



**AALBORG UNIVERSITET**  
STUDENTERRAPPORT



Investigating the case of Helsingør School, a critical investigation of the implementation of VR in the learning environment.

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**Master Thesis**

**Thesis**

**F23 TAN10, [S-C-M]**

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Characters incl. spaces: 28087

Delivery Date: 02.06.2023

# Abstract

*This thesis investigates the implementation of Virtual Reality (VR) technology in Helsingør School, focusing on the factors that facilitate or hinder its integration into the learning environment. The study aims to provide insights into the specific context of VR implementation in educational settings, mostly through a combination of empirical data collection methods by including interviews and observations which explore the field of VR in education to identify all settings. Drawing on theoretical frameworks of social constructivism, informed by Lev Vygotsky, and critical theory, influenced by Hartmut Rosa, the research examines how these theoretical perspectives help understand the factors influencing the successful adoption of VR. By analyzing the micro and macro factors, the study identifies both the benefits and challenges of implementing VR in Helsingør School. The findings contribute to the existing knowledge on VR implementation in education and offer recommendations for optimizing the integration of VR technology in similar educational contexts.*

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# 1. Introduction

Imagine a future in which virtual reality (VR) could become a part of the Danish school system. Imagine having students experience learning by taking kids into virtual worlds, whether it is experiencing visiting the moon, constructing houses, or walking past historical cities. All these scenarios could be experienced through (VR) technology.

As the technology becomes increasingly efficient while at the same time increasing in price, it is now becoming possible for educational institutions in Denmark to use VR as part of learning. (danskindustri.dk, 2019)

In 2019 Indeed, the proposal from the Danish Ministry of Education was implemented (Undervisningsministeriet, 2018). A 3-year experiment with primary schools nationwide will work towards a better technological understanding to promote students' involvement with new technologies. Furthermore, the Danish Ministry of Children and Education outlined a strategy in March 2018, making STEM (Science, Technology, Engineering, and Mathematics) a bigger priority in primary schools (Undervisningsministeriet, 2018). This strategy includes a focus on STEM subjects, with new approaches being introduced to teachers to captivate the attention and interest of more students. VR is included as one of the ways in which, technology understanding (teknologiforståelse) can be fostered. The government's goal is to grow the interest in STEM subjects in the younger generation so that more students will choose the scientific route when choosing a career later in life.

The public school of Helsingør is one such school where the administration has chosen to introduce the use VR into the learning environment with the help of the Danish government funding. As VR rapidly developing technology is becoming increasingly part of our everyday lives, it would be too easy to assume that VR can benefit education and that it is beneficial to implement VR in the Helsingør School. In an article on (Videnskab.dk) ,Jesper Balslev, Associate Professor at Copenhagen Business Academy and PhD student at Roskilde University research group for science studies),- believes that VR is overhyped and lacks research on the topic. Namely, the technology has not yet been appropriately investigated to fully understand the expected effect on student's learning

outcomes (Ringard, 2018). Thus, further research is urgently needed on this topic to figure out the possible effects (positive or negative) of the use of VR technology in didactics and to reshape curricula given, enhancing students gaining of knowledge (in such a groundbreaking way). We will do that by focusing on a case study targeting the VR implementation process in a public school in Denmark.

In this context, we aim to investigate: 1) Is VR even really being used in practice? 2) How is VR used in the Helsingør School, and is the technology evidently benefitting the learning outcomes?

Therefore this study will explore how VR is being implemented in Helsingør school and which factors are/could be part of this process or what factors are hindering the adaptation of VR in the educational environment. We recognise that exploring the attitudes and beliefs of the actors within the school of Helsingør is essential to understand how VR is used in practice. This task includes exploring the readiness and/or willingness of the educators at Helsingør School to incorporate VR technologies into their teaching/learning methods and also to which degree the VR technology is currently available to them. We also acknowledge the significance of external factors, such as technological advancement, government policies and the educational trends of using VR in learning environments influencing the implementation of VR into the learning environment at Helsingør School.

## 1.1. Problem Area

Our research project will expand on the current literature available to comprehend the gaps in the research regarding VR. At the same time, our problem field includes research of companies and educational institutions in which the technological element of VR is present.

By limiting our focus to a VR in educational settings, we can identify the conditions that affect either the success or failure -in implementing the VR technology as an educational tool in the Danish context (and in the Helsingør School).

Because our research aims to address the limited body of research in the field of VR in education, we first recognize the importance of incorporating knowledge from existing literature, which includes a Danish and international context. On the one hand, by including studies from an international perspective, we can provide a broader understanding of the challenges and figure out the actual possibility of success in the practices associated with the implementation of VR. Thus, this angle/perspective allows us to explore large sample sizes from different educational institutions, as the international literature explores the topic in a bigger global perspective. We will also account for the literature on VR in education from a Danish context, which will enhance our comprehension of the conditions placed within the Danish educational system, and how specific cultural aspects can influence such processes.

Our thesis focuses on exploring the implementation of VR technology in the case of Helsingør School, and understanding the factors which influence its integration into the learning environment. Thus, we aim to explore how VR is being integrated as part of the educational practices in a case study in order to comprehend the factors that influence not only the VR technology and its implementation but also, to further get an insight on what could be the progression in using VR tools in the Danish educational system and the opportunities and challenges that it can provide for both teachers and students.

## 1.2. Problem formulation

**What factors can facilitate or hinder the implementation of VR technologies in the learning environment, focusing on the case study of Helsingør School?**

This field of research is still relatively new and needs to be improved in particular empirical studies examining the effects of using VR tools in primary schools.

Consequently, this thesis must be understood as a contribution to this field of research area: **by investigating the factors that influence technology and its educational environment.** Based on relevant literature (on VR) and our empirical data, we will further aim to elucidate:

Sub questions



- 1) How to identify the factors which affect the educational settings technology of VR in education?
- 2) How is VR used as a part of the learning environment in question and to reach specific learning objectives and goals?
- 3) How can critical theory, combined in collaboration with social constructivist learning approaches, be functional to provide an advanced understanding and meaningful comprehension of how the VR technology is used/implemented as a teaching/learning tool in the Helsingør School case?

## 2. Introducing the field

In this section, we will describe the current conditions that influence form VR implementation in the educational setting while introducing the aspects of the field that relate to our specific case. As a starting point, we will explain and account for the existing artefacts/hardware used in the case of Helsingør School in the classroom; namely, to establish a fundamental understanding of the technology used in the learning activities in Helsingør School. As the field of VR in education is developing rapidly, we will include empirical data (primary data) we have collected from the case of Helsingør school, and the secondary data, from the existing literature regarding VR in education, both from a danish and international context.

As part of this background section of our research, we will summarise what are the components of the technology of VR by describing what the technology is, how it works, and who is behind developing the technology. Ultimately, we will highlight the connection of education through exploring the practical use of various programs (in Helsingør School) and the functions of VR that are actually used in the learning environment.

## 2.1. Virtual Reality

Virtual reality (VR) is an immersive technology which allows to engage in interactive computer-generated experiences. As explained by Sherman and Craig (2018) in their book “Understanding Virtual Reality,” VR enable the users to experience a simulated physical presence within a computer-generated environment. Through the use of the technology of VR, the user can explore and interact with virtual worlds, objects and characters, creating a sense of immersion. VR offers a transformative experience giving the potential to impact various fields including education. As Virtual reality is growing increasingly, it is becoming more prevalent in different practices. In 2023, VR has applications in gaming education, training, and more. (Ibid). The technology allows the users to enter the virtual world as VR is designed to create a sense of realism. Through this interactive media, the user can experience captivating and immersive experiences.

VR is becoming part of the field of education by offering unique opportunities for experimental and interactive learning (“Forstå Virtual-, Augmented- Og Mixed Reality,” 2018). The possibilities of training employees and educating students in advanced processes and applications across national borders is now more possible than ever(Ibid). The technology of VR undoubtedly provides opportunities through simulation where the possibilities seem endless, as the potential of VR is yet to be fully understood.

In the next section/subsection , we will expand on the technical features of VR implemented at Helsingør School, to highlight their function in the learning enviroment and understand the challenges related to implementation in the specific learning environment.

### 2. 1. 1. Technical details

The hardware in virtual reality includes a headset and sometimes other peripherals used to enhance the immersive experience, such as handheld controllers and sensors for motion tracking (Bardi, 2022). Understanding the technical specifications of the VR hardware systems is crucial in assessing their functionality and potential impact on teaching and learning within Helsingør School. Based on our empirical data (c.f. 4.3), we will account for two VR systems used in the school, the Oculus and The Pico.

## 2. 1. 2. Pico

Pico is a VR hardware system offering various features and capabilities. The Pico headset weighs about 276 grams, making it lightweight and comfortable for extended use. It is powered by a Qualcomm Snapdragon Processor, a high-performance processor known for rendering immersive VR content efficiently. The headset boasts a 2880 x 1600 pixels resolution, ensuring sharp visuals and a realistic visual experience for users. (*PICO Virtual Reality | Official Website | PICO Global, 2023*).

One notable feature of the Pico hardware system is its all-in-one design, which does not require a separate computer or console. This makes it convenient and portable, allowing for easy deployment of VR applications in various educational settings. Additionally, Pico offers a software program called Streaming Assistant, which enables the user to stream PC games or videos from a computer or tablet using Wi-fi. The Pico headset can play programs and applications through a computer or tablet as long as it is connected. Pico prides itself on having the latest and most advanced hardware configurations, including independently developed core technologies. This commitment to technological advancements ensures that users can enjoy cutting-edge VR experiences. (Ibid)

The Pico store is an essential component of the Pico ecosystem. It serves as a platform for content curation, offering a diverse range of educational applications and experiences worldwide. This content repository is continuously updated to provide users, including the educators and students in Helsingør School, with an access to the available educational VR content.

Regarding tracking capabilities, the Pico VR hardware system supports 6 degrees of freedom (6DoF) tracking. This means users can freely move within the three-dimensional space, including translational and rotational movements. This level of tracking precision enhances the sense of immersion and enables more interactive engagement within the virtual environment. The headset also features Wi-Fi, Bluetooth, and USB-C connectivity, allowing seamless integration with other devices and peripherals.

### 2. 1. 3. Oculus Go

The Oculus Go, which is also being used in Helsingør School (Appendix 4), The Oculus GO hardware system offers its own unique set of features. The headset weighs 467 grams, providing a comfortable fit for extended use. It has a battery life of up to 2.5 hours or 2 hours for video playback, allowing for sustained VR experiences.

The Oculus Go features a 2560 x 1440 pixels resolution, delivering crisp visuals and immersive graphics. However, it is essential to note that the Oculus Go utilizes 3 degrees of freedom (3DoF) tracking. This means that while users can move their heads to look around the virtual environment, the tracking is limited to head movements and does not capture full-body movements like Pico's 6DoF tracking. This distinction should be considered when evaluating the suitability of the Oculus Go for specific educational activities.

It is worth mentioning that while the Oculus Go is no longer in production, Meta (formerly Facebook) has committed to supporting existing Oculus Go owners with software updates. Meta is now focusing its production efforts on two VR hardware systems, the Meta Quest Pro and the Meta Quest 2, which offer enhanced capabilities and improved features. Although educators express interest in updating their hardware, Helsingør School has yet to buy the newest Meta Quest 2 (Appendix 4).

Focusing on the practical application of the technology of VR in Helsingør School, it is important to understand the technical details and capabilities of Pico and Oculus GO hardware which are being used in Helsingør School. These VR systems offer specifications such as intuitive controls and built-in tracking capabilities, enabling the users to interact with virtual environments. Additionally, the hardware includes the access to VR content created by the developers of the hardware, which the educators also use as part of their specific teaching practises involving VR. By understanding these technical aspects, we gain insights into the practical use of the VR technology in our case, which helps us comprehend how VR functions in the educational context. By exploring the specific scenarios in which VR is used for educational purposes, we can assess the practical implementation and the challenges/opportunities that can provide students with immersive and interactive learning activities.

## 2. 2. Education

According to the Danish lexicon (*Uddannelse — Den Danske Ordbog*, n.d.) Education is defined as acquiring knowledge, skills, values, and attitudes through a structured course using teaching, training, and research methods. This thesis aims to investigate how the implementation of VR is influenced by the hindering factors that facilitate the education and learning environment and enhance the learning process. We will account for the term “learning environment, ” where physical, social and psychological learning occurs.

In this vein, our research defines education based on the conceptual understanding of what education is according to the Danish Ministry of Higher Education and Science. (Ministry of Education, Denmark, 2023). The government’s webpage defines education as facilitating learning including skills, knowledge and values. This definition of education entails and points to different learning methods, such as teaching, training and researching.

Recently, VR has expanded its functionality and is now used in various industries, including all educational levels. In the next section, we will account for the rise of VR in education, specifically related to Denmark, as our problem delineation regarding VR in education is expected to include additional research on VR implementation across Denmark.

### 2. 2. 1. VR in Denmark

Recently VR has entered the Danish educational system, and different educational institutions all over Denmark have been using VR in their teaching. In 2020, The Knowledge Center for Crafts, Design & Architecture announced they had opened three 3D laboratories in Denmark. The 3D laboratories support 3 Danish business schools (“handelskoler”) by offering students the ability to experience 3D technology, including VR.

Schools within vocational education and primary schools choose to include Virtual reality as part of different disciplines within education. How VR is used can vary depending on

how each school implements VR in their education, regardless of whether the technology of VR is applied to contribute to a more lively and immersive learning experience, as expressed by Randers School (*Hobrovejens Skole Investerer I Fremtiden Med Virtual Reality*, 2022). Or, to address specific problems within human development, as seen in Gladsaxe municipality, a special-needs school called Bakkeskolen uses VR to combat stress, anxiety and school avoidance. (*Gladsaxe Styrker Elevers Mentale Sundhed Med Virtual Reality | Gladsaxe Kommune*, 2021.) The matter is how VR has been used in different circumstances according to the need of specific educational institutions.

As the trend of VR has grown in Denmark in recent years, so has the interest in integrating VR into educational spaces. The Danish government has shown their commitment to promoting a greater understanding of technology, “teknologiforståelse” as stated in the Danish strategy for digitalisation from 2021. “Robot systems and digital technologies such as virtual reality (VR) and augmented reality (AR) offer the opportunity to create more practical teaching in vocational education and adult vocational training to strengthen the link between school and training/workplace”(Danish Ministry of Education, 2021). In the report, the government states how they recognise the potential of digital technologies in facilitating practical and effective learning. As a testament to this belief, the government is taking steps to provide financial support for these technologies to improve the quality of education in Denmark. (Ibid). “Funds will be earmarked for a digital equipment fund to allow investment in the latest technology, such as VR, AR, simulation, 3D and competence development for teachers” (Ibid).

In our case, governmental funds have been used to advance the digitalization of the teaching in Helsingør schools (udenrigsministeriet, 2018) and adopt the VR tools described above. In this process, the consultancy provided by a private company Khora has been fundamental to implementing VR in Helsingør School. In the following section, we will account for three private companies developing VR content, solutions and services for various purposes, including education.

## 2. 2. The role of consultant companies and software developers/(to introduce VR in education)

The private sector, including consulting companies and VR software developers, is also crucial in driving the trend of using virtual reality in education. The rise of virtual reality in education has created a market opportunity for private sector companies to develop and sell virtual reality educational tools, software, and hardware to educational institutions which further employ these companies to assist them with Virtual Reality services. Consultant companies work closely with different educational institutions and provide different services, i.e. helping them identify the most appropriate technologies and strategies for implementing VR. Technological developers and studios will often be involved either independently or through consultant companies to create tailor-made VR content to the needs of educational institutions.

**Khora** is a virtual reality studio based in Copenhagen, Denmark. They are developing and producing VR content for various clients, including Helsingør School. In the case of Helsingør School, we categorise Khora as members of the technical expert group. As such, they are essential actors as they provide the virtual reality equipment and software used in Helsingør School. Khora has worked closely with the learning consultant and the principal of Helsingør to ensure that VR technology is helpful as a tool in the classroom and provides the intended objective. They have provided support and assistance throughout the implementation process since the beginning of the project. Khora's expertise in virtual reality has been indispensable for the school. Their involvement highlights how external partners through the private sector are part of the actors making up the case of Helsingør School. Our contact in the company is an educational expert within the company of VR. He spoke with us as a representative of Khora about the technology being implemented in Helsingør School. In the context of our case study of Helsingør School, Khora is directly involved in guiding the school in their effort to implement VR as part of the learning environment. Khora has been involved with the case of Helsingør School since 2018 (Appendix 2. 35:16), creating and providing educational content, and choosing an guiding the specific hardware used in Helsingør School.

