertive but at the same time polite way. As a result of achieving communication and negotiation success, the protagonist receives free tickets for accessible screenings that will take place at a later date.

This playing sequence teaches the player, that as a deaf person, she/he has a right to demand accessibility in cultural institutions, and in the case of inaccessibility, she/he may demand compensation. At the same time, the game emphasizes that the player should tone down emotions, not react too impulsively, and communicate his needs while maintaining personal culture. Therefore, the educational aspect of *Deafverse* is not limited to teaching about the rights of deaf people and problem-skills solving development, but it also refers to social norms and manners. In the case of deaf children, it may be especially important, as according to the research shown in Chapter Two, they tend to be more impulsive and impatient than hearing children.

The third sequence from Word One that is worth describing is the situation that happens while the protagonist is at school. In the school environment, the player has to face many challenges, such as limited access to an interpreter, communication problems with hearing classmates and not-hearing a fire alarm. Each of these challenges addresses a different kind of problem that deaf teenagers can meet in daily life. They are characterized by different levels of importance – while feeling excluded from a conversation led by hearing classmates is a sad experience that can cause negative emotions, not-hearing a fire alarm can be very dangerous for health, or even life. Meeting a challenge, the player can count on Catbot’s help. For instance, when the protagonist finds out that the fire alarm was not accessible to deaf students, she/he expresses frustration to Catbot:

“You look for a quiet place and open your backpack to find Catbot looking back at you. It seems like it’s doing okay now so you ask, »What happened? I couldn’t tell if the fire alarm was going off. It seems like the system only used alarm sounds«” (“Deafverse” n.d.).

Then, Catbot educates the player about deaf person’ rights:

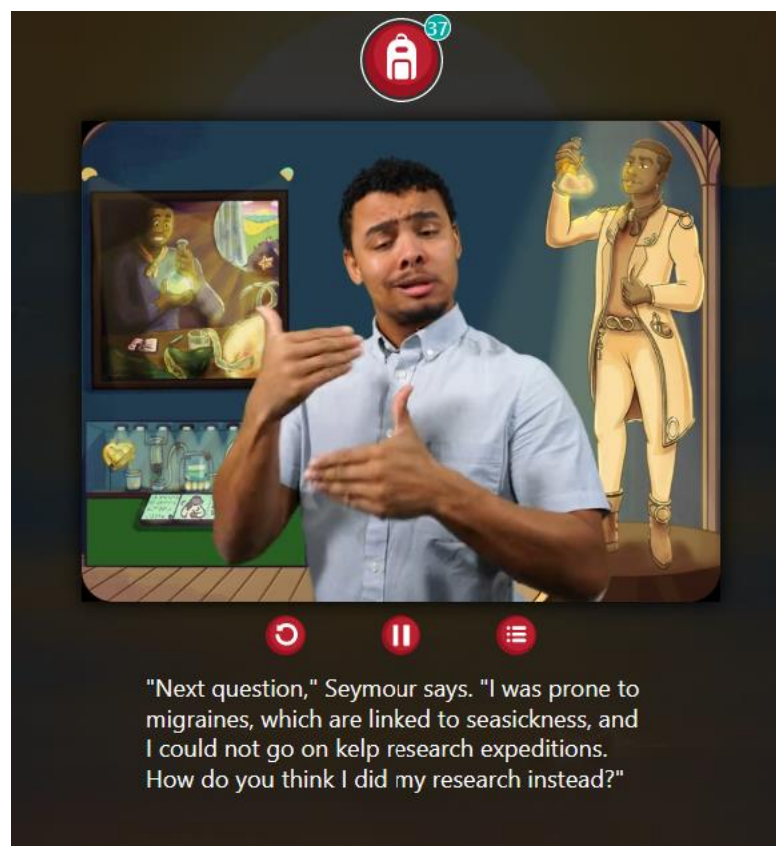
“Catbot nods, »As a deaf person, you have the right to have fire alarms installed at your school that has visual cues like strobe flashing lights. Your safety is important! I suspect that there is a reason things are going downhill around here...«” (Deafverse, 2019).

As can be seen (and has been already said before in this chapter) the player is the protagonist. Justin tells the quotes presented above to the player in sign language, using the word *you*, therefore addressing the message directly to the player. The narrator decides what the player (who plays the role of the game's protagonist) should say. It is Justin who quotes the protagonist's words, and the player has little influence on them. Thus, the game narrator suggests a possible player's reaction to the fire alarm, in such a way as to effectively lead to the next utterance, this time spoken by the robot. Then, Catbot informs the player about his/her rights. In this part of the game, storytelling becomes the main element, and the player's activity recedes into the background. However, it is for educational purposes, because the primary goal of this part is to lead to a situation in which Catbot can inform the player about her/his rights that she/he can face in real life.

In World Two, the player has to meet new challenges. As it was mentioned earlier in this chapter, the adventures awaiting the player in World Two are of a different kind than in World One. Instead of attending high school and experiencing problems caused by living in a town inhabited by hearing people, in World One the game character visits Vine Island – a place enriched with fantastic elements (such as the presence of monsters), where mostly deaf people live. The game is opened by Justin's welcome speech, expressed in sign language, in which he explains the reality of the new world. He informs the player that Catbot disappeared after he was sent on a mission to Vine Island. The player's main task is therefore to find Catbot and complete the mission. Moreover, Justin highlights the importance of player's choices: "throughout the mission, you will encounter situations that require you to make choices. Depending on the choice you make, your journey will unfold in a different way. Always make the best choice to improve your chances of succeeding in the mission", he says. This is a direct message to the player, that reminds her/him about the importance of her/his role, how meaningful her/his choices are, and how huge impact the choices have on the game's plot (and, thus, also on succeeding in the mission). The opening monologue itself indicates that the game combines an adventure aspect (the importance of succeeding in a mission) with an educational aspect (the development of the ability to make the right choices, and thus the development of decision-making and problem-solving skills).