**Epinion**, a danish consultant company, has been working with schools to implement virtual reality within the institutions. They provide a guideline for integrating virtual reality into the school system and how the institutions can effectively use the technology to enhance learning outcomes. Epinion. (*Styrket Interesse for Naturvidenskab via Virtual Reality &Ndash; Epinion*, 2021)

**Talespin** is an international company that focuses on bringing the ability to create an immersive environment to individual consumers. Their website (*Talespin - Enterprise VR, AR & AI*, 2020)

states that their company works with content creators to enable customers to utilize virtual reality for professional and learning purposes. Through their platform, they offer a platform with different training programs catering to various industries and employment functions. With their software such as the “CoPilot Designer” (Ibid) , Talespin offers a program that allows creating content independently, without any coding necessary.

These consultant companies, such as Khora, Epinion and Talespin, are actively participating in developing VR in educational spaces as they actively seek to incorporate the technology into the system of the institutions. The consultants use their expertise to help the schools navigate the complex landscape of implementing new technology in an already set institution. The consultants must determine which technologies will meet the objectives of the specific institutions and help train the teachers to use the technology in the most effective way to ensure the technology of VR fits into their teaching.

## 2. 3. Potential and challenges of using VR in Education?

As part of our empirical data research, we will account for the relevant research regarding VR in education. We will draw upon an international and Danish context to provide relevant information. As previously mentioned, VR has gained increasing attention as a potential educational tool. The expectations that VR have brought with it as technology has put VR as becoming the biggest future computing platform in the world. Many Business analyses and reports have stated this anticipation (e.g., Belini et al., 2016; Greenlight & Roadtovr, 2016).

### 2. 3. 1. VR in Learning Environments

A British study, “*The Adoption of immersive virtual reality (I-VR) as a pedagogical method in education*”, by Hamilton, McKechnie, Edgerton and Wilson (2020), points to how VR is challenging what is defined as a conceptual learning environment. They investigated how High-quality graphics and immersive content using a head-mounted display (HMD) give students the experience of exploring subjects that are too complex to do so in traditional teaching. Despite their assessment that research on learning outcomes with VR as it relates to motivation, VR use has been limited (ibid). Their research aimed to explore this gap in understanding VR in the area by using a literature search which yielded 29 publications published since 2013. The Medical Education Research Study



Quality Instrument (MERSQI), a tool applied to assess the quality of research studies in medical education, using this method they deemed their selected research suitable to include in their research of VR being used for motivational benefits in education. All of their research included cases which used HMD-based VR, in educational settings for the purpose of motivating the student to engage in the material using VR. They compared the case which with less immersive pedagogical methods such as desktop computers and slideshows. Most of their studies found a significant advantage in applying and utilizing VR for motivational benefits in learning environments.

In contrast, they found that very few studies reported no significant difference in attainment level, regardless of the presence of I-VR or non-immersive teaching methods being utilized (Ibid). Yet only two studies (over 29) pointed towards an adverse effect of using I-VR in learning environments. These findings highlight the overall positive trend towards the effectiveness of I-VR as a pedagogical tool. It is important to consider the specific context and implementation of I-VR in these cases, such as the subject matter and the instructional design, which could influence the outcome.

Furthermore, the methods used in their search for literature, the MERSQI, showed how learning outcomes are often challenging to evaluate (ibid), which could negatively influence the interpretation of the utility of applying VR in learning environments. Their literature review points towards a stringent methodological approach where specific appropriate measurements and characteristics are essential to understand the potential of I-VR as a pedagogical method.

Our literature research is based on the 130 articles we found from searching the academic databases (4.3.1) we concluded ourselves that evaluating the learning outcomes in the context of applying VR in education can be challenging. We highlight the study using MERSQI because it was used as a method to assess the quality of the studies in the field of VR in education. This highlights how there is a need for a stringent methodological approach when evaluating the utility of VR in learning environments.

## 2. 4. 2. The Danish Context

VR is steadily increasing its presence in Denmark as well. Many Danish households may already be used to the technology as VR has risen immensely in the gaming sector. (*Ikke Længere Underholdning: 3 Steder Virtual Reality Er Hverdag*, 2019). While the gaming

industry has expanded rapidly over the past few years, VR is also used to train employees and teach students. (ibid)

The potential to revolutionise education by providing immersive experiences through virtual reality technology has opened up the discussion of how VR can be used in classrooms for educational purposes. (undervisningsministeriet, 2018).

In Denmark, researchers conducted studies to understand the potential benefits and challenges/drawbacks associated with using VR in learning environments. While no data entirely state VR's utility based on learning input for students (Nielsen, 2019), different research points to the finding that VR can improve student learning outcomes by improving student motivation by applying immersive experiences (Ibid). While it is essential to rely on research drawing on the positive effect of increasing student motivation through VR, it should also be stated that there still are no solid bases to argue that VR as a whole is beneficial to education, (even when the technology is currently available, as in the case of Helsingør School).

Based on international researchers, various investigation lenses research different purposes of VR. Some refer to private companies and individuals that expand the field of study, while others focus on different educational institutions. Thus, one of the articles (Makransky & Lilleholt, 2018) explores the potential benefits of VR. In addition, they have explored the emotional value of immersive virtual reality in education using structural equation modelling. This research investigated how the students' emotional engagement was impacted by using VR in the classroom and how valence and stimulation can have an influence in the student's learning outcomes. Further, the article investigates the impact of VR on students' emotional engagement, valence, and arousal and how these factors influence students' learning outcomes and motivation. (Ibid)The researchers conducted their study by designing and implementing a VR program (Makransky & Lilleholt, 2018), an intervention in a Danish university learning environment. They collected data on students' emotional responses, learning outcomes, and motivation using surveys and performance assessments. The study aimed to provide empirical evidence on the potential of VR to enhance students' emotional engagement and learning experiences. Makransky and Lillehot (2018) have investigated the impact and utility of using VR as an e-learning tool and the influence students receive through emotions during the learning experience. Based on this research, Makrinsky and Lilleholt (2018) state the positive

effects of using VR regarding motivation as VR provides a unique and immersive learning experience that captivates the students' attention, creating a sense of excitement and curiosity.

According to Lasse Jensen, a PhD student at the “Center for Online and Blended Learning and the Department of Public Health Science” at the University of Copenhagen, a lack of scientific documentation supports the notion that VR is a revolutionary learning tool (Jensen & Ringaard, 2018). The biggest issue has to do with the absence of content and the inability to adequately integrate VR in the School system as part of the curriculum or the standard teaching practices.

In Denmark, VR is already being used in educational spaces: museums, vocational education, and language learning programs (Larsen, 2018). Thus, the implementation of VR in educational institutions has its challenges where one school Helsingør School, located in Denmark, is one such institution currently implementing VR for educational purposes. While other research focus on exploring the learning outcomes based on specific interactions using VR in education, our study aims to differentiate itself by exploring the implementation process to understand to which degree the VR technology is aligned with the educational goals of Helsingør School. By focusing on the implementation process regarding VR as a tool to enhance the learning environment, we aim to provide unique insights into the effective implementation of VR and how it impacts teaching and learning outcomes. The technology we explore in the case of Helsingør School may differ from other schools in Denmark as the institutional settings differ. However, the hardware that is used includes the most common and popular VR Headsets and devices available, the Oculus Go and Pico. The selection of VR content we explore includes content from Pico and Oculus Go as well as the specific tailor-made content developed by Khora. Our study at Helsingør School distinguishes itself by exploring VR integration in education from a holistic perspective exploring both outside macro factors such as the political landscape surrounding VR in education, the economical factors driving the market of VR in education, and the micro factors which facilitate the implementation of VR technology in Helsingør School.

## 2. 4. The case of Helsingør School

Helsingør School is a danish Primary school located in the city of Helsingør in, Denmark. The school includes a population of approximately 800 pupils from 0-9 grade. Helsingør School is a conglomerate of 4 schools located in Helsingør Municipality. The school comprises the School at Gurrevej (Skolen På Gurrevej), The Northwest School (Nordvestskolen), The School in the Towncenter (Skolen I Bymidten) and Nygård School (Nygård Skole). Together they make up one of the most prominent schools in Denmark. (Appendix 1, 2:03)

**Skolen Ved Gurrevej** is one of the primary schools that make up Helsingør School, located in the eastern part of Helsingør. The school offers programs for students from 0th to 9th grade and strongly focuses on creating a learning environment that stimulates curiosity, creativity, and cooperation. The school also values physical activity and offers a variety of sports and outdoor activities for students.

**Nordvestskolen** is another primary and lower secondary school that makes up Helsingør, located in the northwestern part of Helsingør. The school offers programs for students from 0th to 9th grade and focuses on creating a learning environment that values diversity, respect, and community. The school strongly emphasises sustainability and environmental awareness, and students are encouraged to participate in related projects.

**Skolen I Bymidten** is located in the center of Helsingør, another primary and lower secondary school part of Helsingør School. The school offers programs for students from 0th to 9th grade and focuses on creating a learning environment that encourages creativity, engagement, and academic excellence. The school has a diverse student body, and teachers work to create a welcoming and inclusive environment for all students.

**Nygård Skole** is a school that is also part of Helsingør School, located in the southern part of Helsingør. The school offers programs for students with special needs and focuses on creating a learning environment that provides support, inclusion, and opportunities for growth. The school has a team of teachers and support staff who work closely with students to provide individualized support and guidance. (Helsingørskole, N.D.)

The Principal of Helsingør is determined to incorporate VR into various subjects and programs, including history, geography, math, and anti-bullying programs and anti-anxiety programs providing (well-beingness) students with VR headsets and educational VR software. Keeping in line with the danish ministry of educations current proposal from 2018 to foster tech understanding (teknologiforståelse), the principal chose to include VR as part of the learning environment for several purposes, including anxiety care. The principal hired a former teacher of the school (the learning consultant) to act as the mediator between the school and the VR studio Khora, which provides support in the form of content creation and advice for purchasing and using VR targeting educational environments. After a series of workshops by Khora for educating the teachers, several teachers were assigned as super users and helped create a manual for using VR at Helsingør School (Appendix 2, 24). However, it is not clearly apparent to what extent VR is used as a tool in learning and how this technology can sustain as a valuable supplement to the learning experience. The integration of VR into Helsingør School have encountered challenges, such as the educator's resistance to adopting and incorporating VR into their teaching practices, as there is a lack of VR expertise among teachers, while the technology acquires additional training and support to supplement their teaching. In addition, Helsingør School has taken steps to provide support and training for to the teachers.

Therefore, we believe a deeper understanding of the current implementation of VR at the Helsingør School on a more practical level is required to comprehend how VR is used in different teaching disciplines by various teachers within the Helsingør School. Additionally, by understanding the experiences and perspectives of the actors involved in the implementation process, such as the educators, school administrators, and consultants, we can gain valuable insights into the factors that facilitate or hinder the adaptation and use of VR in the learning environment. Through our empirical data, this research aims to provide a thorough analysis of the current implementation of VR at the Helsingør School, drawing from Hartmut Rosas's concept of Social Acceleration and Resonance (c.f. 3.1.) to help us understand the broader societal context and a social constructivist perspective using Lev Vygotskys understanding of knowledge creation through learning theory (Harasim, 2017) to understand how to create a meaningful learning environment which uses concepts of collaborative learning.

## 2. 5. 1. Introducing the Actors

The Case of Helsingør School involves several actors with different roles and perspectives upon adopting VR in education, in order to be used in the learning environment. These actors include the stakeholders which in our case include the Helsingør school and the Ministry of Education, the users that are defined as the teachers and the students and further the experts who are categorized as companies and consultants from the private sector. Thus, this section will introduce the essential actors and explore their roles and contributions to the case study. By understanding the perspectives and motivations of each actor, we hope to gain a comprehensive view of the actors' position associated with the implementation of VR.

**The principal** is the leading school administrator and the principal of Helsingør School. The principal's vision of bringing VR into the school is the origin of this case as the personal vision of the principal is a mission to implement VR and commit to expanding the pedagogical and learning field through educational VR in order to explore the potential learning opportunities that new technology can provide students.

**The Learning consultant**, a former teacher of Helsingør, has been hired by the Principle as a consultant who will help in implementing VR within the school of Helsingør. The Learning Consultant has aligned himself with a virtual reality company named Khora, to implement the technology of VR as a didactic tool, while further being actively involved in the implementation process within Helsingør School. As a former teacher, the learning consultant has provided practical insights into the challenges and opportunities of integrating virtual reality technology in the learning environment. Furthermore, the learning consultant is helping to create a tailor-made VR program for specific purposes in Helsingør by collaborating with the VR studio called “Khora” (c.f. 2.2).

**The educators of Helsingør School** represent a group of actors who play a critical role In the case of Helsingør School. Thus, some educators are critical for the implementation of VR in practice. We define educators as teachers and pedagogues hired to educate in Helsingør School. Educators are influencing the adoption and use of virtual reality in the classroom as they implement VR as a tool to assist their teaching methods. They are responsible for incorporating the technology into their teaching practices and integrating it

into the current school system, be it the curriculum or special education, such as Anti-bullying and anxiety exercises. The teachers and pedagogies follow the conjecture of the Helsingør School as an educational institution as they are offered VR in their toolbox. However, implementing VR is up to them individually as they are the experts in that case to personally judge if VR is required as they have different backgrounds with a variety of expertises and technical skills, thus, they are vital actors and essential to include in our research as they influence the success or failure of the implementation of VR. Our contact and source of data is a pedagogue who works in Skolen Ved Gurrevej, who would share how and why they incorporate VR in their work. Engaging the educator's implementation process, and understanding their knowledge and understanding of VR as a didactic tool, provides us with a greater insight into the implementation of VR in Helsingør School (Appendix 1,2,3,4).

**The students** are the last group that we will define as actors. As, we are not interested exclusively in the effect of the technology of VR on the students but rather on how VR is applied as a tool in the learning environment, we choose to observe the students using VR in practice. Their behaviour and engagement have been noted and analyzed in the context of VR being used in an educational context in the classroom. While further experiences and perspectives have been indirectly captured through the observations conducted with the educator and the learning consultant (Appendix 4).

### 3. Theory

In the following section, we will present the theories espoused to build up the theoretical framework of our study, which will be used to analyse the data collected through our research methods (c.f. 4.3). Explicitly, the theory developed by Hartmut Rosa regarding “social acceleration” (Rosa,2013) and “resonance” (Rosa,2016), as well as the social constructivist learning theory based on Lev Vygotsky's concepts of “zone of proximal development” and “scaffolding” (Vygotsky, 1973), are the main views underlying of our analysis and the interpretation of data/findings. In our study, we will briefly overview the chosen theoretical perspectives and their relevance to the research conducted at Helsingør School.

### 3.1. Hartmut Rosa: A critical approach

This study will draw from Hartmut Rosa's theory of social acceleration and resonance to provide us with the necessary theoretical framework to analyse the broader societal context in which VR as a part of learning is implemented. With a theory stemming from critical theory, we can go beyond the surface-level observations done to understand the practical understanding of VR in Helsingør School. Hartmut Rosa allows us to identify the societal, technological, and organisational factors shaping the implementation of VR in Helsingør School. Then, by applying the social constructivist perspective using Vygotsky's collaborative learning theory, we can examine how VR is integrated into the current learning environment, and base our observations on the social constructivist learning processes, that knowledge emerges from student engagement and social interactions.

Rosa's perspective is drawing upon many overlapping fields some of which include sociology and philosophy and political sciences. Rosa is exceptionally well known for his work on the concept of "social acceleration" and the impact of modernity on the human experience; What Rosa's (2013) work suggest is that the progress of socio-technical and cultural transformations has escalated in the modern era, resulting in a feeling of disengagement, detachment, and a lack of significance in contemporary society. Thus, Rosa (2013) argues that this acceleration has deeply impacted human experiences, affecting how individuals interact with their surroundings, self-identity, and social and political systems. On the other hand, the theory of "resonance" posits that individuals seek to establish meaningful relationships with their surroundings and that a sense of resonance can counteract feelings of dissonance (Rosa, 2016).

Through our empirical data, it was highlighted that VR as a technological innovation is a product of the accelerated progress of socio-technical transformations. Thus further, we recognise that VR has the potential to revolutionise the learning environment. However, this implementation of VR can also bring challenges and dissonance, especially if the technology does not align with the current learning methods associated with the teaching practices in the educational context under examination. Here, Rosa's theory is responding to the rapid technological advancement of which VR is part, as the development of not only the hardware of VR has taken off, but also the utilization, as VR enters new territories; precisely the Danish school system.



### 3. 1. 1. Social Acceleration

Rosa's (2013,1) theory of social acceleration is a critical response to social progress. This term relates to the "increase in the speed of societal processes of transformation," and the consequent compression of time and space. Several factors affect this acceleration process, including technological innovations, economic globalisation, and social and political changes. While most of these aspects not only influence themselves but also affect the technology and its relation with its users. The technical innovations being developed play a significant role in social acceleration as they drive the advancement of new technologies. As part of the rapidly growing technologies, VR has the potential to impact society. As VR can provide immersive and interactive capabilities attractive to many industries, it is essential to explore the interconnectedness of the global market and the monopoly of large tech companies that affect how VR is available as a tool for the learning environment in Helsingør School.

In an article, Rosa (2013,13) explains that the reason behind social acceleration is that the pace of change in modern societies has exceeded the capacity of individuals to adapt to new conditions. He further argues that this social progression has led to a crisis of identity and disorientation among individuals. To understand the social constructivist approach and why this theoretical perspective is interesting as it pertains to the case of the Helsingør School, we have to expand on Hartmut Rosa's work (2003, 2010a, 2010b, 2013), where his contributions have played a significant role in defining what drives the aforementioned social acceleration. Through his proposal of a three-part model of the social acceleration process, Rosa (2003, 2013) has convincingly advocated for a theory that can be empirically validated and has a more intricate conceptual framework. This crucially entails recognizing that social acceleration is a multifaceted phenomenon that impacts various dimensions of social existence. Thus, Rosa (2013) identifies the following three dimensions that compose social acceleration, wherein he argues that these factors are intertwined and influence each other dimension. This perspective can provide valuable insights for our research as we explore the implications of implementing VR in learning environments and in the context of rapid societal transformation.

### 3.1.1.1. TECHNICAL ACCELERATION

Hartmut Rosa has utilized the term “**technical acceleration**”, Rosa (2013,xix) to refer to the rapid progress and adoption of technology while highlighting the increasing speed of technological advancements in emerging technologies. This dimension does not refer only to the technological innovations. It refers as well to how the actors, implicated in the case, contribute to an overall acceleration through improvements of the techniques which they apply, where Rosa (2013, p. 71) cites that it is “The most evident and consequential shape that modern acceleration takes is the intentional, technical, and above all technological (i.e., machine-based) acceleration of goal-directed processes.” In addition to the aforementioned, there are positive and negative influences, where Rosa explains a potential for leveraging on enhancing elements of productivity and quality of life. However, challenges also might occur such as potential job displacements and surveillances (Rosa, 2019).

### 3.1.1.2. Acceleration of Social Change

The second dimension refers to the “acceleration of social change”, which refers to the speed at which societal norms, values, and structures undergo transformation. According to Rosa (2013) social changes are reflected in cultural practices, economic systems, political landscapes, and social relationships. Thus, acceleration of social change refers to the “increase of the rate of decay of action-orienting experiences and expectations and as a contraction of the time periods that determine the presence of respective functional, value, and action spheres.” (Rosa 2013,77). However, these social changes may contribute to social progress and inclusivity but can also generate social dislocation and resistance to change (Rosa, 2019).

### 3.1.1.3 Acceleration of the Pace of Life

The last dimension refers to the acceleration of the “pace of life”, which talks about the speed and the intensity of everyday experiences that lead to a sense of lack of time and pressure; Rosa (2013) argues that the pace of life has accelerated due to the interplay of technological acceleration and the acceleration of social change. The widespread adoption of Information and Communication Technologies (ICT) and the globalisation of communication networks have compressed space and time. This compression has resulted in the intensification of work, leisure, and social activities, contributing to heightened

stress levels, burnout, and challenges in maintaining meaningful social connections (Rosa, 2019); in addition Rosa(2013) explains that the socio-cultural transition relates to ““a priori substantial identities,” where “ the content or substance of which is determined by one’s place in long-enduring social structures, to a posteriori chosen identities, the content of which is determined by selection from a set of structurally available options”.

However, acceleration of the pace of life can also lead to convenience and connectivity but may as well as undermine well-being and the ability for self-reflection, namely when one subjects the collection of mental models used to establish a reference self-image, to a relative comparison with the version to-aspire-to, which is highly influenced by the ever-evolving enviromental expectations, complexicating the mental process and introducing an element of resitance to change.

The three dimensions of acceleration presented above are interconnected and influence one another. Technological advancements drive social change, reshaping societal structures and practices and influencing the pace of life. The consequences of acceleration are complex and have both positive and negative implications. Therefore, by comprehending the interconnectedness and implications of the three dimensions of social acceleration above, we will provide a perspective on the societal changes that technological advancements like VR can bring. In this vein, Hartmut Rosa's perspective allows us to adopt a rather fruitfull framework in exploring and explaining both the opportunities and challenges arising from the accelerated technological environment at stake (i.e., the Helsingør School case).

According to Rosa (2013, 94), social acceleration has significant implications for the human experience, affecting not only the relationship between individuals and their environments but also personal identity and social and political systems. Still, Rosa suggests that social acceleration has caused individuals to feel disconnected and alienated from their surroundings, as they find it more challenging to keep up with the fast changes. Rosa argues that social acceleration has given rise to an identity crisis, where individuals face difficulty finding purpose and orientation in a world undergoing rapid transformations.

Despite the adverse effects of social acceleration, Rosa (2013,161) acknowledges that acceleration can also create new opportunities for human action and creativity. He argues

that it is possible to harness the positive aspects of acceleration while focusing on its adverse effects. Rosa further suggests that this can be achieved by creating “spaces of deceleration” in which individuals can slow down and reflect on their experiences. From the other hand Rosa explains that under specific conditions of implementing VR, it can positively influence education we also recognize that, due to the social, political and technical parameters that affect the technology, the socio technical challenges should first be resolved in order to provide valuable new opportunities. Further Rosa ( 2013, p. 21-22) explains that “forces of acceleration and deceleration do not balance out [...] the discernible tendencies of deceleration can be interpreted either as residual or as reactions to acceleration processes (and occasionally as functional for the latter)”. They are, therefore, in all cases secondary to the forces of acceleration.”. In our case, where the implementation of VR is investigated, we have to be very critical regarding what can be a benefit or a challenge and what conditions might present themselves as something that will differ in time.

Rosa's concept of acceleration provides a valuable theoretical framework for understanding the multidimensional nature of societal transformations forced by technological progress and innovation. Hence, the technical acceleration, the acceleration of social change, and the acceleration of the pace of life are interconnected phenomena that shape our contemporary world. Recognizing the dimensions and their interplay also allows us to critically analyse “ social acceleration” in the implementation process of VR in the Helsingor School.

### 3. 1. 2. Resonance

Hartmut Rosa's theory of resonance has gained significant attention in the social sciences for its unique perspective on human experience and its potential for addressing societal issues. Rosa's theory is essential in the understanding the implementation of emerging technologies, for instance VR in our case, with in the framework of modernity.

In our case, we use Rosa's approach to resonance to define what is good or beneficial for individuals and their environment with other words, what gives meaning or what resonates. One of the key contributions of Rosa's theory of resonance is its emphasis on

the importance of harmony as part of the human experience. As Rosa (2016) argues, resonance occurs when individuals connect with the world meaningfully, leading to a sense of well-being and fulfilment.

Even though Rosa argues that the “lack of resonance” Often -results from social acceleration, we will use his theoretical framework to justify research problem and identify how to answer our research question (see section 1.2). That is to say, to be critical and evaluate what is good or positive in implementing VR, we need more than the social acceleration theory to create a contrast that explains and lead our approach toward a more ethical and sociotechnical investigation (in a genuine “techno-anthropology perspective”, as seen in section 4.1).

The advantages of Hartmut Rosa’s theory of resonance vis a vis other rival theories in the social sciences can be found in its unique perspectives, in human experience and its potential for addressing societal issues. While Rosa's approach to sociological foundation seems in many ways also an attempt to ground a critical theory; such as similar previous attempts e.g. Hans Jonas's theory of creativity,(Lindberg, 2005, p. 180) it also differs considerably when compared to what second or third-generation scholars in critical theory advocated such as Habermas (Kreide, 2023).

In our case, we use Rosa’s approach to resonance to define what is good or beneficial for individuals and their environment in the scrutiny of our empirical study/data. One of the key contributions of Rosa's theory of resonance is its emphasis on the importance of harmony as part of the human experience. As Rosa (2016) argues, resonance occurs when individuals connect with the world meaningfully, leading to a sense of well-being and fulfilment that are fundamental in aspects in education, especially, primary education.

**Social resonance** relates to the degree to which individuals can connect with others through shared values, beliefs, and experiences.

**Temporal resonance** relates to the degree to which individuals can connect with the past, present, and future, including through experiences of continuity and meaning.

**Material resonance** refers to the degree to which individuals can connect with the physical environment around them, such as through experiences of beauty or awe.

Whereas, Rosa's theory of resonance has been often used to analyse many different social phenomena (e.g., environmental sustainability), in this thesis, it is used to highlight the impact of technology on human experience and, particularly, to explain the suppression of the individuals and the relationship between humans and technologies in our case study (i.e., the way teachers and students react/relate to the implementation of VR technologies at Helsingør school). Accordingly, by considering how resonance can be achieved, we will be able to define what makes a positive impact on the implementation process and how to approach this process to incorporate this procedure as a more systematic method to improve the conditions of the implementation of VR technologies at School. Furthermore, it is important to explore how the existing practices of the school and the broader educational context can coincide with the implementation of VR in the learning environment. By understanding what brings resonance, we must understand to what degree VR is seen as a valuable tool, a trend, or a novelty. This will help us identifying the factors (as main RQ and Q1 aim, c.f. 1.2) which could contribute towards creating an effective learning environment with VR in Helsingør School and integrating the technology as a meaningful supplement to the educators' work with the students.

Overall, Hartmut Rosa's theory of resonance provides a helpful framework for understanding the potential impact of virtual reality in Helsingør School. By providing an understanding of the broader societal context in which VR is Implemented in Helsingør School, Rosa's theory allows to look beyond mere technical aspects (as standard technological frameworks do) into the increasing "pace of societal change" and highlights its impacts on individuals and institutions. As Rosa strongly emphasises the need for institutions and individuals to establish resonant connections with the world they live in. In our case, this means exploring the relationship between technology and the different actors in the school of Helsingør. As part of this research, we will also apply a "social constructivist" perspective to explore to what degree the practical use of VR in the Helsingør School aligns with active learning principles. The purpose of further that this combined stance allows to better comprehend how the implementation of VR in the Helsingør School "resonates" with our ever-changing society. Similarity the social

constructivist perspective can help us approach the implementation problems more holistically with broader implications and the potential benefits that using VR can bring in the didactics of the specific learning environment at Helsingør School and view of valuable learning objectives.

### 3. 2. Connecting the Hartmut Rosas theoretical approach to our study and (empirical) research Design.

Given the current research on VR in education and our empirical data, we have identified power structures, dominant narratives, and assumptions about why VR is not present to the extent the school administration wishes. The dominant narrative we will account for in the (“findings” section) is the systemic structures, technological advancement and political/economic structures. We aim to address these structures by applying a critical approach because we aim to uncover these underlying power dynamics and systemic issues and how they relate to the case of Helsingør School. With a theoretical perspective which aims to question the dominant narrative and the status quo, we believe applying a critical perspective using Hartmut Rosa's concepts of social acceleration and resonance (Rosa, 2013) in our research can help us uncover the wicked problem of understanding social issues and the political structures that influence the implementation of VR in the Helsingør School.

To further direct our understanding of what creates a meaningful learning environment using VR, to represent (and further combine) a perspective exploring collaborative learning in the context of creating meaningful learning experiences, we have chosen the social constructivist theory through Lev Vygotsky's concepts of collaborative learning (1978), which will focus on social interaction and collaboration as beneficial factors in education and how these processes can contribute to the learning environment in the Helsingør School. Because we are interested in what gives meaning (resonance) in the learning environment using VR, we want to apply a social constructivist learning theory to explore how VR can function successfully as part of the learning environment based on the concepts of collaborative learning. Using these theoretical approaches, the analysis of the empirical material will capture the complexities associated with implementing VR in Helsingør School while exploring a more comprehensive theoretical framework which

offers complementary perspectives exploring the interplay between critical theory and learning theory.

We must first understand how VR is impacted by the modern society before we can address the practices for integrating this VR as a technology in a learning environment. In the following section, each of our theorist perspectives will be explained. By applying the theoretical framework of Hartmut Rosas on “social acceleration” and Lev Vygotskys theory of social constructivism, we aim to gain a deeper understanding of the implementation process behind VR in Helsingør School and its impact on the overall learning environment.

### 3. 3. Social constructivism

As mentioned, we will also include a social constructivist perspective in our study, emphasising the role of social interaction and “shared meanings” in constructing knowledge. Generally speaking, a social constructivist would argue that social and cognitive skill development can also be enhanced through technology, facilitating communication and cooperation using Linda Harrasims book “Learning Theory” (Harasim, 2017).

Through our insights from the empirical data of the case of Helsingør, we chose to include a social constructivist perspective the observations of the practical usage of VR in the learning environment (c.f. 5), which showed us the importance of interplay between the educator and the student, as it relates to creating social interactions and knowledge construction with the use of the VR technology.

Indeed, the collaboration between the teacher and the student using VR is expected to be essential, as seen in our observations of the practical use of VR (-as part of the learning environment) (c.f 5) For this reason, our theoretical framework will include a social constructivist perspective: to,- emphasize how knowledge on new technologies and their possibilities is absorbed as part of a socially constructed process in a “situated” context.



### 3. 3. 1. Understanding the foundation of Social Constructivism

Constructivism as a learning theory is based on an updated understanding of how learning takes place by education-oriented professionals. Constructivism must be understood as a confrontation to the cognitivist idea that human beings, specifically the brain/mind, function like information processors or computers, understanding learning as some internal mental process. In constructivism, there is an understanding that individuals learn and gain an understanding of the world through their interactions with the outside world. When we come across new ideas and perspectives in our daily interactions with others, these are put into perspective with our pre-established understandings, for which it is decided whether this newfound knowledge should be integrated with our current framework of understanding or discarded (Harasim, 2017, pp. 61-62 ).

Constructivism encompasses both a learning theory and an epistemological perspective, offering valuable insights into how learning takes place and how knowledge is understood (Harasim, 2017, pp. 61-62). From an epistemological standpoint, constructivism posits that knowledge is not an objective entity to be transferred from a teacher or a source of authority to a learner. Instead, knowledge is viewed as socially constructed, actively built through interactions with others, the environment, and personal experiences. Learners construct meaning by integrating new information into their existing cognitive frameworks and by actively engaging in sense-making activities (Harrasim 2017, p. 62).

The creators of constructivism as a learning theory can be attributed to theorists such as Piaget, Vygotsky, and Bruner (Harasim 2017, p. 86). All of them believe in the fundamental notion of constructivism being rooted in the idea of active learning. However, it is important to emphasise the varying interpretations of the theorists. Siemens (2016), who can be categorised as a new age learning theorist, points this out as he states how researchers in different fields, be it science education or instructional technology, they often express different characteristics of constructivist theory. (Ibid) While there may be different opinions to what to call constructivism, a theory or a philosophy, as Siemens state “ “whether constructivism is actually a theory or a philosophy” (Siemens, 2006,

Quoted from Harasim, 2017).” It is clear there is a fundamental constructivist learning pedagogy which deals with the practical understanding of active learning.

### 3. 3. 2. The constructivist learning pedagogy. The Cognitive and the Social.

There are two main branches within constructivist approaches: cognitive constructivism and social constructivism. Our Thesis will utilise the conceptual understanding of social constructivism examine the teaching practisis of Helsingør School as it relates to VR. Through our empirical data we identified patterns in the current teaching practisis in Helsingør School, making social constructivm a optimal theoretical lens to examine the teaching practisis at Helsingør School.

**Social constructivism**, influenced by Lev Vygotsky's work, emphasizes the role of social interactions and cultural contexts in knowledge construction. A social constructivist would argue how meaning and understanding develop out social encounters (Harasim, 2017, P. 64)

Thus both perspectives on cognitive and social recognize the significance of the learner's active engagement and the social nature of learning (Harasim, 2017, p. 63). The key difference is how social constructivism views learning as a “shared” and “negotiated” process, where students construct meaning through their interactions with teachers and the broader social environment. There is a clear focus on sociocultural factors and how knowledge is co-constructed.