The narrative, structure, and mechanics of the game remain the same in World Two, as they were in World One. However, the environment, side characters, and tasks are different. Also, the characteristics of challenges awaiting the player change. Contrary to World One, in World Two the game protagonist is no longer a high school student, but she/he must face the

reality of searching for a first job and navigating challenges in the workplace. Two situations are especially important – meeting the café’s worker Rita and talking to her about a job, as well as visiting a museum and talking to three statues – Chloe the Captain, Helga the Harpooner, and Seymour the Scientist. In Rita’s café, the player has a chance to have a quick chat with the café’s workers and get to know what it looks like to work there. In the museum, the play has even more fantastic and adventurous characteristics than in Rita’s café, and at the same time is more interesting when it comes to the game’s mechanics and structure. Thus, the main focus of the analysis of World Two will be devoted to the visit to the museum.



10. *Deafverse* - screenshot from the game (Deafverse, 2019)

The screenshot from the game presented above visualizes the protagonist’s conversation with the stature of Seymour the Scientist. As in the cases analyzed previously in this chapter, the narrative is led by Justin, who tells the story and lines spoken by the protagonist and other characters. The protagonist, as the player plays his/her role, cannot be seen on the screen. Seymour the Scientist can be seen in the background. His face is very similar to Justin’s face, which can be understood as an attempt to identify the narrator with the character in order to

maintain consistency, as well as make the player feel that they are communicating directly with the scientist.

The visit to the museum is connected with the protagonist's search for a job. The game's protagonist finds three job offers: a scientist, a captain, and a harpooner – exactly these positions, that are represented by the statues placed in the museum. It is up to the player, which job she/he will choose. However, the game's narrative and mechanics require the player to read the descriptions of all of them and talk to all of the sculptures, in order to listen to their stories and get to know what it looks like to work in their industries. For instance, the job advertisement for the position of scientist looks like this:

“The scientist will collect field research data to identify the most effective method for neutralizing the target oceanic pest.

Responsibilities:

Perform basic and applied research to characterize the behavior of oceanic pest targets.

Communicate research data to crew members.

Study oceanic pests before and after missions to improve success in pest control.

Qualifications:

Scientific knowledge of the various types of oceanic pests.

Ability to analyze field data and interpret results.

Efficient problem-solver” (Deafverse, 2019).

The job advertisement is written in a simple structure and language and transfers only necessary information. As can be seen, the scientist is considered a job position for someone who is an *efficient problem-solver*, indeed an expert in one of the main educational struggles of deaf children and teenagers. The possibility of being good in something that used to be a weakness can motivate the player to choose this job position, as well as encourage him in everyday life and motivate him to fight obstacles in order to constantly improve his skills.

When it comes time for deciding which job the player wants to apply for, the player can choose between a captain, harpooner, and scientist. After choosing the option *scientist*, the following message appears on the screen: “You tell Kat that you're here to solve problems” (Deafverse, 2019). Again, problem-solving is highlighted as the main feature of the scientist's job. That means that the willingness to solve problems and do it professionally, which arises in the player, will be verified in the game in the practice (with a high probability of success). Then, Kat updates the player's cover letter. Meanwhile, the player has to meet the statue of the scientist again, in order to verify problem-solving skills. The statue asks the player the question

that can be seen in screenshot 9. on the previous page – how the research can be done instead of going on the sea expeditions? the player can choose the answer from three options. However, only one of them is correct. The player received feedback immediately. If the answer is wrong, the player can choose again, until she/he succeeds. The correct answer turns out to be remote participation in conferences. After being informed about the correctness of the chosen answer, the player is introduced by the captain to the broader context and explanation of the answer:

"The people of Vine Island realized that video conferencing allowed us to relay important data more efficiently. It also made it so that I could feel like I was there in the middle of the ocean with my colleagues rather than sitting in my air-conditioned lab!" Seymour explains (Deafverse, 2019).

After choosing the correct answer, the following feedback appears:

“»Congratulations! You've won the scientist challenge!« Seymour gives you a nod of approval and examines the laboratory flask in his hands.

At the base of the statue, a slot opens and a piece of gummi pops out. It is in the form of a laboratory flask! You pick it up and pop it in your mouth. Mmm...curious” (Deafverse, 2019).

As can be seen, the feedback is characterized by a funny tone. It combines an adventure and humorous aspect with a serious one. Interaction with the statue and receiving gummies create a situation in which the player can feel an active part of the presented world – the description appeals to the player's sense of touch and taste. It is therefore easier for her/him to imagine that he is the hero of the game. At the same time, congratulating the player and calling finishing the task “winning the challenge” emphasizes that the player managed to solve a difficult problem, got new skills, and should be proud of herself/himself.

Deafverse seems to be a very effective game in developing problem-solving skills among deaf youth. It presents to the player problems that need to be solved, and proposes potential solutions, but does not suggest which one is the most relevant until the player makes the decision. At the same time, the game remains attractive in reception due to the adventure dimension and funny utterances of the characters of the game. Naturally, *Deafverse* still has some elements that could be improved, but this issue will be discussed in the next chapter of this master's thesis.

4.4.4. Potential for usage at schools

According to the creators' assumptions, *Deafverse* can be played both at home and school (“Deafverse” n.d.). Indeed, the game design is simple enough to allow the player to play independently, without being supported by the teacher’s supervision. And playing the game in the classroom, as a part of school classes, is also possible and considered worthwhile. On the game’s official website, there can be found two guides: the Teacher Strategy Guide (which can be used by teachers to support pupils during the gameplay) and Player Strategy Guide (which supports players in gameplay both at home and in the classroom). The guides are PDF documents available to download. The player’s guide is 48 pages long, while the teacher’s guide has 36 pages. The player’s guide is an addition to the game, containing tasks that stimulate critical thinking and creativity. The teacher’s guide includes discussion questions and activities that can be used in the classroom before, during, and after the gameplay.

Below, there can be found sample pages from each of the guides. The first figure is a screenshot of page 31 of The Player Strategy Guide. The second figure shows page 26 of The Teacher Strategy Guide. On both pages, the same task is presented. However, the first figure presents the task directed to a student, while the second figure shows instructions for the teacher, on how to support students in the realization of the task.

CHARACTER SHEET



NOW, TELL US A LITTLE ABOUT YOURSELF! CREATE YOUR DEAFVERSE CHARACTER, A COMIC BOOK VERSION OF YOU. THE ONLY RULE IS THAT YOU NEED TO BE HONEST WITH YOURSELF AND PUT DOWN WHAT MAKES YOU ... WELL, YOU!

CHARACTER

MY NAME IS _____

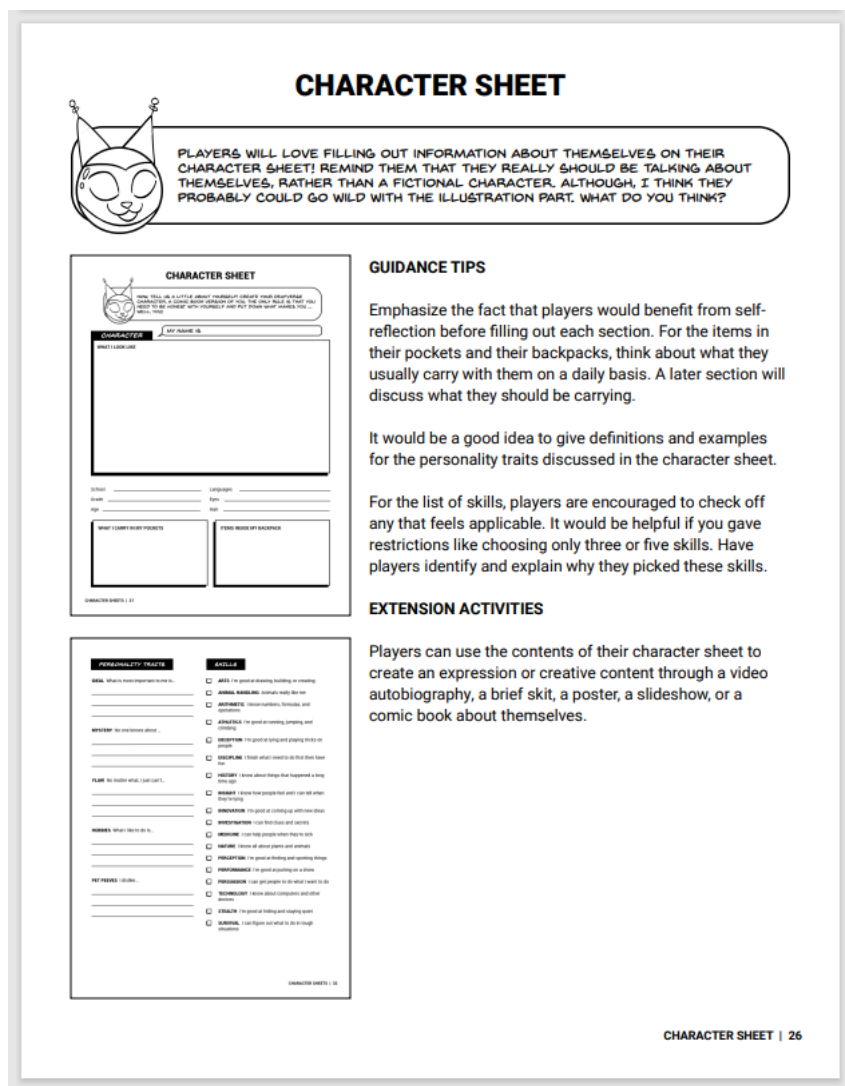
WHAT I LOOK LIKE

School _____ Languages _____
Grade _____ Eyes _____
Age _____ Hair _____

WHAT I CARRY IN MY POCKETS

ITEMS INSIDE MY BACKPACK

11. Page 31. from the *Deafverse* Player Strategy Guide (<https://deafverse.com/resources/psg/>)



12. Page 26. from the *Deafverse* Teacher Strategy Guide (<https://deafverse.com/resources/tsg/>)

The student's task is to design a comic book version of herself/himself. Therefore, the student's drawing can be considered compatible with the convention of the game, which consists of comic sequences. The visualization of own body in a comic style may make it easier for the player to imagine that she/he is an integral part of the game. Thus, when receiving a message from Justin in the second-person narrative, the player will more easily imagine herself/himself as a protagonist. This, in turn, may lead to taking the game's messages more personal to the player, and therefore strengthen her/his motivation and engagement in the learning process present in the game.

As can be seen in Figure 11, the teacher's guide includes suggestions on how to conduct the class and how to support pupils in the proper execution of the task. The teacher should make sure that children's self-representations are close to reality, as the main task is to create the most

honest image. She/he can also help the students by suggesting to them, which characteristic item could be their representations.

Looking at all the observations above, *Deafverse* can be considered an effective educational tool for deaf children's problem-solving and self-advocating skills development. The game, through the right balance between the adventure and educational aspects, is as engaging as it teaches. The mechanics and customization of the game, as well as guides for players and teachers, allow players to play the game both at home and in the classroom. In both environments, the player can get immersed in the game, learn much and develop useful skills, such as problem-solving and self-advocating.

4.4.5. Accessible design

In section 2.9. of this master's thesis, design guidelines for video games for deaf children were presented. Reflecting on *Deafverse* as the first video game accessible to deaf players, it is necessary to verify to what extent this game can be considered to meet these guidelines. Therefore, below I am contrasting the guidelines shown in section 2.9. with *Deafverse* features.

It should be clearly defined what the game designed for deaf children is supposed to teach them. In the case of *Deafverse*, the game's objectives are specified from the beginning. Narrator Justin informs the player that the main goal of the adventure experienced during the gameplay is to learn how to navigate real life as a deaf person. Also, on the game's official website, learning aims are defined – the creators highlight the role of the game in developing deaf teenagers' self-advocating and problem-solving skills. Moreover, the game objectives are clear and directly connected to the taught content, which is evidenced by the fact that all the tasks and challenges that the player meets during gameplay, consequently refer to self-advocating and problem-solving skills. Furthermore, the genre of the game designed for young deaf audiences should suit the target audience and the taught content. In the case of *Deafverse*, the adventurous genre is very adequate for deaf teenagers as it meets their needs of having fun, but at the same time, with its content and structure, it forces the player to make a mental effort and learn how to solve problems that may potentially happen in his/her life. Meeting these hypothetical challenges during gameplay can prepare the player for future life.