The constructivist learning pedagogy emphasizes the learner's active role in knowledge construction and understanding.(Harasim, 2017, pp. 70-74).

This social constructivist perspective is relevant when examining how VR is used in the classroom at Helsingør school. In our research through a theoretical lens using constructivist learning pedagogy, we can acknowledge the importance of creating learning environments that foster active student engagement, critical thinking, and collaborative interactions. Additionally, it allows to explore the role of teachers as facilitators of the learning process in Helsingør School, wherein they teach students in their exploration and construction of knowledge by using VR technologies. Thus through the social

constructivist lens, it is possible to better examine how VR can be integrated and leveraged in educational settings to support and enhance genuine constructivist learning experiences.

### 3. 3. 3. Social Constructivism as a relevant theoretical framework.

The following section briefly explains social constructivism as a learning theory through Linda Harrasims' work about Learning Theory and Online Technologies from (2017). we will also use the book "Mind in Society: The Development of Higher Psychological Processes" (1978) written by Lev Vygotsky and his colleagues Alexei Leontiev and Alexander Luria, but only published several years after his death. Here, to a greater extent, there is a focus on the social aspect's influence on cognitive development rather than the mental processes the individual goes through. Harasim, 2017, pp. (68-69).

By understanding the use of VR in Helsingør as a tool through a social constructivist learning theory lens, our research seeks to explore how integrating VR technology in Helsingør School aligns with the principles of social constructivist learning. As we seek to understand the factors which facilitate or hinder the adoption of VR in the classroom, (main RQ section 1.2) we want to understand how VR can enhance active learning, promote knowledge construction, and facilitate collaborative interactions among students. We examine how teachers support and guide students' learning experiences in the VR environment, ultimately contributing to a deeper understanding of the role of VR as a didactic tool in Helsingør School.

### 3. 3. 5. The zone of proximal development

In the social constructivist learning theory from Vygotsky, we see arguments being made for the Zone of Proximal Development (ZPD) to describe how learning best takes place with a student. Contrary to Piaget's cognitive way of thinking, where students' development is divided into biological and mental stages, Vygotsky's is concerned with the social contexts in which the student finds themselves. Vygotsky's ZPD describes how the relationship between sender and receiver must be understood as a learning partnership. E.g. between a student and a teacher, where a teacher assists a student in the development

process. The relationship is asymmetrical, through a competent sender and a less competent recipient, where new learning opportunities arise for the help the student received. In the quote below, Vygotsky describes this relationship. In the context of our casestudy the concept of ZPD gives us a framework conceotualise the teaching practisis in which the educators operate from, as they seek to assist the students moving further out of the ZPD

"what we call the zone of proximal development. It is the distance between the actual developmental level determined by independent problem solving and the level of potential development determined through problem-solving under adult guidance or in collaboration with more capable peers." (Vygotsky, 1978, p.86).

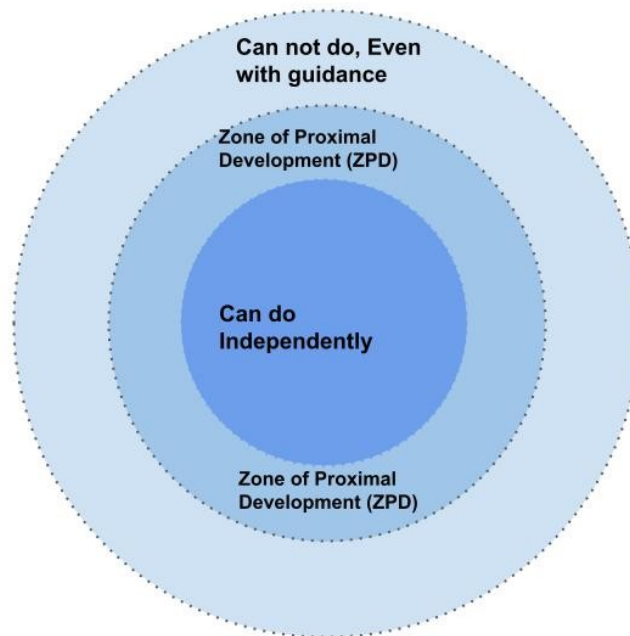


Figure 1. Model of the Zone of Proximal Development (ZPD), often used to describe how learning best takes place between a teacher and a student (Soure: Harrasim 2017) (Appendix 5).

ZPD is depicted in the model above. The model presents the relationship between student and teacher. Because the student can receive help from an educator, they can deal with problems that would otherwise be beyond the scope of the students' limits. The teacher plays a central role as a supporter providing the necessary tools and input to help the student overcome the problems independently, not just showing the student the correct answer. In our case the educators are responsible as the “more knowledgeable other” (MKO) as defined by Lev Vygotsky. (c.f Harasim, 2017 p.74)

The term Scaffolding has become closely associated with ZPD, although Vygotsky did not use the term himself. (Harasim, 2017, p.73-74). Scaffolding deals with learning strategies and tools that create this support and foundation when moving within an unknown subject.

Adding a social constructivist learning theory perspective contributes to a better understanding of how learning could effectively take place with the use of the technology of VR, taking into account the necessary steps by creating the conditions of the so-called **zone of proximal development** (see Harasim 2017, pp. 73-74) between the student and teacher. That is the point; to give students deepened knowledge and, to a greater degree, the ability to independently comprehend notions within the subject (see Figure 1) In addition, the social constructivist way of thinking is included to provide a framework for understanding the possibilities through different tools and methods to improve the teaching practices at the Helsingør School.

With a social constructivist perspective, we can assess which specific measures would contribute to positive changes within the teaching practice - when adopting VR tools - as a substantially based on what constitutes effective learning for a social constructivist. In this light social constructivism is helpful to identify what constitutes good learning and knowledge sharing that,- together with Hartmut Rosa's perspective on technological development, which draws upon critical theory, is a central goal to understand the role of social relations, the power structures and the like underlying the implementation of technological innovation - as VR,- a to figure out the possible effects on individuals and society at large: once VR would routinely be implemented as didactic tools at public schools in Denmark. In this undertaking, the empirical study related to the theoretical framework depicted above, will be outlined in the next methodological section (4) and in view of the main empirical findings (5).

## 4. Methodology

In this section, we will outline our research approach and research design conducted at the Helsingør School. We will present the data collection strategy we employed to gather qualitative data from the various actors involved in the case of the Helsingør School. Our research approach adopts a descriptive procedure which aims to gather specific knowledge about personal experiences and the perceptions of the technology while also applying the

techno-anthropological lens to explore the factors influencing the technology of VR in the learning environment. Our data collection methods sought to gain a comprehensive understanding of how VR is being employed in the Helsingør School and thereby identify the socio-technical issues that may arise in the context of the current implementation of the VR technology at the Helsingør School. We employed various methods to collect the qualitative data, including interviews, observations, and researching the relevant literature, see section(4.3). By applying this multi-faceted data collection strategy, we aimed to triangulate and validate the findings to ensure a comprehensive understanding of how the technology of VR can impact the social, political, economical and technical factors, among the many that influence its implementation.

#### 4.1. A Techno-Anthropological Perspective and Our Role as techno-anthropologist

As part of the methodology, we will account for our roles as techno-anthropologist, and how we use the Techno-Anthropological principles for bridging the gap between humans and technologies, and to explore the relationship between the technical artifacts, its end users and the technical experts/developers. By bridging those gaps, Techno-anthropology offers a holistic framework allowing interdisciplinary approaches which foster collaboration.

As Børsen (2016, p. 36) explains techno-anthropology refers to an area of study which uses interdisciplinary approaches to address the tensions involved by the technological progress. We define Techno-anthropology as Børsen (2016, p. 39) states is an interdisciplinary study as a way to “[...] completechnological understanding with anthropological and ethical analysis” (Børsen, 2016, p. 36), and address the “[...] challenges associated with the human - technology interface.”.

According to Børsen (2013), techno-Anthropology aims to examine the relationship of technologies with anthropology, more specifically by investigating the influence of technology on humans and vice versa.). By researching this mutual impact, we aim to provide insights regarding a more ethical and beneficial approach that can help future implementations of technological artefacts such as the VR. As techno-anthropologists, we

are interested in how technology influences human behaviour, culture, and society. We argue that techno-anthropology can offer a holistic research approach to studying the relationship between technology, such as VR, in learning environments and the actors/human beings involved.

In the following (Figure 2), there is a representation of what constitutes a techno-anthropological approach to technology (on that, see also Børsen 2013); accordingly, our focus from a techno-anthropological perspective is aiming at the whole triangle where the sides of it represent the aspects that compose the various levels of interaction among the artefacts, the experts and the users/other stakeholders affected by the technology at stake.

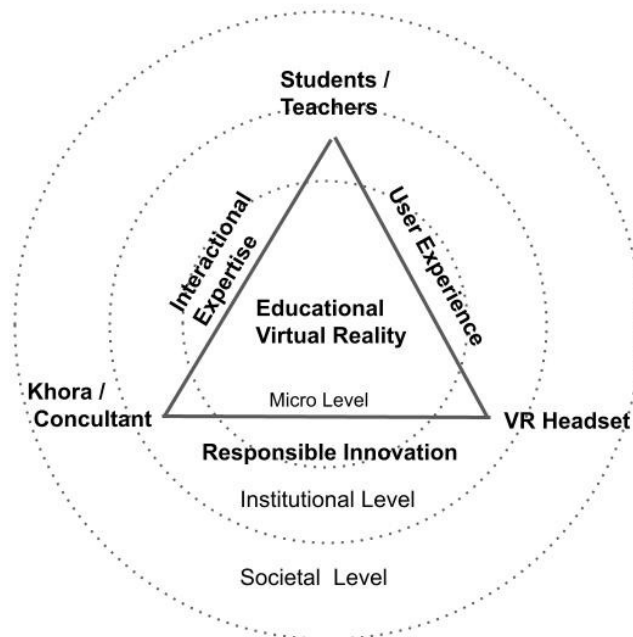


Figure 2. Techno-anthropological triangle adapted to our case (Source: Børsen 2020, p. 220).

Our role in this thesis is not merely to position ourselves on the sides of the triangle but rather to investigate different aspects that influence the relations between the users, the experts and the artefacts; thus, investigating all the factors that compose the VR

technology. To better comprehend what constitutes the aim of our socio-technical investigation, our research focuses on all three levels that the technology extends. We recognise that the implementation and impact of the VR extend beyond the individual level, which is why we include the broader context at an institutional level and the societal aspects.

Beginning with the micro level, we will investigate how individuals can contribute to our analysis by providing insights based on their personal experiences. The list of individuals/actors in our case will include professionals from different backgrounds that represent all aspects that compose the triangle, while a Macro analysis of the technology in question will identify the situation at an institutional/ organisational and societal level. By investigating both the macro and micro level of the sociotechnical landscape of the implementation process of VR in relation to the case of the Helsingør School, we aim to provide a comprehensive understanding of the technology implementation and its effects. With such a multi-dimensional approach, we can better grasp the diverse perspectives on the interactions amongst the user, experts and technical artefacts, and with our research, we will contribute to the discourse surrounding the use of VR in learning environments like the Helsingør School.

## 4. 2. Research design

This section will outline our methodological approach and how we will draw on various qualitative data. It will detail our process in transforming initial ideas into specific research questions and guiding our research towards the analysis.

When conducting research, the early stages usually involve transforming initial ideas into specific research questions that can be addressed through data collection and analysis (Hammerley and Atkinson, 1983). This process may involve creating a narrative description of events, developing a generalized understanding of a particular group's perspectives and practices, or formulating an abstract theoretical framework; however, it is common for initial research problems to be modified or even discarded during this process (Hammerley and Atkinson, 1983).



Researching VR in education might involve taking a broad idea, such as "the use of virtual reality in education", and breaking it down into more specific research questions (Dalgarno & Lee, 2010). For example, researchers might ask, "What are the benefits and drawbacks of using virtual reality to teach complex scientific concepts to high school students?" or "How does the use of virtual reality impact student engagement and learning outcomes in a college history course?" (Ibidem). The goal is to refine the research problem to address it effectively through data collection and analysis (see also Hammerley and Atkinson, 1983, p. 4).

During the early stages of the data analysis, a significant amount of work is focused on refining the research problem to ensure it is productive and can be effectively investigated, thus ensuring valuable design research by following Hammerley and Atkinson (1983, p. 24) guidelines upon the problem formulation of an investigation. They argue that the research problem at an abstraction level can differ, and researchers may need to adjust depending on the research questions and the available data. Then, Hammerley and Atkinson (Ibidem, p. 25) refer to the grounded theory by Glaser and Strauss (1967) and particularly, their description of substantive and formal analysis, which implies the substantive or empirical area of sociological inquiry. In this vein, substantive theory pertains to an empirical area of sociology like patient care, education, delinquency and race relation or further research organizations; while formal theory pertains to a conceptual area of sociology such as stigma, deviant behaviour, formal organisation, socialization, status incongruency, authority and power, reward systems, or social mobility (see also Glaser and Strauss 1967, p. 32).

In our ethnographic study conducted in Helsingør, we employed Hammerley and Atkinson (1983, p. 26) suggestion of utilising a combination of substantive and formal theory in investigating educational issues. Our primary focus was on the substantive theory since we focused on personal experiences. However, many aspects of the thesis can be categorized as formal. Thus, for that reason, throughout our investigation, we were required to continually alternate between topical and generic perspectives, moving from the formal to the substantive or vice versa, the same way Atkinson (1981a-b) acted on his research.

Our methodological approach to the field aligns with the phenomenological tradition, as Atkinson also suggests. We are aiming to be critical of our biases and focus on a

descriptive investigation, where we aim to gain insight into the sociotechnical phenomena from the actors' perspectives. We are interested in their understanding of the world wherein they live. The actors we will investigate are individuals with key characteristics in our case-study and a valuable influence on the implementation process of the VR technology in the specific setting of the Helsingør school. According to Hammersley and Atkinson (1983, p. 27), by identifying the important actors in our case, we focused on what gives these individuals the power to form technology, the social relationships with other actors and how the government is giving titles to these actors.

As researchers, we must approach the field open-mindedly and not let our biases influence how we are shaping the investigation to ensure that we will give a lot of attention to the settings and the cases that co-create the environment of the implementation. Whereas Hammersley and Atkinson (1983, pp. 28-29) mentions that “a setting is selected based on foreshadowed problems, the nature of the setting may still shape the development of the research questions”. Although they argue that settings may appear to be natural occurrences, they are formed and upheld through cultural definitions and social strategies; thus, these boundaries are not static and can change to varying degrees through processes of renegotiation and redefinition during different occasions.

As previously mentioned, in ethnographic research, research problems are often only fully developed after fieldwork begins. Primary data collection frequently contributes to the development process. Additionally, it is common to encounter situations where specific questions derived from the anticipated problems cannot be investigated within the selected setting. In contrast, Hammersley and Atkinson mentions that more questions are usually generated than can be tackled in a single Study. In that case, the initial method for collecting data was to facilitate a workshop with teachers currently using the VR technology within the chosen educational environment. To better understand how VR is part of the learning environment at the Helsingør School, we had to find technology users who could share their knowledge and experience using the technology as part of their teaching. Due to time constraints and limited feedback received from the teachers who we sought out, we decided to move on from the workshop we had planned. Ideally, the workshop aimed at gathering a minimum of 6 teachers to get as much data as possible from the professionals' perspective. Due to the impossibility of carrying out the workshop, we proceeded with the following data collection strategy, which substantially relies on the

observation of how the VR technology is being used in practice in the classroom activities. Yet, the initial workshop planning can be found in the (Appendix Workshop), since it can help in understanding our initial plans and the topics we selected for engaging the teachers in a discussion on the implementation of the VR technology in public educational settings.

#### 4. 2. 1. Overview

Our first initial step, gathering data included a literature search, which involved insights from existing research on the field of VR in education. As usual, the literature research aims to provide a theoretical framework for the study, identify gaps in the existing literature on VR in education, and explore the current conditions in the field (Freina and Ott, 2015). Namely, it gave us an understanding of the present conditions for implementing VR in education from an international and a Danish perspective. The second step was to start investigating the case of the Helsingør School, by identifying all the actors engaged with the VR technology. Entering the case of the Helsingør school, we based our research on the description of the technical domain and insights on previous research on the field (c.f. 2), to further proceed with planning semi-structured interviews targeting some main actors in our cases, such as the teachers, the school administration, and the technical experts/developers of the VR tools used at the Helsingør school.