Another suggestion presented in Chapter Two was the statement according to which a game intended for use by deaf audiences should be constructed from semantic triples, which are: national language, sign language signs, and illustration. *Deafverse* meets these conditions. English, a national language of the USA, where the game was designed, appears on the screen in text form. Whereas sign language is the main medium of narrative. Narrator Justin transfers all the messages from the game world to the player, using American Sign Language. When it comes to the issue of illustrations, it can be analyzed considering several different factors. Firstly, illustrations appear in the comics, are an overview of the game's sequences, and show what the game's scene will be about. Secondly, they are also Justin's background – pictures can be seen behind the narrator, they visualize his words and support storytelling. Therefore, it can be said that *Deafverse* combines all the parts of the semantic triples, and therefore meets this design guideline.

What has to also be considered while designing a video game for deaf youth, is the issue of avoiding distractions. The game's form should be as simple as possible, to not distract players from the main task. *Deafverse* conforms to these guidelines. The game style is very minimalistic, devoid of unnecessary information and audiovisual effects. The structure of each of the game sequences looks very similar – the narrator tells the story or explains the task to the player in sign language, the simple background behind him suggests the place of action, and a board with a task and three answers to choose from appears. There is no space for additional effects. Also, the offer of choices in the case of games for deaf audiences cannot be too wide. *Deafverse* is very accurate in this matter – the player can always choose between two or three options and never gets more alternatives to choose from.

Moreover, the researchers quoted in Chapter Two mentioned that video games for deaf children should be single-player games, due to deaf children's communication and interaction problems. *Deafverse* is definitely a single-player game. Although the game can be played in the classroom during school classes, the game is intended for individual use and each player makes his/her own decisions on a separate computer. What is also worth mentioning, is the matter of an avatar. Researchers recommend designing a cooperating human-like avatar that guides players through the game tasks. Narrator Justin in *Deafverse* is the exact implementation of these postulates – he is not only human-like, but he is an actual human, and he is a guide who compasses players through the game challenges.

Last, but not least, when analyzing *Deafverse* through the prism of meeting the design guidelines, the issue of feedback has to be mentioned. The feedback for the deaf players has to

be understandable and must appear immediately, to avoid a situation in which the player could lose attention. Moreover, the feedback needs to be well-balanced, to not cause an exaggerated reaction from the player. In *Deafverse*, feedback appears on the screen straight after making the right decision or choosing the correct answer for a question. It is very simple and mostly takes the form of Justin's sign language expression, informing that the choice made by the player was good.

However, it is hard to unequivocally state if *Deafverse* meets some of the guidelines. Hesitations are listed and described below:

1. A system of player evaluation and performance records does not actually exist, and there are no meaningful grades or quantifiers of the evaluation system. The characteristics of the tasks in *Deafverse* do not include the option of promotion or development, overcoming subsequent levels, and observing progress. Rather, the player follows the story with a linear narrative. The only signs of making progress and going far in the game are the comic scenes which signalize that the player goes further in the story, information about entering the next chapter of the game, and items collected in a backpack. There is no space where progress is specifically noted and evaluated.
2. Levels of difficulty are not various, and the workload does not increase over time. The tasks seem to have a similar level of difficulty, the only differences that can be pointed out between them are related to the characteristics of the tasks in terms of the game's plot and the place of action (school life in World One vs. looking for a job in World Two), but the level of their difficulty can be considered similar in itself.
3. Texts are not avoided. Instead, below the video part showing Justin, a huge amount of written text is placed. However, this objection can be defended by the fact that the text is simultaneously expressed by the narrator in sign language. Thus, it is not necessary to read the text. For a deaf player, it should be enough to ignore the text and just pay attention to Justin's movements visible on the screen.

In general, *Deafverse* can be considered a game meeting the most important guidelines for designing a game accessible to young deaf players. There are some elements that could be

improved, but rather, these are issues of lesser importance, not fundamental, and not determining the accessibility of the game itself.

4.5. Conclusion

The main goal of the analysis conducted in this chapter was to verify which features of video games make them accessible to deaf and hard-of-hearing users, as well as to indicate video games' usefulness in deaf education. It was proved that *Prodigy English* and *Wordwall*, even though they are not dedicated especially to deaf users, can be effective in deaf children's education, especially when it comes to language skills development. In the case of these two games, much depends on the teacher's involvement in supporting students, modeling tasks, and adapting them to the specific needs of the deaf. The games themselves meet some criteria of accessibility, such as the option of task customization by a teacher, fast and understandable feedback, and a simple interface. However, they cannot be considered fully accessible for deaf players, as they still need an improvement in elements such as equipping the game with sign language options and illustrations that would visualize abstract terms.

A game that meets the most important guidelines for designing a game accessible to young players, is *Deafverse*. The game uses American Sign Language, and the adventurous world presented in the game is characterized by the representativeness of the deaf cultural minority. The adventure genre of the game harmonizes with the educational goals oriented toward the development of problem-solving and self-advocating skills. The adventure genre works well for the game's main educational goals – although the player navigates in an adventure environment, she/he must make decisions and solve the challenges that can be considered possible to meet in the real life of a deaf person.

It can be concluded that not only serious games can be considered educational tools, but the teaching potential can be also found in adventure games. Serious games are more effective in language learning, while adventure games are more effective in developing problem-solving and decision-making skills. Since language and problem-solving skills are the main challenges in teaching deaf children, it can be assumed that using both genres of video games can be valuable in schools dedicated to deaf students - if serious games are used in language classes and adventure games in order to develop children's soft skills.

Chapter Five: Discussion

The main purpose of this master's thesis was to verify whether video games could prove to be a proper additional method in teaching in the case of deaf and hard-of-hearing children. In this chapter, I will discuss the results of the research presented in Chapter Three and Chapter Four, as well as refer to the theoretical assumptions described in Chapter Two, to answer the research questions (the research questions were formulated in Chapter One of this master's thesis).

5.1. Video games as a solution for educational challenges

One of the main research questions of this master's thesis was: how, through using video games, can modern education meet the challenges of young deaf students and make learning more absorbing and effective? Also, special attention was paid to the issue of adventure games' potential in the education of deaf and hard-of-hearing children. The following additional questions were formulated: Can adventure games be considered a tool helpful in the education of deaf and hard-of-hearing students? What and in which aspects is more efficient, a serious or an adventure game? At this point, it is necessary to reflect on all the questions written above.

In this master's thesis, based on the literature review, issues such as language and problem-solving skills were pointed out as the main educational challenges in deaf children's education. It was assumed that serious games can be an effective tool in learning a language, while adventure games may help in problem-solving skills development. Moreover, the educational process taking place during playing serious games was identified as intentional learning, while playing adventurous games was considered incidental learning. Therefore, it was stated that adventurous games may be equally valuable educational tools as serious games, but in different aspects. While serious games (such as *Prodigy English* and *Wordwall*, analyzed in this paper), seem to be very effective in improving hard skills, such as writing and reading, adventure games tend to be powerful in developing soft skills, such as problem-solving and self-advocating. Therefore, both serious and adventure games have educational applications. Moreover, in a way, adventure games can prove to be a more absorbing genre than serious

games. Due to the aspect of fun and the adventurous nature of the world presented in the game, a young player can be completely immersed in the game world, and thus feel flow.

The only complaint about games' effectiveness in deaf education may be the issue of accessibility. As shown by the survey in Chapter Three, teachers working with deaf youth declare the use of video games as an additional pedagogical method, but they emphasize that the offer of games accessible to the deaf is limited. In Chapter Four, I conducted the analysis of two games mentioned by interviewed teachers (*Prodigy English* and *Wordwall*), and of a third game that remained unknown to the respondents (*Deafverse*). *Prodigy* and *Wordwall*, although they are games designed without special focus on deaf players, in general, show potential for effective teaching of the national language, especially when it comes to learning vocabulary and spelling. Whereas *Deafverse*, the first ASL-accessible video game available on the market, designed especially to meet deaf users' needs, turns out to be a tool with high educational potential.

To conclude, modern education can meet the challenges of young deaf students and make learning more absorbing and effective by using video games. By playing video games, students get immersed. For this reason, they can experience flow more easily than in the case of traditional teaching, and the state of flow strengthens the involvement in the process of acquiring knowledge. For this reason, not only serious games but also adventure games have educational potential. The first genre seems to be more effective in international hard-skills development, while the second genre may be a tool for incidental getting soft skills.

5.2. Video games and accessibility

The second research question of this paper was: what features should a game have to be accessible to deaf and hard-of-hearing players? The following questions were also formulated: How can the elements of games designed for people without disabilities be helpful for deaf and hard-of-hearing people? How to create a video game that would be useful for deaf and hard-of-hearing students?

These questions can be partially answered based on the literature discussed in section 2.9. of Chapter Two, where design guidelines for games accessible to deaf players were described. However, as was shown in Chapter Four, some of the features of existing video

games still need improvement to be fully accessible, and thus, customized and effective educational tools for deaf and hard-of-hearing students.

In Chapter Three of this master's thesis, there was shown the deaf player's attitude toward video games. Although sharing their opinions was additional and was not deeply analyzed, some of their suggestions are worth recalling at this point. Deaf players asked what features they are looking for in video games, and what would they recommend for game companies to design games that would meet the needs of deaf people. Both respondents suggested that most of the games are not subtitled, but they should be. Keeping in mind this hint, it can be assumed that the main feature that a game should have to be accessible for deaf players, is equipping the game with subtitles. It is a simple solution, which can be easily implemented, and thus make the video games market more inclusive for deaf and hard-of-hearing persons. Respondent 14 mentioned also, that video games could be equipped in comfortable headphones that accommodate hearing aids. She/he also pointed out, that effects such as vibrations and color changes in particular moments of gameplay would also make a video game more accessible.

Deafverse, due to its mechanics, structure, and sign narrative, is considered an accessible video game for deaf and hard-of-hearing players. However, it still has some elements that could be improved. First of all, it can be suggested that a system of player evaluation should be developed. The current version of the game does not have a specific system to accurately evaluate a player's performance. It could be changed by adding some tasks that would not only focus on solving problems and following the linear storyline but would also verify the player's real progress in acquiring skills. Another solution would be also adding the option of the teacher's insight into the course of the game and ongoing analysis of the player's way of thinking - how she/he makes decisions and what influences her/his choices.

However, a very important thing about *Deafverse* is the fact, that the game was created by only deaf specialists for only deaf players. The game is therefore a representation of the cultural minority of Deaf people. This is a way to meet the needs of deaf gamers who often felt overlooked by cultural texts, which is evidenced by the comment of Respondent 14. She/he wrote: "There should be more accessibility and representations for us. I only know of deaf characters but sadly no games themselves" (see Chapter Three). *Deafverse* can be definitely considered a game that represents Deaf culture itself. Thus, *Deafverse*'s structure, mechanics, and design should be an inspiration for future game creators.

Nonetheless, it should be emphasized that *Deafverse*, even though it is an accessible game for the deaf, is available only in American Sign Language. As every country in the world has a different sign language, the potential popularization of the game on the world market may be problematic. Sign language translation is a more complicated process than a translation of a written or verbal language. Nevertheless, there is hope for a future solution to this problem. Using artificial intelligence, it would be possible to translate sign language. It can be suspected that in the future, Sign Language Recognition will be used to implement an automated sign-language translator (Ardiansyah et al., 2021, p. 541-549).

Keeping in mind all the suggestions written above, it can be said that creating a video game that would be useful for deaf and hard-of-hearing students is a complicated and challenging process, which requires more work and the use of innovative solutions than in the case of games for hearing people. However, designing a video game that would meet the expectations and needs of deaf students and their teachers, is possible, and *Deafverse* can be considered a pioneer in this field. Taking this game as a guide and enriching it with additional options stimulating senses other than hearing, such as vibrations, can lead to developing another accessible video game.