All of the three interviews conducted for this thesis were obtained by applying a semistructured format and inspired by Spradley's ethnographic approach (1979), where the research question/s is located in the middle of the discussion. He argues indeed, that interviews can explore the field through our interaction with the informants. Our Interviews have explored the personal experiences of the actors involved (the Principal of Helsingør School, a learning consultant and the educational specialist) with VR in education, including the challenges and benefits they have encountered in both the implementation process and actual usage. This method can provide a rich data source to help identify the barriers and opportunities associated with implementing VR in educational settings.

Finally, in addition to the interviews, two VR sessions were observed which provided insights into the field by offering a practical understanding of how VR is used in the teaching at the Helsingør School. To provide a broader view, the VR sessions we observed

were based on four different students, the first from the department at Skolen ved Gurrevej, while the rest are part of the school department at Skolen ved Bymidten.

By combining these data collection methods and following the anthropological approaches by (Spradley, 1979, Flyvbjerg, 2006, Brinkmann & Tanggaard, 2015), and by using insights from current research, this investigation aims to provide a multi-faceted understanding of the implementation process of VR in education at the Helsingør School. By incorporating the three forms of data obtained through interviews, observations, and the existing literature on VR in educational settings, we will be able to identify some patterns and provide a reliable picture of the challenges and opportunities associated with using VR in educational settings.

### 4. 3. Methods

In the following section, we will present the different methods used to collect data and provide findings through the personal insights that the actors can offer by investigating them to be directed at the factors that impact the process of implementing VR as a didactic tool.

#### 4. 3. 1. Literature search

To identify the gaps in the field of VR in education, we conducted a literature search to comprehend the currently available knowledge and figure out further developments. The investigation focuses on the educational perspective of VR and its usage. The search included many steps to provide us with different field researchers, theories, and cases related to our problem formulation. We aimed to include the existing body of literature on the field of VR in education, to identify the gaps and trends of using the technology for teaching and learning purposes and provide us with the data to critically analyse the current state of the technology in question. That is, we wanted to obtain a “...a firm foundation for advancing knowledge and facilitating theory development. By integrating findings and perspectives from many empirical findings, a literature review can address research questions with a power that no single study has” (see Snyder, 2019, p. 334).

Thus, by using Snyders (2019) methodological approach to literature research, we aimed to understand VR in education to build our research onto the previous research. This

enabled us to build and ground our research on the patterns evidenced by existing literature in the field. To ensure the literature chosen was relevant for our study, we sorted out the articles based on three criteria. First, article must be applicable to our problem statement. Second, the articles must be recent; lastly; the articles should contain some critique of its own research limitations.

the literature research we conducted by targeting academic databases, to understand the current state of the research in the field and gain insights into the common knowledge within the field. We selected databases encompassing various professional disciplines to handle and manage the large possible number of articles. These included AAU library, IEEE Xplore, Scopus and PubMed. Then, we created a search string to navigate through the databases focusing on key aspects of our investigation. Through a trial and error approach, we have refined and obtained the results we considered adequate in relation to our topic of interest. The final search string was about: ("Virtual Reality") AND ("Education" OR "Pedagogy" OR Educational settings\*) AND ("Didactic" OR Didactic tool). After applying additional filters, such as limiting to certain geographical areas and disregarding the articles before 2010 and non-peer-reviewed publications, we narrowed the scope of our search to about 130 relevant articles. These articles were categorised based on their abstracts' subject matter to assess the potential contribution to our problem systematically. Subsequent literature research followed, focusing on exploring connections, and identifying the Danish literature, which was limited.

#### 4. 3. 2. Interviews

In this study, the primary method for extracting qualitative data is the interviews, each with a specific order directing our interest towards the aspects and the actors that most impact the implementation of VR in the Helsingør School. The interviews were conducted with some informants from different professional backgrounds and actors that significantly influence the technological progress of VR in the specific educational environment. The interviews were conducted with a sample of individuals with purposive experience with VR in education, including teachers, students, and educational technology specialists. The sample was selected based on their expertise, experience with VR in education, and influence on the implementation process of the technology in question.

The three interviews we conducted with, the principle, the learning consultant and the representative from Khora, were semistructured in its design and inspired by Spradley's (2003) ethnographic approach. Following Spradley (2003) who emphasises the importance of understanding the cultural context in which individuals operate and their lived experiences, we explore the field through our interaction with the informants on the VR technology and a focus on their personal experiences with the implementation at Helsingør school. Further, as Spradley (1979) argues that interviews are a commonly used tool in ethnographic research to allow in-depth exploration of participants' experiences and perspectives, we adopt this perspective in our study.

Indeed, the interviews aimed to grasp the respondents' sensations on the implementation process of VR in our case while attempting to get data on factors that could contribute to such an implementation process (so that advance our investigation accordingly). Further, the reason behind the format of the semi-structured interviews is to ensure a common red thread of our problem statement throughout the report and the interviews while allowing the informants to bring new, valuable information from the field; since as Spradley (2003,48) argues, ethnographic interviews can discover new perspectives and extrapolate new relevant questions from the informants.

The interviews were conducted in person and via video conferencing, depending on the location and availability of participants. Each interview lasted approximately 45 minutes and was audio-recorded. The interviews included open-ended questions that explored the participants' experiences, opinions, and attitudes towards VR in education. The questions were developed based on our review of the literature and expert input from the research team. The interview guide for all three interviews, varied according to the nature of the informant's professional background and their role and position of power in the implementation of the VR technology at the Helsingør school. However, although the interview guides differed, some broad thematic sections were common. Firstly, one of these topics was regarding the consent to record the sessions and a short introduction of the informant. Secondly, a small discussion on some organisational issues and a broader understanding of the ethical concerns regarding VR at school, followed up by the topic of the potential of using VR in public education in the future.

Furthermore, as each informant belongs to a different field, another aim of the interviews was to make the informants expand on aspects that we are not familiar with. Thus, because of their experience, they could better comprehend the factors that impact the implementation of such technology and can lead the discussion into more valuable knowledge better suited to relate to our problem formulation. In addition, to achieve that, the beginning of the interviews includes the typical “grand tour” questions, which refer to the typical state of things in a given setting (Spradley, 2003, p. 50). After the introductory part, the discussion focuses on specific features, such as the regular use of VR, technological development or legal matters/ data issues, referring to what Spradley (2003, p. 51) calls “mini-tour” questions. The last part of the interviews consisted on broad and generic questions regarding concerns about the technology or the informant’s vision on educational use of the VR technology.

#### 4. 3. 3. Observations

The following section will expand on our approach to participatory observations of the field along with the supporting literature validating a similar data collection strategy. Therefore, our second main method for collecting data was by means of participatory observations of four sessions with four kids using VR individually for educational purposes. Each session lasted around 30 minutes, and the sessions were facilitated at Skolen i Bymidten (0.-9. klassesetrin) and Skolen ved Gurrevej (0.-5. klassesetrin).

To observe these personal experiences with an open mind and to provide useful notes that can help us define the current situation at the Helsingør School, we followed Eriksen’s (2001) ethnographic approach to fieldwork, where he suggests that the aim of observations is “to enter as deeply as possible into the social and cultural field one researches” (Eriksen, 2001, p. 25). That is to say, further exploring the socio-cultural and sociotechnical aspects that occur by observing the participants can help us bridge the gaps created within the current implementation processes of VR at the Helsingør school. Along with Eriksen’s approach, we also consider the Brinkmann & Tanggaard (2015) approach upon observation, where the aim is to observe a virtual reality session which will also be used to gain further insights into implementing virtual reality at Helsingør School (Brinkmann & Tanggaard, 2015). That is, by gaining insight into a practical understanding of the usages

of VR, by observing the use of VR in the classroom by noting the types of activities and experiences facilitated by VR, and the challenges that arise during the use of VR in the classroom.

Furthermore, Eriksen (2001, 24) argues that ethnographic research on a particular field and its related components can offer valuable insights into the sociocultural aspects of that field, with the ultimate goal of comprehending the object of study. With this in mind, the present study seeks to enhance the comprehension of social phenomena connected to using VR as a tool. This data collection aimed to observe the field as it presents itself, with a focus on the personal experiences of the participants and the environments that the sessions were facilitated.

All of the sessions took place in Danish, as this is the primary language of the kids. It is worth mentioning that both researchers took field notes during the sessions. Only one of the researchers involved in this study understands Danish, this fact allows us to focus on different elements during the VR sessions, such as the implicit elements, that may be indifferent to the danish speaker. Thus, to ensure that our notes and reflections align with each other and the problem we are investigating. Further, there was a discussion where we shared our thoughts and compared our observations to highlight the participants' valuable contributions.

In this report, we did not include student interviews, as our focus is on the insights, perspectives and experiences shared by the educators responsible for facilitating the learning environment. Only two participants would be observed using VR as part of their teaching, one being a pedagogue and the learning consultant who regularly uses VR with a selected group of students.

In this report, we respect all actors' and participants' privacy and confidentiality. Therefore we refrain from using names or personal identifiers. These people are referred to by their professional roles to ensure their privacy and confidentiality.

As said before, the four sessions of observations include four kids as participants, where the first one, presented in the appendix, is part of the Skolen ved Gurrevej, which is preschool education but still part of the Helsingor school. More specifically, the observation focused on a wellness session, which was achieved with the aid of VR and the



guidance of Annette, a pedagogue. The sessions were not fully structured, as the teacher behaved according to the kids' reactions. The kid was not diagnosed with any special needs or need for mental health; thus, the purpose of the sessions was to relax and relieve stress by explaining the kids' personal experiences while disconnecting from reality and unwanted stimuli.

The second and third sessions were facilitated at Skolen I Bymidten, and both of the sessions have the same structure, which includes three different activities with VR for the kids. This time the kids are a bit older and diagnosed for special attention. Both kids are having these wellness sessions separated of their regular teaching sessions, as this helps them relax, focus and learn how to behave under stressful circumstances.

The first activity includes a virtual trip into the forest under the guidance of the learning consultant. This is a shared experience for the kid and the learning consultant as their headsets are connected with the help of a tablet that transmits the video. This activity aims to introduce the kid to a calming virtual world while preparing the kids for the next one that requires the kids to pedal on an analogue bike simulator made for exercising. This activity includes only the kids where the learning Consultant is helping with the exercise part, not the digital aspects. Last but not least, the session ends with an individual interactive game, where the kids have to build 3d structures using a hand controller.

The last session was not an official session or part of the Helsingor school, but it was an off-school hours introductory setup discussion of the learning consultant with one of the students and her mother. Participating in this meeting aimed to understand the personal concerns and the guidelines that all participants should know. The meeting was about the learning consultant introducing a 360 video of the interior of a gym during physical education time to a kid that feels anxious and stressed. The kid was planning to take the equipment to her place to achieve better results with the help of a more relaxing and familiar environment.

#### 4. 3. 4. Coding Data

To divide and categorize the information collected through our interviews and observations, we coded the data as a method that enables us to become more aware of the aspects that influence the implementation of the technology.

As Jackson and Bazeley (2010, p. 70) argue, a code serves as a conceptual representation of an object or a phenomenon, or in simpler terms, and it helps identify patterns or themes in a piece of text. The scope of codes can vary from being purely descriptive, such as labels for topics or themes, to more analytical or interpretive concepts. The thematic titles were discovered during our first interviews. Ensuring that the thematic topics are common to every case, we kept the same titles to create a red thread for the report and prepare our data for further analysis.

In addition, early recognition of patterns within the data can establish a strong basis for analysis (Jackson and Bazeley 2010, 69); thus, initially, we discovered these patterns by thoroughly examining the empirical data and generating codes for various categories within the data. The identified topics were broad categories that contribute positively or negatively the technology of VR, something that led into dividing our data into broader topics and serve as a method for initiating the process and identifying relevant links for further analysis, what Jackson and Bazeley (2010, p. 71) called “Broad coding”.

To improve our thematic coding, we applied colours as additional coding technique that helps us define the location of the important information while at the same time has been useful to divide the broad coding material into subcategories.

Further, by providing thematic titles to the data from our transcripts of the interviews and our notes from the observations, we came up with the following thematic categories, that we will use to analyse our data from our theoretical framework. Finally, we proceed with the five main broad categories of data that refer to various aspects that influence how the technology of VR is implemented at Helsingør School: the topics identified are the following: **1) Social issues, 2) Political issues, 3) Economic issues , 4) Technology issues and Ethical issues.**

## 5. Findings

As mentioned in the Methods (c.f. 4.3.), this project is based on qualitative data collected from three primary sources: Interviews, observations, and the relevant literature. At the same time, this research paper aims to investigate the use of VR at the Helsingør School and what factors hinder or facilitate its adoption. To proceed with categorizing our

findings into a contextual framework based on logical interpretations from a critical point of view without using our narrative to affect the results, our main findings will be presented in the following section.

The findings are divided into five broad categories highlighted by the actors implicated in the data collection. However, many statements address thematic categories that overlap and are interrelated with other factors that implicate the implementation of VR in the context under observation. Thus, in the end, our theoretical framework will be used as a justification tool to analyse what creates opportunities for benefits and what brings regression that forms challenges. So as the next broad category of findings regards the advantages and disadvantages that appear to exist within the field.

## 5.1 Benefits and Challenges

To begin with the findings, we will refer to the benefits and challenges of implementing VR, a broad category related to our problem formulation. In keeping with the general literature review we carried out, many aspects form a technology and its relationship with the users and the experts. Thus, many factors implicate the process of implementing VR. The qualitative data we collected refer only to methods and circumstances that we facilitated as researchers. That is to say, our findings are divided into different categories that overlap, whereas the field of research regarding the long-term usage of VR is mostly due to a lack of qualitative data in education, especially when we refer to a progressive technology that is constantly influenced both in a micro and a macro level.

To understand the current situation of VR and the factors that make it beneficial for the learning environment, we will focus on the purposes and the problems that indicate the conditions while deconstructing the reasons behind the technology that will guide us, as we conduct a more structural analysis. Therefore to give an example of the current situation of the technology of VR. We cite the learning consultant, who is referring to the struggles of adopting VR as part of the learning environment.

“I think it is now, I think it is, there will always be some problems, there will be a group of teachers and others, which says, this is not for me.” (Appendix 2, 22:37)

Although this statement refers to one of the initial problems that occurred in the Helsingør Case, the realisation of the potential benefits is overpowering the current problems and

conception of VR, as the learning consultant is highlighting the indubitable perks of the emerging technology.

“But I think it's more mature now. To give something to the teaching. It has opportunities, which you can get in another way, you can be impossible places in VR, you can simulate impossible things.”(Appendix 2, 22:37)

The learning consultant believes VR as a technology has matured and reached a stage where it can contribute meaningfully not only to the learning environment at the Helsingør School but to the kids' wellbeing too. As he further argues that well-being is part of the learning process.

“That's the two legs we are standing on the education and the well-being part is growing in the school today, because you have recognised that the well-being is an important part of the things to learn and how you learn.” (appendix 2. 1:02)

As the learning consultant stresses, there is a strong belief in the significance of exploring the potential of VR in the teaching environment and the value it can bring to learning wellness.

## 5.2 Ethical Concerns

This report investigates the factors that influence the technology of VR and the succession of its use in education. According to our data, some key aspects fall into the category of ethical concerns. However, these ethical consequences are limited; a few were directed from our semi-structured interview guide. That is to say that the ethical factors that implicate the process of the implementation will not be addressed and especially from an ethical or a philosophical perspective of what is wrong or right, but rather deconstruct the challenges that occur from the following overlapping factors to find the causes that affect the technology and its environment.

As the following quote is about the ethical problems that might appear in the field of VR, there will always be problems with the personal data in every technology, especially the emerging ones.

“Of course, GDPR issues are on our table. Of course, it is but I think it's a little bit down the road. Now it's we have to make have some experiences about how to get a platform for VR in the teaching and wellbeing, so the GDPR, I think it'll come down the road later at some point.” (Appendix 2, pp. 42-40)

However, the findings regarding these potential ethical problems are limited to the expert's perspective presented above, whereas he argues that these ethical issues regarding personal data belong to the future, so as our current aim is to develop some important elements that the technology of VR is lacking, mainly in the field of education. In keeping with the Rosa's perspective (c.f. 3.1.) we adopted to frame this study and the data collection: “the realization of any ethical life project lies in the way individuals are increasingly caught in an ever denser web of deadlines required by the various social spheres (“subsystems”) in which they participate” (Rosa 2013, xxiv)”. Thus these required actions are deconstructed to the systems that dominate the sociotechnical background.