Chapter Six: Research Conclusion

6.1. Research Outcomes

The main purpose of this master's thesis was to contribute to solving the problem of learning difficulties among deaf children by proposing video games as an additional educational tool. In the beginning, the literature was reviewed in order to gain an in-depth knowledge of the main challenges in the education of deaf children, as well as to explore the topic of video games and to theoretically reflect on how games can be used in schools. Then, qualitative research was done. The survey was conducted among high-qualified teachers who work at schools dedicated to young deaf students. Based on the responses, it was discovered that there is a willingness to use video games at schools, but inaccessibility is the main obstacle. Most of the educational games available on the market do not meet the specific needs of deaf players, such as using sign language and narrative. Currently, teachers are using serious games intended for children in general (including the hearing ones), and thus not fully compatible with design guidelines for deaf-accessible games. The most popular games mentioned in the survey were *Prodigy* and *Wordwall*, which allow the teacher to customize the tasks. Using creativity and based on professional experience, teachers try to adapt the game tasks to the needs of the students.

In Chapter Four, next to the analysis of the games mentioned above, the first ASL-accessible adventure game *Deafverse* was presented and deeply discussed. Despite showing some of the game's flaws, *Deafverse* was found to be an example of an accessible game with great potential for teaching deaf youth. This game can be an inspiration for the creation of future adventure and serious games adapted to the needs of deaf audiences.

Contrasting the teacher's concerns with analyzed games' features, and considering all the aspects discussed in Theoretical Framework, it can be said that both serious and adventure games have educational potential. They can and should be used as an additional teaching tool in deaf education, as the goals of the games are compatible with the main challenges of teaching deaf children, which are language and problem-solving. Serious games turn out to be effective tools in learning a language and gaining hard skills, such as writing and reading. Whereas adventure games show potential in developing soft skills, such as problem-solving and self-advocating.

To summarize, serious and adventure video games are effective and absorbing educational tools that can meet the needs of young deaf students and resolve the main pedagogical problems. The only issue preventing the use of games from being practiced on a large scale in schools is accessibility. However, as the example of *Deafverse* shows, designing a game adapted to the deaf audience is possible, and even can be a great success. Now, the next step is to create more video games that will be accessible to deaf players. There is a demand for such games, so the market should meet them. This would make the world of computer games more inclusive for deaf players, and learning through video games would be more popularized.

6.2. Limitations

The survey conducted for the needs of this master's thesis shows the importance of the research. However, despite efforts to reach as many respondents as possible, complications were encountered. In the end, twelve teachers were reached and twelve high-quality answers to the questions were obtained. However, to broaden the knowledge of the studied subject, I would like to reach out to a much larger number of respondents.

Unfortunately, one of the ideas for expanding qualitative research has not been implemented. I wanted to get the opinion of deaf players about video games. Contrary to my expectations, only two gamers decided to answer the set of questions I prepared. For this reason, I could not conduct a detailed analysis of the research results or draw general conclusions. However, I believe that this idea will be realized in future research, which will make it possible to get to know a completely new point of view on computer games and lead to the introduction of innovative solutions in the design of games so that they are more inclusive and accessible.

6.3. Future Research

I hope that this master's thesis can contribute, at least to a small extent, to future research on video games supporting the education of deaf people. I believe that in the future, some researchers will reflect on the issue of using video games in deaf education, and find solutions to make games more accessible. What I would suggest in particular, is developing solutions for translating the sign language present in games into other language versions, to give the available games a global reach. The fact that there is a game using ASL is optimistic, but at the same time, it leads to reflection that English-speaking countries (or even, since each sign language

has different characteristics, the United States) are privileged in terms of access to games. The possibility of translating games into other sign languages would lead to equal access to education among deaf people around the world.

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Appendix

The following pages of this paper include:

- 1) The survey for English-speaking teachers posted on relevant Facebook groups & Answers
- 2) The survey for Polish-speaking teachers shared in the school for deaf and hard-of-hearing children in Gdynia, Poland & Answers
- 3) The survey for deaf and hard-of-hearing players & Answers

Questions to teachers: Using computer games in the education of deaf and hard of hearing children

6 odpowiedzi

[Publikuj statystyki](#)

How many years is your professional experience as a teacher of deaf children/deaf youth? Do you teach in a special school dedicated to deaf children or in an integration school?

6 odpowiedzi

3 years, mainstream (integration)

5 years; 3 in a private OPTION school and 2 in a public school as an itinerant

3 years as a teacher. 5 years as a paraprofessional. Dedicated school - Residential/Day School for the Deaf.

20+ and I work in a public school DHH program

2 years, integration

7 years, in a dedicated school



What subject(s) do you teach and what age groups are your students in?

6 odpowiedzi

DHH Expanded Skills class, high school

Private: 4th/5th grade and Kindergarten - all subjects (math, writing, reading, science, social studies)

Public: ECI - High School - subjects vary regarding the needs of the students

Self-Contained all academic subjects (Math, Science, Social Studies, Reading, English Language Arts). I taught 3-4 year old preschool for 2 years. This year I have a combined class with 4th, 5th, and 6th grade.

9-12, I teach mostly ELA and History

Science, 4-6th grade

Math

What is your opinion on the use of serious games* in teaching?

*serious games are defined as an “educational application, whose initial intention is to combine, coherently and at the same time, serious aspects, in a non-exhaustive and non-exclusive way, teaching, learning, communication, or even information with the fun aspects of video games” (Connected Healthcare for the Citizen, 2018)

6 odpowiedzi

I think it is a potential tool/resource if proven to be accessible to ALL Deaf/hard of hearing students with varying language/reading levels

Love it when the game is great! My only concern is doing so in moderation.

I think play is the best way for students to learn and video games are the way many kids play these days. I think games should be incorporated in all teaching, whether it be table-top games, physical movement games, or video/computer games.

I think can be very useful if the students can use them independently and use ASL

I think it is a good idea but there are NOT many games accessible to deaf pupils

I think it can be a good supportive tool



Have you used any games in your teaching? Which games and how?

6 odpowiedzi

Not many, as most are not accessible for all.

iPad apps (Prodigy, Quiziz, IXL, etc)

I use Prodigy Math, Prodigy English, Dreamscape, Super Mario Maker (Nintendo Switch), Typing.com, Reading Eggs, Touch Math game apps.

Very few, there aren't many

No

prodigy

If you rarely or not at all use games, what are the reasons why you don't?

4 odpowiedzi

Accessibility

They do not use ASL. I teach mostly ELA and my student need language practice that they can do independently

Accessibility

-



How would you describe your own playing ability?

6 odpowiedzi

Intermediate

Love to when I need to wind down

I grew up playing tabletop and video games. I am an avid video gamer now, and play nightly. I met my husband on an online video game, so it is very much a family affair. I have extensive knowledge of a variety of games and a high player ability in most.

None existent

Low

intermediate

Do you play any games casually yourself? What games?

6 odpowiedzi

Yes, varying PC/PS5 games

Currently playing games on the Switch console

World of Warcraft, Story-based RPGs, (Final Fantasy, Octopath Traveler,) Massive multiplayer online games, platformers (mario, etc.), survival games (Ark, Icarus, etc.), Shooter games that are team based (Back for Blood, GTFO, etc.). Honestly, I'm pretty open to most games. I prefer story driven games and/or games I can interact with other real people in.

None

No

no



How would you describe your school's access to computer games?

6 odpowiedzi

Each student is given a laptop and can access games easily from their individual device

Limited due to funding. Biggest issue is having devices that are compatible with students' hearing aids.

We have an esports club with at least 10 gaming computers, computer controllers. A PS4, working on getting a Nintendo Switch or another PS4. All students have 1-1 Chromebooks (most games are blocked, but we can individually unblock many educational games). All classrooms have smart panel TVs for smart boards. I can easily bring my Nintendo Switch and hook it up to the smart board. I sometimes use Super Mario maker to create levels for math or sentence structure where students have to pick the correct tubes that make the expressions correct to beat the level. If they pick the wrong one they fall into a pit and die. They enjoy this.

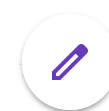
Limited; especially at the High School level

Limited

Limited - not enough computers in the classroom

Ta treść nie została utworzona ani zatwierdzona przez Google. [Zgłoś nadużycie](#) - [Warunki korzystania z usługi](#) - [Ochrona danych osobowych](#)

Formularze Google



Pytania do nauczycieli: zastosowanie gier komputerowych w nauczaniu dzieci niedosłyszących

7 odpowiedzi

[Publikuj statystyki](#)

Ile lat wynosi Pani/Pana doświadczenie zawodowe w nauczaniu dzieci niedosłyszących? Nauczają Pani/Pan w szkole specjalnie dedykowanej dzieciom niedosłyszącym czy integracyjnej?

5 odpowiedzi

30 lat szkoła specjalna dedykowana dzieciom niedosłyszącym

1.5 roku

28 lat

23 lata. Szkoła specjalnie dedykowana dzieciom niedosłyszącym

3 lata

Jakiego przedmiotu Pani/Pan naucza i w jakich grupach wiekowych?

5 odpowiedzi

logopedia 5-18 lat

Nauczyciel świetlicy, nauczyciel języka migowego i rewalidacja. Nauczyciel języka migowego klasy 1-3, rewalidacja 10-13 lat.

logopedia, język polski dzieci w wieku szkolnym od 5 do 18 lat

edukacja wczesnoszkolna, logopedia, rewalidacja (zajęcia grupowe i indywidualne). Uczniowie w wieku 6-15 lat.

zajęcia rewalidacyjne ukształtowane na rozwój komunikacji - wiek 6-16



Jaka jest Pani/Pana opinia na temat zastosowania gier komputerowych w nauczaniu?

6 odpowiedzi

Jestem przekonana o dużym znaczeniu gier komputerowych w nauczaniu /z zachowaniem higieny pracy z komputerem/; są nie tylko pełnoprawnym narzędziem edukacyjnym ale odpowiadają na potrzeby czasu - lepszy dostęp do aktualnej wiedzy, szybszą edukację, w przypadku osób niepełnosprawnych są dobrym narzędziem wyrównywania szans edukacyjnych, kompensację w zakresie danej niepełnosprawności, uzupełniania opóźnień czy braków

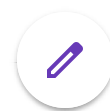
Mieszana.

są bardzo przydatne

Dobrze skonstruowana pod względem metodycznym i merytorycznym gra komputerowa na pewno znalazłaby zastosowanie w nauczaniu i mogłaby być pomocna.

Uważam że jest dobry pomysł, ponieważ dzieci ciągną po telefonu, grają w niestosownym gry. Zamiast to dzięki temu mogą uczyć się czegoś ze gier na przyszłościowe życie

bywają pomocne ale nie powinny być podstawowym narzędziem w terapii



Czy używała Pani/używał Pan gier komputerowych jako narzędzi edukacyjnych? Jeśli tak, jakie były to gry i w jaki sposób były stosowane?

6 odpowiedzi

Gry specjalistyczne do nauczania mowy i języka polskiego oraz migowego; gry ogólnorozwojowe w zakresie kształtowania i rozwoju oraz usprawniania funkcji poznawczych, słuchowych, wzrokowych, ruchowych, koordynacyjnych. Poza specjalnymi programami logopedycznymi stosuję platformy edukacyjne, dostępne w internecie.

Gry mają szerokie spektrum wykorzystania w zależności od inwencji logopedy oraz możliwości uczniów.

Uczeń samodzielnie lub z pomocą nauczyciela wykonuje zadania.

Często wordwall. Takich typowo gier komputerowych, nie.

tak, używałam wielokrotnie, ale były to gry sprofilowane, edukacyjne, np na platformie "Superkid" lub te stworzone przez logopedów lub polonistów na stronie wordwall lub stronach logopedycznych oraz "Logo-gry" pakiet gier logopedycznych lub "Sfonem" do ćwiczeń słuchowych itp. (różnego rodzaju quizy, dobieranki, układanki słowne, wykreślanki wyrazowe, uzupełnianki zdaniowe, teksty z lukami itp.

Rzadko. Była to np. gra, a właściwie cały pakiet interaktywny "Logopedia" polskich specjalistów w Digital Young Planet. Była stosowana indywidualnie. Uczeń miał do wykonania różne zadania np. połączyć obrazek z podpisem albo powtarzać słowa za postacią z gry (pod kierunkiem nauczyciela) itp. Używałam też gier ze strony ito.hg - np. trzeba było etykietować obrazki itd., ale od pewnego czasu ta strona jest już nieaktywna.