### 5.3. What aspects influence the implementation of VR in Helsingør School?

Many indications regarding benefits and challenges combine the following categories of findings. Our empirical data identified benefits and challenges associated with implementing VR in the Helsingør School that will shed light on the complexities of adopting the technology. To identify the circumstances that hinder opportunities or predict consequences that will create challenges, we have identified five themes in play when exploring the factors which hinder or facilitate the adoption of VR in the Helsingør School. Combining the coding with these findings has highlighted the following thematic sections: Social issues, Politics, Economical issues Technology and Ethics.

#### 5.3.1. Social Aspects of VR

Based on our collected empirical data, we have identified a significant connection between the social aspect. From an initial step, our first interview directed us immediately at the social factors that influence the implementation process of VR in Helsingør School. The

quote below provides an example of the challenges that arise due to the differences in thinking, teaching styles, and levels of technical expertise among the actors involved in implementing VR in the Helsingør School. We have chosen to include this topic because it highlights the importance of acknowledging and understanding the different perspectives present, whether it be skills or personalities within the educators of Helsingør School.

“That's what I've tried to give the learning consultant, but he, he had some difficulties with the staff, not wanting the same thing as he wants, not thinking as quick as or fast as he does.” (Appendix 1, p.4).

As the quote from the principle of Helsingør above points to, our findings suggest, the adaptation and integration of VR as a tool used in learning require effective communication, collaboration, and a mutual understanding among all the actors involved in the Helsingør School. The social dynamics between the educators, administrators, and other staff members play a crucial role in shaping the implementation process and determining its outcomes. This is just one example highlighting the social aspects. It underscores the significance of fostering a supportive and understanding environment where individuals can communicate openly and adapt VR to different teaching styles and practices.

### 5.3.2. Power Relations, Governance and Policies

A significant part of our empirical research aimed to identify the challenges and limitations that occur based on the current policies and management as well as the governance of the public educational system. All these factors fall into the same category of Political relations. However, with the word political, we do not limit our findings in politics but primarily to acting in the interests of status or power relations within the micro level directing to personal agendas or the institutional level that includes governmental policies and further the vision of the market. From a micro perspective, many issues influence the macro conditions and vice versa. With that in mind, we are dividing the political findings into the governance in different levels of management and how the lack of guidance and policies leads to the micro-management of Helsingør School and the policies of individuals.

To begin with political findings, we will refer to the principal's explanation of the difference between personal and governmental agendas.

“I don't have to use VR. That's my choice. But technology, understanding (subject), I have to make sure that everybody has a broad understanding.” (Appendix 1, 21:30).

The previous quote refers to the personal agenda of the principal around the implementation initiative of VR, while the following quote from the same interview, is highlighting what is the perspective of the principal of Helsingør regarding governance, where she refers to the challenges of the managerial position and how it extends from the school leaders to the organisational level.

“And I think one of the reasons why that is happening is that there is we have got another leader, one more leader, and she's kind of keen on VR. And I will, and I think that's one of the key issues that we need to get through the leaders. I think we said something about it last time. Yeah. Our biggest enemy, if I could use that wording, it's not very nice. Maybe I'll leaders. Yeah. And that's the toughest part to get through. And especially when you when it's an organisation like mine, where I was the one who decided, they said yes. And was on board. And then they maybe thought it will go over. She will do something else in some time.” (Appendix 1 ,1)

On the other hand, from the perspective of the educational expert, the procedure of taking action does not matter. As he argues in the following quote, even though there will always be people that are responsible for the initiatives and the management, eventually, the teachers that will make a benefit of the technology will be a few. Their position will be contradictory to the high-level management.

“Initially, it's the principal of some of the school leaders who took the initiatives here, who also are in charge of like budgets and decision-making. And when that was accepted, they pointed out a few teachers that they thought would be the good kind of project managers on this. And then we work really closely with them. So it is a mix of always, when we work with schools, there are some high level people who make the decisions, and then there are the actual teachers who will use it.” (Appendix 3, 17:09).

Further, we can see different countermeasures and foundations when we refer to the macro level, which includes factors that can further implicate the use and the perception of the technology and its market based on the visions and policies of private companies.

"Yeah, the issue right now is that we do not control the hardware. The producers are the big giants of Oculus, owned by Meta, and Pico, owned by Byte-dance, which is the parent company of Tiktok. Then you have a few headsets from HTC and Google, who are trying to compete, but they (Meta and Byte.dance) control the market. They launch a new headset like you see new smartphones every year." (Appendix, p.26)

Thus, the provided quote sheds light on the political aspects which also impact the implementation of VR in Helsingør School. It highlights the influence of powerful entities within the VR hardware industry. The quote from a representative of Khora emphasizes through this quote how the VR studio Khora, which has been collaborating with the Helsingør School, is not in control of the hardware used for the implementation of VR. It identifies Oculus, owned by Facebook, and Pico, owned by Bytedance, the parent company of TikTok, as the dominant company in the market. This illustrates a concern regarding the concentration of power and control in the hands of large corporations and how the macro level impacts the micro.

"...and then you have a few headsets from HTC and Google who are trying, but they control the market, they launch a new headset every year, like you see new smartphones every year (Appendix. p. 26)"

Additionally, the representative mentions HTC and Google as the competitors with less influence over the market. These political factors have implications for the case implementation of VR in the Helsingør School, as it becomes influenced by the strategies of the hardware manufacturers of VR. The monolithic market control by the big players in the industry can affect the affordability, accessibility and availability of the hardware for schools such as the Helsingør School. Certain dominance of these market players may constrain the schools' ability to choose and access suitable VR as a technology for the school of Helsingør. Again, the quote suggests that market dynamics could contribute to the industry's instability and rapid technological changes. New hardware is constantly



being developed, as the comparison with the release cycles of smartphones implies. Thus, Helsingør school must navigate this fast-paced environment and adapt to new technologies. Understanding these political factors can help us in understanding the broader context in which the implementation of VR occurs, relevant to both the Helsingør School and other similar educational institutions.

### 5.3.3. Technological Implications

The technical implications of implementing VR hold significant potential to shape/advance the use of VR in learning and education (in Denmark and beyond). As part of our empirical findings, we will account for the technological advances, social dynamics and political factors that influence the implementation and utilization of VR in the Helsingør School. By understanding the technical implications which affect our case study, we aim to provide a comprehensive understanding of the challenges and opportunities associated with the VR technology. One insight we gained from our investigation, by interviewing a representative from the VR studio “Khora”, was on the importance of finding and selecting the software and hardware, that has the minimum cost while it is the easiest functional solution for Helsingør School to get started and use VR in the teaching and learning practises.

“...for Helsingør, we tried to find the most simple and minimum viable solution, which is what we would 3-degree headset. Three degrees of freedom. So it's basically just a small headset that has everything built in; you don't need a computer or phone or anything other to launch it any you can have 360 experiences in it, but you cannot like move and interact like you can do in some of the more complicated heads that you can like push buttons and so these are for like very cinematic.” (Appendix. p.25)

They selected a specific type of VR headset known for the 3 degrees of freedom it provides (3DOF). They referred to a headset designed to be compact, self-contained and easy to handle. Without external hardware such as computers or phones/tablets to operate them. The representative described the reasoning for their pick of choice being the initial request to run programs for delivering cinematic experiences made in association with the school of Helsingør itself. These headsets are ideal for the intended purposes, as they lack the capability of full movement and interactive features, such as in the more complex

headsets. It was clear the technical considerations from the experts centred on a more practical approach to ensure quick accessibility, making the technology part of Helsingør Schools' learning environment in the easiest way possible. These headsets are the ones from Pico, and it highlights the importance of aligning the specific goals of the learning outcome with the capabilities of the VR technology. It also emphasises the need for exploration and evaluation of the technological advancements in the field of VR in learning. As VR becomes more sophisticated, educators and educational institutions may assess which solutions better align with their educational goals and programs. It highlights the constant need for making informed decisions to harness the potential of the VR technology in learning environments.

#### 5.3.4. Financial aspects of VR

In our data, there are many indications that financial aspects are an important dimension for technological expansion and the implementation of technological innovation. As we consider the economy a fundamental aspect of the social-political and socio-technical configuration, most of the data regarding financial factors overlaps with the findings presented above. However, we will provide citations from our empirical data (collected), which highlights the financial aspects that impact the implementation of VR in the Helsingør School (according to the Principle). Therefore, the following quote from our interview with the principal of the Helsingør school highlights the importance of financial considerations when implementing VR inside the educational premises of the Helsingør School.

“Because we bought 24 VR devices (Pico and Oculus GO) for our schools and found out that one of the schools doesn't have them, so I've ordered them, there's no excuse! That's how I work. So, you know, they..., so we tried to, you know, erase all the difficulties for them.”

As stated by the principal, 24 VR devices have been purchased for the school, it is indicating a significant financial investment to cultivate the use of VR in the Helsingør School. However, this quote also highlights the issues related to the oversight in the distribution of the hardware, as the School did not initially receive them, according to the principal. Regarding equitable access, the principal took the initiative to order the devices

for the one school department in the Helsingør School, which did not receive the VR devices. This quote exemplifies the financial commitment of the principal, who feels it is required to ensure equal opportunities to all students; precisely, by addressing the deficiencies in the implementation process.

“It is good for those who think I can't use it, because, yes, it is working. And when you erase all the difficulties for somebody else, they don't find interest in it. It's kind of like if you are paying me 50 kr. to come to a meeting, some will come because they paid 50 Kr. for it, and some won't come anyhow. It's kind of, I know, maybe a ridiculous picture, but it's kind of the same.”(Appendix 1)

The relationship between financial support and the motivation and interest of the educators in the school is displayed in this quote above from the principal at Helsingør. As the quote suggests, some educators may show increased financial support for VR in Helsingør's school that is granted if the associated challenges are removed. Nonetheless, the principal also acknowledges that not everybody agrees on using VR as part of their teaching work. The analogy of paying educators to attend a meeting depicts the complex nature of motivation and interests, and how financial incentives could influence motivation and interest, and thereby showcasing perhaps disingenuous participation.

Therefore, these findings can direct our analysis into the thematic categories of challenges and benefits. This finding section might not only be limited to the Danish educational system but it likely applies to how the VR initiatives upon education are directing the technology in general (in many different contexts).

## 6. Analysis

In the following section we will begin our analysis, which will consist of analysing the empirical data

of Rosa's concepts of “social acceleration” and “resonance” theory in targeting the integration of VR in the learning environment; specifically, the focus is on the implementation of VR technologies at the Helsingør School.

In the second part of our analysis, we are going to include a reference to Lev Vygotsky's conceptualization of social constructivism, as a justification of resonance, to show how meaningful learning experiences are created within the learning environment in the Helsingør School.

The analysis broadly explores the categories of benefits and challenges in the implementation process of VR in the Helsingør School, while focusing on deconstructing them and identifying what are the causes of these factors. As the findings imply the main thematic categories that influence our case is based on sociological factors, technological details, economic aspects, and governance or policies associated with the use of VR in education. As such, the structure of the analysis aims to examine the macro factors of social acceleration, the concept of resonance in creating meaningful learning experiences, and the application of social constructivist as a teaching method which we have observed during our visits in the Helsingør School.

Following Borsen (2013, c.f. 4.1.), this study aims to provide a nuanced understanding of the compatibility of current implementation strategies with the school's educational objectives. Thus, we refer to the technology as educational VR, which is composed of responsible innovation, interactional expertise and user experience. By cross-referencing our data sources from actors on every side of the Techno-anthropological triangle that allows us to comprehend where the tensions and the technological gaps are in the field. Further, by analysing our data from our theoretical frameworks, we will provide a comprehensive and nuanced analysis of how the technological progress is interlinked with the social changes that occurs in modern societies and how individuals and systems influence the pace of life and further our case at the Helsingør School. By understanding how social acceleration is applying on the innovative applications of VR, that will allow us to provide insights of how to enhance teaching and learning in the educational institution. In continuation of theoretical perspectives in combination with our findings, we will define a series of arguments which will be based on the way that challenges and possibilities of VR emerge.

## 6.1. Social Acceleration

To gain a comprehensive understanding of the success of VR in education, the analysis is grounded in the phenomenological approach of Rosa's theory of social acceleration, which highlights the increasing pace of societal change and its implications for various domains, including education. This theoretical framework enables us to analyse the benefits and challenges of VR implementation within the broader context of societal changes driven by rapid technological advancements and societal expectations for innovation.

Our findings highlight the potential benefits of VR in education, where it offers immersive and experiential learning experiences that enhance student engagement, critical thinking, and knowledge production. Students can explore diverse environments and concepts, enabling active learning through interaction and collaboration. Thus, by exploring what makes VR beneficial in education, we aim to provide valuable insights for educators, policymakers, and stakeholders involved in shaping educational practices. Understanding the potential benefits and challenges of VR integration from a social acceleration perspective can inform decision-making processes and help ensure the effective and beneficial use of this technology in similar cases like the Helsingør School. According to our data there are many indications that highlight the benefits of VR and the potential challenges that might occur by following these advantages. However, in order to identify what eventually can lead to positive or negative results, we have to define which are the factors that lead to social acceleration. In this report, we are utilising the three major contributing component dimensions of driving social acceleration (“technical acceleration”, “acceleration of social change” and “acceleration of the pace of life”). We are analysing from the vantage point of Hartmut Rosa’s (2013) phenomenological research principles within the theory of the field. Social acceleration and Resonance from a phenomenological point of view, appears to be “internally related to each other in the sense that their respective modes of functioning result in mutual causal reinforcement.” which complies with Hartmut Rosa’s findings termed in his theory as “the circle of acceleration.”

### 6.1.1. Technical Acceleration

As seen also in theory (c.f. 3.1.1.1), Rosa (2013) argues that technical acceleration is the initial motive for integrating the technology of VR in education, while the individual actors with their personal beliefs and attempts to improve the technology are also contributing along with the technological progress that takes place. Thus, the following quote focuses on the learning consultant, who is defining what he perceives as a success in the interplay of VR and Education.

“When is it a success? When the teacher thinks that's, this is a technology I can use to motivate the students and I'll think it is into my teaching as supplements. And I think it is a success.” (Appendix 2, 46:38).

Further, he argues that there will always be challenges for making VR beneficial, especially when there are many difficulties, but one main requirement exists in order to move forward, that is to understand the tactics of VR and the purpose of using the technology.

As it pertains to implementing VR in the Schools I think there are many hurdles. But one thing is the (teknologiforståelse) Technology understanding. What does it do with us? And What happens when we use VR in education? That is something you have to know. But it is in terms of education, a job for us to have the students take ownership over a new technology in society. (Appendix 2, 46:38).

Initially as the principal informed us, the reason behind the implementation of VR, was the stem initiative from the government, in order to incorporate STEM systems in the educational system. The learning consultant refers to this situation as an indubitable adjustment of the education to the technological market, where he is mentioning the opportunities of the subject of “technology understanding” (teknologi forståelse) and the kids’ preparation for integrating into a technological society. As the following citation implies, the technological progress is essential for the educational progress.

“In addition, we can say VR is used in many more aspects. IF you are a technician. Coming out of school, with a degree in STEM, then it will be about VR. And so, we have

an educational job for us, to present this technology for the students. So that is part of technology understanding.” (Appendix 2, 46:38).

However, as Rosa’s theory explains, technical acceleration is the first step towards social acceleration, the inconsistency of benefits or limitations directs again to the learning consultant who explains why it is important to comprehend the technology

before its use while the benefits in the learning processes and the kid’s wellbeing is critical to keep up with the technological innovations and vice versa. The quote below from our interview with the learning consultant, speaks into the potential or challenges of gamification, a component of technical acceleration:

“But there is also a learning element in it. It just a question of gamification. So, this way of learning, is also something the teachers have not liked before. To get games into the learning environment. I think this grow in the future, because games are what is working with kids. And then espouse and being able to show the nature like realism, is something that could benefit the children. They could learn something doing this. It becomes something important in the wellbeing-ness work.”(Appendix 2, 34:51).

So that is problem we also saw with then, for many years ago, when the big screens and computer was coming into the classes. But I don't think they have seen and that we is necessary for them right now. But then, maybe there isn't enough content, that could be a problem. And, of course, the support that the leaders will, will give them, I think it's a problem too. And also it right now is it's a free space, I think. So that is difficulties.” (Appendix, 20:14).

Furthermore, the learning consultant, argues that VR is a required aspect in education, as there is an “ urgent need for having a new kind of tactic in the class.” Where the teachers' adaptation to the technology is a mandatory foundation of successful technological advancement. As he further explained, the process of implementing VR is an ongoing process that requires more than the technology to move forward.