Tak, <https://www.gov.pl/web/edukacja-i-nauka/kurs-polskiego-jezyka-migowego-pjm> może nie do końca całkiem gry, ale tam są pare gry które by dzieci mogły skorzystać

gry on-line portal printoteka, superkid, brain, ćwiczące pamięć słuchową, labirynty łączone z ćw. emisyjnymi i oddechowymi, podręczniki z pjm udostępnione na men gov



Jeśli używa Pani/Pan gier komputerowych rzadko, lub nie korzysta z nich wcale, jaki jest tego powód?

6 odpowiedzi

nie dotyczy - używam często wielu gier komputerowych

Nie korzystam, nie chciałabym aby często dzieci w ten sposób mnie wykorzystali, ze chcą grać. Wole na coś innego przeznaczyć gry.

korzystam

Nie znam dobrych gier edukacyjnych, są mało rozpowszechniane. Ponadto preferuję osobisty kontakt z uczniem - j. migowy, obrazki, ilustracje, karty pracy. Gdy dziecko niesłyszące/niedosłyszące jest wpatrzone w ekran komputera, traci kontakt wzrokowy z nauczycielem, przez co odcina się od najważniejszego dla siebie zmysłu poznania.

Rzadko gram z powodu brak czas.

stymulują prawą półkulę mózgu i często dzieci i tak zbyt dużo czasu spędzają przy ekranach dlatego warto stymulować lewą półkulę odpowiedzialną za rozwój mowy (ośrodku Brocka i Wernickiego w mózgu)

Jak opisałaby Pani/opisałby Pan własną zdolność grania w gry komputerowe?

6 odpowiedzi

Średnia, po przyuczeniu jestem w stanie grać w gry komputerowe

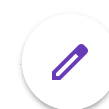
W zależności jakie to są gry komputerowe.

świetna

Zdolność raczej podstawowa. Rzadko gram w gry komputerowe i są to gry dość proste.

7/10

umiem grać ale nie przepadam, wolę inne zajęcia



Czy gra Pan/Pani w gry komputerowe w czasie wolnym? Jeżeli tak, jakie są to gry?

6 odpowiedzi

tak - gry językowe w zakresie j. polskiego, quizy "wiedzowe", treningi sprawnościowe m. in. pamięci, spostrzegawczości, myślenia, logiczne, rozrywkowe np. pasjans itp

Nie mam.

nie gram

Rzadko, preferuję czytanie książek lub oglądanie filmów w czasie wolnym. Są to gry:2048, The Craft, Candy Crush Saga. Korzystam także z Doulingo.

Tak, AE Mysteries, bloons, among us czy różne gry z strzeleniem np fortnite czy call of duty, the last of us

słownikowe, scrable, wow z słownikowymi zagadkami, ćw. mózg na pamięć

Jak opisałaby Pani/opisałby Pan stan dostępu do gier komputerowych w szkole, w której Pani/Pan pracuje?

6 odpowiedzi

umiarkowany, zależy od inwencji nauczycieli, jest możliwość wzajemnego udostępniania. Mogłoby być więcej do samodzielnego wykorzystania w czasie wolnym uczniów / pod opieką nauczycieli np w świetlicy

Dostępu brak.

dobry

Zadowolający - w każdej klasie jest komputer z dostępem do Internetu, można korzystać z darmowych gier, które oferuje Internet. Nie bardzo można coś ściągnąć, bo potrzebna jest zgoda administratora. Nie bardzo można kupić, bo nie ma pieniędzy. Szkoła nie jest też wyposażona w zestawy gier np. na płytach - nie ma takich rzeczy. Czyli pozostaje tylko, co oferuje Internet online i za darmo.

Tak można powiedzieć że powoli się rozwijają.

jest wystarczający



Formularze Google



Questions to players: Using computer games in the education of deaf and hard of hearing children

2 odpowiedzi

[Publikuj statystyki](#)

What kind of video games do you play?

2 odpowiedzi

Ps4 and cell phone video games

Rpj, horror, open world, action

Do you play games designed especially for deaf players? What games?

2 odpowiedzi

Didn't know there was any so no

0 don't know of any personally

To what extend and why are you satisfied/unsatisfied with the current offer of video games for deaf and hard of hearing players?

2 odpowiedzi

You can turn subtitles on all the ps4 games

There should be more accessibility and representations for us. I only know of deaf characters but sadly no games themselves.



What are the features you are looking for and why? Do you have any recommendation for game companies to design games that would meet the needs of deaf people?

2 odpowiedzi

If it's not subtitled/cc they need to be .

More accurate subtitles. Many have trouble keeping up with the dialogue within the games.
More comfortable headphones that accommodate hearing aids. Maybe add other ways to alert plays of nearby enemies, collectibles, ect through vibration, color changes, or something of the like.

Are there any games that you find specifically difficult to play because of being deaf / hard of hearing?

2 odpowiedzi

Not really - example rocksmith (it's a game that teaches you to play a real bass or guitar) even if you can't hear it , it visually shows you what string to hit and when.

Team based games can be difficult without the use of chat. Most of the strategy is lost to us because there usually isn't away to communicate without setting down your controls and typing it out.

Horror games are usually built for audio scares so I tend to miss the warnings of the monsters

Do you know / have you played any games that specifically address/consider hard of hearing players? Please list them and describe why you like/dislike them.

2 odpowiedzi

Not sure

Borderlands and Marvel: Spiderman have wonderful descriptive captions and the settings are pretty easy to change if you need to



Have you used games for educational purposes? If yes, was it at school or outside school?

2 odpowiedzi

I guess rocksmith cuz it teaches you how to play a real instrument (outside of school) . But without the video game playing it's impossible. I'd never actually be able to learn to play without being Hooked up to the video game .

When I was younger I remember play a winterscape math game in middle school as well as a typing game in junior high

Have you played any games as your school activity?

2 odpowiedzi

Yes once we played snood in biology in 1996 it's like bubble pop you don't have to hear anything

Nothing really outside of sports and Improv for drama studies

Would you recommend any games for an educational context for 10-15 years old deaf and hard of hearing players? Why?

2 odpowiedzi

Word games to help vocabulary and spelling . I guess .

Sadly I don't know of any educational ones that I could share

Ta treść nie została utworzona ani zatwierdzona przez Google. [Zgłoś nadużycie](#) - [Warunki korzystania z usługi](#) - [Ochrona danych osobowych](#)

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