“ And then thought like creating content that must also be part of this kind of sentiment, you want to give the teachers by having different types of content that you can use for different types of classes. So it's not, you know, the same programme over and over again, right, that gives the teacher probably a little bit yeah, some better possibilities to implement it in their own of course we have made our projections in that in that matter that we thought that it would give some interest to the technology. And it also has given it some interest. But we are we are not through it yet.” (appendix 2, 22:37)

With the quote above we are referring to the technical problems that lead to the technical acceleration. Even though the initiative for the implementation of VR was initially introduced as a need by the educational system, there are personal challenges that occur within the educational processes as there is a lack of content for a variety of subjects that VR could impose an important learning aspect. Thus, that leads further to the adaptation of the rules and the policies of individuals and further of companies that leads to the global market. Whereas the Learning consultant informed us that part of the technology they have introduced, there are three different kinds of headsets that they are using since 2018. However, that does not mean that there is sufficient content, as he argues that “ So now when dealing with the market, which is now focussing on one model, which gets the most content, So as you say there is a lot of fast movement, and where is it you have to stand and run with it. Now we take the oculus Rift, find the content and have that be the focus? In one year maybe the Oculus rift is over.

In the other side of the technological development, the Educational expert from Khora, presents a different perspective on this matter, where from a firm's vision, the aim is to make the software accessible to the teachers and help them to understand the technology.

“So first of all, that was about what hardware to buy, how do you use it? How do you make like a system that the teachers can apply, so they don't get scared off the technology.” (appendix, 5:07)

That leads to technological progress that is based on insufficient evidence that the technology of VR can be beneficial with the current technological conditions. Whereas



from the principal's perspective, the problem is the lack of interest from the individuals, as mentioned in the following quote.

“And then, you know, without knowing anything about it, they kind of decide that it's difficult. It's not possible. Everything will be a problem. It's not working, there will be no electricity, you know, everything as it, and they are still watching us and have absolutely no interest.” (appendix 2, 10:53)

However, in the following quote, the educational specialist refers to the simplicity of the initial steps to integrate the technology of VR in Helsingor's case while explaining that there is a variety of applications and content appropriate for many educational purposes.

“So what we basically did was creating these school sets of headsets, I think those 30 headsets and a box, the teachers could bring that into a class, they would have a manual with, like, these are some good applications to show in geography and in history and in English. So what we actually did in the beginning was not creating any new content, we just looked at what's out there on the market, there's a lot of apps and content you can download, for free or for, for minimum costs. So, we use existing material to create like a catalogue or learning book for teachers that they could just use for different courses.” (appendix 2. 5:07)

As the educational specialist further argues that this is the only way to progress in the field of Educational VR, where the challenges stem from the lack of understanding, as he mentioned in the following quote.

“But often if there's no process, manual, then it will become chaotic. And some teachers use it and love it. And some they don't even want to touch it because there are no like, guidelines.” (appendix, 19.09)

Moreover, as it was presented in the sum of our data, many aspects drive the technological progress, some of which are particularly leading to a technical acceleration in a broader level. As the learning consultant mentioned, “The issue right now is that we are not in

control of the hardware.” (Appendix 3, 22:19). As it was presented in technical details ( c.f. 2.1.1.), The manufacturers of the hardware are the same big companies that drive the global market with the Facebook and Bytedance on the top of it, while apple and google are competing to expand on the market. The technological progress is rapid as every year there are new releases. “They're just new versions all the time”(Appendix 3, 22:19). Still, adapting to the new versions is possible as a form of critical thinking and further deceleration based on economic factors. Then, the education specialist claims the financial aspect does not matter when the quantity is minimum, and the technological emergence remains stable.

“So it's not like a huge investment. But of course, if you buy 100, it becomes a big thing. So I think, for most schools who are buying hardware, they will need to upgrade to a newer headset within three years or something. But it is still possible to use them after three years. But if you want to follow the technological development, and then it's like it's like iPads and phones.. And the producers will some at some point say you can update this any moist tool. And it is a barrier for us. Because we of course, it's not actually the content we produce. It's very easy to version is for newer headsets. So it's always the hardware was the that's the issue”. (Appendix 3, 22:19)

That is to say that there are many implications in every step of the implementation of VR in the Helsingør case; some of these factors came along the educational initiatives to incorporate STEM, while others occur from the technical details of the hardware as well as the availability of content. However, many technical elements influencing the implementation process apply to other interlinked thematic categories, such as social aspects, the governance of this technical procedure, and economics that lead to social acceleration.

### 6.1.2. Acceleration of Social Change

The second dimension is the acceleration of “social change”, which is a direct link to how the technical foundations of VR further give form to social changes. As Rosa (2013) argues, the social changes from social acceleration reflect upon the foundations of many aspects of drives, and the social structures transform accordingly. Furthermore, Rosa’s(2013, 77) theoretical framework suggests that the social changes are reflected upon

the cultural Practices, economic systems, political landscapes and last, but not least, the social relations; wherein he states that “the present contracts from both a cultural as well as a structural perspective.” These aspects can also be seen in the case of the Helsingør school and the empirical data collected

#### 6.1.2.1 Cultural Practices

The cultural practices apply to all the societal transformations that occur because of the technological progress which eventually leads to technical acceleration and further to social changes. As our findings evinced, many social, political and economic aspects influence the Danish cultural background and its educational system, and the foundations of an emerging technological market.

The following quote highlights how the learning consultant activity can lead to social change through technological progress. Indeed, he states that implementing/using VR "It is not a quick fix, but I can teach them how to express their feelings better". Where he further “sees a future where it can be scaled up on higher didactic levels, but it will take time. It will require a bigger, more open plan of action, and it will take time for the teachers to incorporate technology into their teaching methods. "Do not be afraid of VR" (Appendix 4). Furthermore, as Rosa (2013) suggests, modernization often significantly improves processing speed and productivity. However, these advancements tend to accelerate social changes by creating numerous spheres of social activity. Thus, there is a pressing requirement for coordination and synchronisation across different domains. This necessity is addressed through strict temporal regimentation and the implementation of time discipline. As a result, a need for coordination and synchronization across these technology domains. Initially this is addressed through strict temporal regimentation and adherence of VR implementation to the disciplines involved and their schedules. Even though the current educational use of VR is an ongoing investigation to develop according to the results and progress attained, the educational specialist argues that Khora had many good experience with VR and the feedback from the kids was positive regarding their engagement, “ So, we'd started to try and create some more customised content they had especially this focus on the some of the kids who were not attending school that much in Danish, you would call it school and their own mailing.” (Appendix 3).

Further, we direct the same questions to the principal: to comprehend how individual initiatives can lead to social changes. What the principal was highlighting is that the required diagnosis for the kids in order to be accepted in one of the schools, which is for kids with special needs; it is something that leads to the structural transformation of the school system. While stressing that this process is influenced by the lack of guidelines from the government, the principal claims that the school is succeeding implementing VR in the learning environment at Helsingør School, the capacity of students has doubled since of late, which means the school had to hire more employees.

“Actually, of the students, you need to have a diagnosis to be discharged to the school and the parents can wish for it, but they can be sure they will get the children in at the school. (...) And we are looking into that is school is going to be even bigger expand even better. (...) So it's quite a big problem, you will reach capacity, there's no more far outdoors, or they are in cleaning rooms and changing rooms and offices and meeting rooms and everywhere. So, there are no more rules and still the municipality, getting students in and said, You have to fix it” (Appendix 2, 2:13).

In contrast to the learning consultant, Rosa (2013,109) explains that “even with respect to the tempo of social change, one should assume that a progressive quantitative escalation can lead to qualitative shifts in the constitution of social reality when critical threshold values are reached.” In this light, we can cite the learning consultant again, where he suggests that VR should be used only in unique situations where learning value is created and that there is no point in VR if it is a normal video or an ordinary situation.

“Value Proposition, that's the most important word, I think, what's the value proposition” (Appendix 3, 41:03).

Rosas theory aligns with the education specialist’s perspective, but it requires a critical perspective in the citation above to understand that the value proposition is a very important aspect of the society and what drives peoples’ motives. This is relevant for our research as we explore the motivations for using VR in the learning environment at Helsingør School.

The arguments made by the consultant complies with Rosa's explanations. In this instance, the mismatch in magnitude between the potential value proposed by implementing the well-developed VR technology and the capacity threshold of the school to operate in the presence of the increased social demand for access to the implemented technology, would propose challenges for successful implementation of the technology in the school.

In conclusion,, the challenges that can drive social changes from a macro perspective could be presented in the shade of the analysis performed about the case study of interest: that the uses of VR technology are driving Denmark's technological background.

According to the education specialist, Facebook has been one of the big companies that had many problems as they tried to make it mandatory to have an account to connect to the Oculus headset, something that lead other companies and institutions to avoid being part of that process which as the expert cites that "Facebook is really trying to push the census to the consumer market."(Appendix 3). Furthermore, there is a resistance to adaptation in the market since, as the expert mentions:the last years they are using Pico even though Oculus has the rumour of being a better headset. I think it's also a branding thing. It's all made in China anyway. But I think it will, you will see a wall between these two giants now." (Appendix 3).

The education specialist is explaining that this will happen as VR adapts to technological progress and as "that's the vision for both and that we all will have a VR headset at home like we have. You need people to buy VR at home. And not only just companies in schools, but I think we're still a few years from that".

#### 6.1.2.2. Economic Systems

Economy is a critical aspect of how societies are built along with their sociological influences. As presented in the findings there are many indications that the financial aspects lead to social changes, where further the economic system co-creates the technological and political aspects that lead to social acceleration.

As presented by the principal of Helsingør, the financial challenges is one of the factors that influence the success of VR where there is a need for content for the kids with special needs as there is limited content for these cases.

“But one thing is the ideas but also getting funding and making everything financially possible has is always a challenge when we talk with schools.” (Appendix 3) 8 30

In addition, the learning consultant refers to the challenges that occur, due to the software and the financial aspects that drive the market, where the licence of the software is an essential part of the technology and while comparing the old technology of books with the needs of VR.

“ there is a issue about the licence but you know, we buy books and, and sets for the owner meeting in the class. So I think it's alright, to buy some licence too.” (Appendix 2)

Further, the educational specialist argues that the software is not a financial problem, but especially in the institutional level, the problem is the hardware because of its price. The educational specialist suggests that even with the hardware changing the technical changes remain almost the same, but the problems nest at the institutional level where “they have limited budgets, and they are under some restrictions and rules.( Appendix 3).

However, the financial struggles continues for the educational institution as the learning consultant refers to the situation of the market and the second party applications that have been used while highlighting that “The Pico is most likely our own productions, and productions from khora.” something that benefits the situation as it supports more secondary application. As the following quote cites from the data of our observations “I notice again that there is a Khora Logo on the front of the headset.”( appendix 5); there is an indication of using the position of khora to push the technological progress and especially with financial motives as the logo of Khora has been advertised on the top of the hardware. Thus, in the end, many socio-economical aspects drive to acceleration of social change, that is to say that the financial aspects that form the technology of VR, put pressure on the market itself and its users in order to adapt to the social progress, something which according to Rosa (2013, 261), generates “massive synchronization problems whose costs are as a rule externalized.”.

#### 6.1.2.3. Political Landscapes

As it was presented briefly in the findings (c.f. Power Relations, Governance and Policies) the political landscape is one of the most important aspects that drives the social acceleration while at the same time influencing the technical acceleration and the acceleration of pace of life. As our findings highlighted the political landscape is

constantly been influenced from the micro level to the macro, where we have the individuals' visions and policies driving the technological progress and at the macro level where there is the institutional governance and global market.

The principal's perspective on technological progress, has been guiding the initiative of the VR implementation and a new vision for the Helsingor School, as presented at the section on Power Relations, Governance and Policies (c.f. 5.3.2.). Further, the principal's power given by the managerial position, pushes forward the political progress which defines the political landscape of the technological advancements and the educational system that facilitates them.

As the principal highlighted, many challenges occur from the local governance of the technological applications, where even if there is the freedom of acting from a micro governance perspective it creates contrast with the higher institutional level where there are no initiatives or guidance, something that leads into social acceleration that is driven by the political background.

However, Rosa (2013,253) is justifying these lack of action as follows "The dynamic element in these systems is rooted not least in the clearly demarcated length of legislative terms, usually either four or five years. When contrasted to the time monarchical princes spent controlling the government, which was as a rule much longer, this explains why democracy was experienced as an element of political acceleration deep into the era of classical Modernity". Emerging technology in modern societies proposes elements of uncertainty which are experienced differently from the different perspectives of the various implicated actors. Policymakers are under more pressure when it comes to delivering value return on investment for public projects as their regiem is vastly shorter compared to monarchical princes. Hence, when considering the operational requirements to adapt and implement the new technology, against the resources allocation of the governing body, challenges are naturally proposed due to the misalignment in differently-percieved requirements and expectation proposed by the diverse implicated actors

Taking that into consideration, we are justifying the lack of guidance from the government as the political background in the societal aspect of what Rosa defines as modern society.

The following quote implies that these process reflect power relations where the governance can also influence the technological foundations, as it pertains social changes further by posing further challenges, especially in instances where uncertainty and misalignment in scope and expectations when considering implementation, could impose a level of complexity that challenges the understanding of the implied actors, which manifests in the form of resistance to organizational changes associated with the implementation process.

“So yes, we can decide, I can decide the leaders can decide. When do we do what? Because they hadn't decided on it. The government hasn't decided yet. If it's going to be a subject. Or if it's something we put into every subject” (Appendix 20:03)

Furthermore, the principal explains the procedure of selecting the leaders while highlighting that after becoming leaders they take responsibility of their own actions in the political landscape.

“And, you know, but so we have decided the leader that we have at every school at our place. Our four schools have a leader who is responsible for VR from now on, and at least one teacher at the school (...) So we kind of see, it's your responsibility. “ (Appendix 1 29

In addition the principal explains that in order to become a leader, “you almost need to make a pledge. Yeah, I will always be true to VR.” (Appendix 1), however, as mentioned later on, “I tried to do that at first, but when we started with giving them the hardware, giving them courses, giving them blah, blah, blah, blah. But you know, they kind of forget.” ( appendix 1, 20), which according to Rosa( 2013) this is an element of resistance to information, as the social changes are impacting the political structure.

Moving a bit further, we proceed with the influence of political choices made by individuals and institutions where from the perspective of the learning consultant, VR is not necessarily mandatory for the educators but rather an optional tool. When the tool is optional and necessarily mandatory, the argument for investing public funds for the purpose



of development and implementation becomes of especially challenging to validate from the perspective of policymakers. This, indeed, and as observed in this instance, generate an additional challenge for implementation in the form of motivation policy to enhance the engagement the users of the implemented VR technology in the school, students, teachers and regulators. This is noticed from the statement of the learning consultant where the consultant explains that they reverted to traditional motivation methodology by applying the classical punishment-reward system. “So for right now it's maybe I shouldn't say the mandatory it's, it's a choice, right is a tool that they can choose freely to apply their own tool bag and in their own methods, teaching methods, but so what you're saying is that it's being pushed to have a more to be a bigger part of the curriculum, or at least be being used more or being taken effect by more teachers.” (Appendix 2) where in the continuation of our interview, the expert highlighted that “We would like to it to be a part of the curriculum. Okay. So they have to use it.” (appenMoreover, the principal gave an example of the current situation with the teachers where as she said there is a Danish saying “whip or carrot”, You know, if you punish them, or give them sweets. To get people to do something”.

Furthermore, the learning consultant agrees that the leader situation proposes additional efficiency challenges as the problem is transferred further in the system, “So there is a problem there. And also, therefore, there will be a problem with the teachers and the pedagogues. ...they are very interested and positive for the new checking technology. But they have to be supported. And I don't think the local leaders give that support, or that interest to this problem up to this project. I don't know why. Maybe it's because there's so many other things to do on daily basis. But I don't think they earn the right support. So they can benefit for it. So that's a problem there”.

By moving forward, the learning consultant makes a connection of the local political landscape to the macro level of institutional governance, by suggesting that in a different case the expert experienced bigger progress because “it was part of their more structured project. It was a structured EU programme, project. And that thing, that was a little more money in the project. And I think it was pushed also the progression a bit.” (Appendix 2).

Further we direct to the educational specialist who is talking about Khora's policies and how the political landscape is affected at the macro level, from individuals and companies in the field. Also the educational specialist is explaining that initially, the firm's policy was to make the technology accessible to everyone, while "also part of spreading the good word about VR. But since then, the business has developed into a production house." Appendix 3) something that creates, concerns regarding the initial beneficial positioning in the market where as Khora present themselves as " Khora started seven years ago, as the first virtual reality shop. In the world, probably, that's what we say at least."

The last part that forms the macro level is how the big companies can influence not only the local individuals in the micro level but drive the social acceleration through policies and through power within the market. Further, the education specialist is referring to the political restriction that apply in the global market, where a situation is unravelled along the company that owns Tik Tok, and how the governmental guidelines for banning tik tok can lead to big implications. As the education specialist explains "it could become a problem if tik tok gets into some kind of ban." in addition, the expert explains that " if schools suddenly get or clients of ours get the kind of rule that says you cannot buy anything that is related to tik tok, that is a problem. But then it's the bite dangerous problem because then everyone will go and buy Facebook or Oculus headsets." (Appendix 3) Ominefficientecures the power and the position of the big companies while creating a false perception of a balance in the technological market. The education specialist is hoping that more companies other than the two tech giants are going to open the market and further drive the "technological acceleration", which is going to affect the social circumstances taking place within the political landscapes, something that in the end, can also lead to "social acceleration".

Conversely, if social change, encompassing the transformation of established structures and cultural norms, surpasses the pace at which generations naturally succeed one another, it can have profound consequences. As Rosa (2013,109-110) argues together with Karl Mannheim's "the erosion of lifeworld certainties achieves a new quality, which cannot help but affect cultural reproduction as well as the form of subjective relationships to self". In the end, change ceases to be perceived as a mere alteration of fixed structures and instead becomes a fundamental and potentially chaotic state of uncertainty.

#### 6.1.2.4. Social Relations

As it was presented in the findings the social aspects of VR are also contributing to social changes, the learning consultant is talking about the challenges that appear in the field and that relate to the social aspects of the VR, thus including the perception of the technology as a problem situated in the lack of knowledge and interest for the emerging technologies by the teachers. as mentions

“there are some teachers out there that don't understand why we need to use new technology for this, why don't we just teach the math as we always do, but there are some people longer up in the era, who would who want to push like a technological agenda, and finding that balance is always hard.” these individuals that the education specialist suggest are the ones that according to Rosa are resisting the social acceleration while the expert is the one that is driving the progress. As follows, “I think we can try sometimes and help them convince some of these people who are not that big of a fan of the technology to actually try it and see the potential. But at the end it is there will always be some who are a little bit against changing too much.” (Appendix 2, 17:07).

Furthermore, many technological applications are driving social changes, some of them overlap with other categories of social changes and some stem from the technical acceleration. Additionally, we have indication that VR should adapt according to the technological advances, something that leads to social changes. These adaptations refer to potential benefits in the technological progress, such as mixing AI with VR and AR, social conversational applications and integrating new technological innovations upon the technology of VR.

The indications of social relation were mostly highlighted through our observation where simple benefits that are experienced by the actors utilizing the value of social relations are also driving the social accelerations, as the current social relations within the use of VR are leading into the way that the technology is already utilized and projected to to be used.

In the first session (Appendix 4,5) it is presented to us that each of the above discussed elements are meant to showcase different social situations. while in the next sessions in Skolen Ved Gurrevej, social relations are used as a tool in combination with the VR to

have a constructive conversation based on subjects unrelated to the technology or the activity.

As the following quote by the learning consultant indicates, the social connection reached with the aid of VR has positive impact on the kids' wellness; namely, benefits archived by "Keep on asking questions and engaging in different topics, switching between describing the program and expressing the emotions and feelings the student associates with the experience and then, turning the conversation into personal subjects outside the VR program." This showcases how the actors in this instance have transferred the value obtained through utilization of the technology in social relations, reinforcing the internal value reward generated from the behavior of adapting the technology something that leads to the final dimension of social acceleration.

### 6.1.3. Acceleration of the Pace of Life

Rosa (2013, 64-65) argues that in almost every occurrence in his investigations, one out of the three dimensions that drives social acceleration, is "for the most part unreflectively, placed front and center while phenomena in the other domains are falsely subsumed under the chosen category". He suggests also that most frequently, the first two dimensions, i.e. Technical Acceleration and Acceleration of Social Change, showcase profound evidence of contribution to the phenomena. Accordingly, the Acceleration of the "Pace of Life" is the last dimension in the endless circle of rapid progress and the indications that direct to social acceleration are externally driven by the cultural promise of acceleration in the form of "an increase of episodes of action and/or experience per unit of time that is linked with a scarcity of temporal resources and the resulting "lack of time". Furthermore, the intensification of informations and the technological innovations is driving the individual upon alienation of the environment that they interact with, leading to the last dimension of social acceleration. However, there are both indications of benefits through alienation and elements that confirm such procedures of alienation, most of them come from our observations, as it follows in an observation session where the learning consultant interacts with a participant using the technology.

This set-up, according to our evaluation, provided the opportunity to observe the phenomena from the perspective of both sides (experts and users), where Technical

Acceleration and Acceleration of Social Changes are arguably the two major component dimensions placed front and center in the mental modelling of the self-image relative to the version matching the changing expectations of its dynamic environment. As part of the observations follows

*“The student would prefer something else to the bicycle program. “wow, it is nighttime”. It is scary”* ( Appendix, 4) the student says, seemingly a little animated. He expresses how he would run in the daytime instead, and the learning consultant obliges after changing the bicycle program to the day. Learning consultant continues with the same line of questions as before

In addition to being able to observe the phenomena from the perspective of the participant, where adaption of the technology is arguably more dependant on the mental burden associated with conditioning the behavior and perception of the participant to adapt to the new environment. The abundance of alien factors in the new environment challenges the participant to intensively comprehend and adapt at a higher level than otherwise done in a familiar environment. Accordingly, a sense of pressure in time to process, is arguably the dimension placed front and centre in the mental modelling process from the perspective of the user as its behavior is conditioned to use the technology.

*Overall it seems that the kid goes into the digital worlds but at the same time he is conscious of The learning consultant’s question even without watching him.* (Appendix 4)

As the quote suggests above, the mental burden becomes more noticeable when we consider the effects of social dynamics in the instance of the school on participants and their formulation of an socially expected image relative to the one they adapt to.

## 6.2. The lack of resonance creates meaningful learning experiences in Helsingør School.

As presented above, the three theoretical aspects of resonance sum up into contributing to a better facilitation of the learning environment. As a continuation of resonance, we will proceed by analysing how our data can further create value by aligning with the

constructivist theory of Harasim that aligns with the social constructivist learning theory, as the methods in teaching are meant to create a learning environment based on the social interactions between the teacher and the student. The educator seems to be willing to create a sense of shared meaning between the student and teacher. We have identified this collaborative process in the observations of VR in learning environments. It highlights the importance of creating social interactions between students and teachers, despite having the student fully engaged in the technology. Supplemented with proper resource allocation from the institutional level, would potentially provide a balanced merit for the establishment of a comprehensive standard approach, where the biases in positioning components from the three major contributing dimensions of Social Acceleration front and centered from the different perspectives of the diverse stakeholders would be acknowledged, yet the standard approach would balance between the three dimensions to align the different stakeholders and allow for a balanced equilibrium to arise where the burden for changes is balanced leading to a state of resonance in the complex system with the potential to facilitate the adaption and implementation of the new VR technology increasing the potential for successful implementation and subsequent value actualisation.

In the instance of our case study, we observed the practical usage of VR in the learning environment which identified clear similarities in the teaching methods of the educators and the conceptual practises which align with social constructivism. The educator's interactions with the students that use VR, are based on creating social interactions, fostering collaboration and cultivating motivation. In their efforts to establish a meaningful connection between the educator's own practices and the technology of VR, where a beneficial learning experience should be created. This requires taking ownership of VR as part of their toolbox and applying it to the learning objective they are expected to follow.

“The coming-into-being of resonance in social life, then, presupposes not only relationality and reciprocity between two (or more) entities but also a minimal degree of autonomy enjoyed by each of them when interacting with one another.”(Rosa, 2016).

It is the lack of standard practice of using VR in education (lack of resonance) that places the educator in the position to take ownership of VR. A level of autonomy must be present for the educators to freely use VR to create meaningful learning experiences (Rosa, 2016). We connect Hartmut concepts of social resonance with the inclination of the educators to

use the technology for the specific purposes regarding their own teaching practices. I.E well-beingness (c.f. 2.5).

*At one point, the student asks Anette to explain what the adults say in the program, and Anette then explains. No specific program is followed. Programs are quickly selected or passed on. "Then pick the next one," Anette says as the student is browsing through the different programs. As far as the whole lesson goes, it has some effect on making the student focus on the task. (Appendix 4).*

As presented in the quote above from the observations, the educator seems to operate freely using all kinds of VR content available for the educator. The impression is that the VR session lacks a standard practice or specific agenda. The educator is instead switching between different programs, using whatever is most applicable in the situated context with the student. To sum up, the lack of a standard practice allows for flexibility in the educator teaching practice using VR. From the perspective of social constructivist learning pedagogy, it is important to explore how educators can effectively integrate VR and maintain social resonance.

### 6.3. VR as a social constructivist learning method

To understand our identification of the presence of social constructivist learning pedagogy in the teaching practises in Helsingør School using VR, we must look at the conditions of the learning environment and how the educator uses VR to facilitate collaborative learning. Firstly the student must sit comfortably facing the educator. This setup indicates a close and intimate interaction between the student and educator.

*The educator starts preparing the equipment of VR for the kid, something that takes some time....The kid is now sitting comfortably at the chair facing The Educator who is also sitting down. (Appendix 4)*

However, the observations also highlight how some of the students would display nervousness and discomfort while wearing the VR headset.

*The kid feels a bit nervous and being very active with her limbs and scratching her teeth... the student is not feeling the headset comfortable at her head as the student keeps fixing the headband on her ears and putting her fingers in between the headset and her nose as it hurts her. Sometimes the student takes off the whole headset to make eye contact and talk with the educator. (Appendix 4).*

The student is actively engaged but exhibits mental behaviours like scratching their teeth and continuously adjusting the headband to alleviate discomfort. Despite the students efforts to become immersive in the digital environment through the VR the educator plays a significant role in guiding and supporting the students experience. The educator, as stated in the quote above repeats the words and statements made by the student, constantly providing clarifications and explaining what is happening. This aligns with the principles of social constructivist learning theory, where learning is believed to be facilitated through social interactions, and the construction of shared meaning. Our observations paint a picture of the importance of the educators, who choose to use VR, to create a collaborative learning environment, even when it comes to using immersive technologies like VR. The educators' role is fostering social interactions and shared understanding becomes crucial for students learning experience. By acknowledging the students discomfort and constantly providing support, the educator can create a trusting atmosphere and lead the student into a more meaningful and effective learning process.

As we have observed the current learning environment with VR tools in the Helsingør School, indeed is fostering social interactions and shared understandings plays a crucial role in creating a meaningful and beneficial engagement with the VR technology. Educators who use VR in their teaching, must create meaningful interactions with the students. By fostering a collaborative interactions and discussions, students can fully immerse themselves in the VR program, and at the same time be guided by the educator who leads discussions.

*The learning consultant is asking questions about school life and whether he has plans with some friends after school. The student is opening up seemingly, being more talkative, and sharing more about his feelings. (Appendix 4).*



As depicted in the notes from our observation taken in the meeting with the learning consultant, by leveraging VR technology as a tool for collaboration, educators can enhance student engagement by creating the conditions for social resonance.

### 6.3.1 Navigating the Learning Horizon: Unveiling the Zone of Proximal Development in VR Experiences at the Helsingør School

As we observed in the students' engagement with the VR experience and the interactions with the educator, it was clear that the ZPD model/tenets plays a crucial role in understanding the students engagement with the VR experience and the interactions between the educator and students at the Helsingør School. In the observed scenario, the student is dependent on the collaboration with the educator, since the educator navigates the VR technology to make sense of using VR in the learning environment. The educator's role can be described as what Vygotsky would have called "the more knowledgeable other" (see Harasim, 2017 p.74):the educator is more knowledgeable and provides guidance and support to the student/s. The educator enables the student to engage in tasks that the student would not be able to accomplish independently. The educator applies scaffolding concepts (Ibid), providing the temporary support needed so the student can move beyond their current level of understanding and skill, enabling them to achieve a higher level of competence.

*As well as keeps rotating her chair, even though in a dialogue, she understands that it is pre-recorded, and she keeps repeating the words she hears even though she is looking at the digital environment around the student. (Appendix 4)*

Given the students understanding of the pre-recorded dialogue, as is described in the quote above from our observation of the VR session with the student, whose repetition of the words heard, indicate the students progress within the ZPD. As the student engages with the VR technology, the student actively constructs meaning and expands knowledge and skills. The educator's presence and guidance is part of facilitating the learning environment. This observation indicates how the ZPD is dynamically manifested via the use of VR in the learning environment. The more knowledgeable other, the educator in this situation, is facilitating the student's active participation within her ZPD.

## 7. Discussion: Exploring the Role of VR Companies, comparing outcomes based on different approaches.

Understanding the potential for further research, we can examine the role of Khora regarding the implementation of VR in Helsingør School. Because the end-users of our case study pertains to the educators of the school, all practical insights on the usage of VR in education must be understood through the framework of Khora's abilities as a company, while there are also limitations regarding variety of the settings and that VR is applied. It is important to understand the different approaches which might exist through the many VR companies and individuals as various solutions and guidance solutions are offered in the market of VR companies working with educational institutions. Regarding the implementation of VR in educational settings, companies such as Talespin and Epinion (2.3) could be compared to Khora, according to the solutions and services they offered to their clients. These companies. However, these conditions would totally alter the position of the actors and the technology. By understanding how different educational institutions collaborate with other VR companies, we should uncover, 1.) what are the results of these educational institutions regarding the implementation of VR? 2.) Highlight the role of VR companies providing support, guidance and their expertise in content creation, including the software they offer and use, and what hardware they operate on and recommend to educational institutions.

In this discussion, we show the key features and services of the two companies Talespin and Epinion, compare with Khora concerning services offered, and the content quality of their productions. Understanding the software and hardware recommendations of Talespin and Epinion could help researchers who are interested in comparative case analysis, as these insights could provide knowledge on the content and services available, ultimately providing educators and the school administrations of the educational institutions to make informed decisions about the technology they chose to adopt. Further research into other VR companies would also provide insights into the quality and relevance of using VR in schools in Denmark. The fast-paced and ever-evolving VR industry should further

examine similar settings and conditions of the case of Helsingør School, while can lead into a more practical understanding of how a meaningful implementation can occur.

## 8. Conclusion

Examining the case study of the implementation of VR technology in Helsingør School for special education classes, a set of findings were found compliant with the theoretical literature. When analyzed under the lens of the of Hartmut Rosa's Social Acceleration Theory of Modernity (2013). The analysis of Empirical Data collected from the case study indicates the potential for the three dimensions of Social Acceleration suggested by Hartmut Rosa: Technical Acceleration, Acceleration of Social Changes and Acceleration of the Pace of Life, as the major factors influencing the adoption and implementation of VR technology. Empirical observations from the case study suggest biases in positioning components from the three major contributing dimensions of Social Acceleration front and centered from the different perspectives of diverse stakeholders, could arguably lead to a lack of resonance causing impediments to adaptation and implementations. We observed how the teaching practices aligns with social constructivist teaching. As Educators using VR technology in Helsingør of VR include VR as a tool in their own didactics. Given the lack of a standard practice which contributes to the lack of resonance, the only meaningful teaching practise involving VR we have managed to identify have been one of creating social relations through the technology, and thereby creating the format for meaningful teaching experience, as it compliments the learning objective in Helsingør School. The potential of investigating the role of "technical acceleration" as proposed by Rosa (2013), was established to develop resonance-based standard practices to facilitate the adaptation and implementation of VR technology for leveraging goal-oriented process, such as those in education.

Considering the objectives we set, to gain a comprehensive understanding of the implementation of VR in Helsingør School and explore the present factors influencing the integration of VR into the learning environment. We thoroughly analysed the implementation process and examined the experiences and perspectives of the educators, school administration and a technical expert. We aimed to shed light on the opportunities and challenges that VR tools can provide in the context of a danish primary school. In conclusion, our research, as a case study, aimed to contribute to the scarce literature

available on the research of implementation processes for VR in education. By understanding these factors we presented, our insights regarding the benefits and challenges that contribute to the broader field of VR technologies in primary schools and to the future developments in the case of Helsingør School.

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