Driving innovation together

Introducing Metaverse for education and research

Navigating the New Wave of Hope, Hype, and Hypotheticals

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1 Introduction

As the current technological revolution continues to advance at a rapid pace, the concept of the Metaverse is gaining significant traction and attention. The definition of the Metaverse is rather contested, however, and the terminology surrounding this emerging concept is equally confusing. The timeline concerning when we believe the Metaverse will be fully mature is another point of contention, fueled by the discussion around what exactly a fully mature Metaverse would look like.

This report will aim to map out what the (leading) experts and institutions say on the topic of:
a) the terminology surrounding the concept of the Metaverse,
b) the envisioned timeline for a mature Metaverse, and
c) what the prerequisites are, to achieve a Metaverse mature enough for education and research in the Netherlands.

Throwback to the concept of the Metaverse

The term "Metaverse" was first coined by the science fiction writer Neal Stephenson in his 1992 novel "Snow Crash." In the novel, the Metaverse is depicted as a virtual reality-based successor to the internet, where users interact with each other and digital environments through avatars. While Stephenson's vision of the Metaverse was fictional, the concept has since gained traction and has been used to describe the idea of a collective virtual shared space, often facilitated by advancements in technology such as virtual reality, augmented reality, and the internet.

In June 2003 Linden Lab released 'Second Life' as one of the first virtual worlds with its regions and currency by the end of the year. More and more games embodied elements of the Metaverse concept by allowing for the creation of avatars, interaction with others, and engagement in various activities in these virtual worlds and online games (MMOG).

Triggered by the emergence of (more) advanced virtual reality (VR) and augmented reality (AR) developments in 2010, the interest in the concept of the Metaverse sparkled. Oculus Rift and Pokémon Go inspired new ways of interacting with information and others in immersive environments. This new way of interaction inspired the tech industry, including Zuckerberg (CEO of Facebook back in the day), to start talking about the Metaverse and how they saw the future of the internet. Interconnected virtual environments allow seamless interaction between users, digital objects, and experiences. The concept of the Metaverse inspired Zuckerberg so much that he decided to rebrand Facebook by renaming it Meta in 2021. The rebranding showed dedication and commitment to the concept of the Metaverse by Meta.

The rebranding by Zuckerberg had a significant impact on the discussions regarding the Metaverse concept. It meant that Meta was investing in the vision of the Metaverse being a shared, immersive virtual space where people interact, work, play, and socialise through digital experiences. This led to the concept of Metaverse becoming (more) mainstream (read: increased awareness), and to more organisations working on Metaverse-related technologies (e.g. VR, AR, 3D graphs, spatial computing and blockchain), which meant that Meta acted as a catalyst. At the

same time, it led to more concerns regarding privacy, addiction, data ownership and the potential centralisation of the concept of Metaverse under a single corporate entity.

Troublesome terminology

The Copenhagen Institute for Future Studies (CIFS) has, in its Delphi study on the Metaverse, defined the Metaverse as: “the seamless convergence of our physical and digital lives that will bring people, spaces, and things together in virtual or augmented digital worlds. This includes augmented visual layers added on top of our physical reality as well as virtual worlds”. Most researchers agree that the Metaverse refers to some sort of immersive and interactive virtual world where users can engage in a wide range of activities, from socialising and gaming to shopping and working. However, this term is not the only one used to describe this relatively new wave of technology. Organisations, experts and institutions are simultaneously describing this emerging concept as everything from "virtual world," and "mirror world," to "cyberspace," "virtual reality," "Web 3.0" and “Web 4.0”. Understanding the differences and nuances in terminology is crucial to grasp the broader concept of the Metaverse, and its potential to impact education and research amongst most aspects of our lives.

“Cyberspace”, first coined by science fiction author William Gibson in his 1982 novel "Neuromancer," broadly refers to the virtual realm accessed through computer networks. It is a term often used to describe the interconnected digital space where information, communication, and online activities take place, like the internet. Cyberspace describes a wide range of online platforms, websites, social media, and digital interactions, but it is a concept that focuses more on the interconnectedness of the digital world than a specific immersive virtual world. The definition of Cyberspace might have several overlaps and similarities with the concept of the Metaverse, but the nature of the digital interaction, the aims, and the scopes of these two concepts show decisive differences that should not be ignored when mapping out the terminology surrounding the Metaverse.

On the more dystopian side of things, the term “Mirror World”, was first introduced by David Gelernter in his 1991 book "Mirror Worlds”. A mirror world is a digital replica or reflection of the real world. It is typically understood as trying to provide an accurate representation of the physical world, often used for purposes such as urban planning, simulations, or data analysis. With this definition in mind, one might say that mirror worlds are not primarily focused on user interaction or immersion, but rather on capturing and reflecting real-world data and events. However, some experts claim the Metaverse is merely a new branding of the term Mirror World, and that the two concepts are not in fact that different.

> *The concept of a mirror world is similar, yet slightly different, from the concept of a “digital twin”. Both terms relate to the idea of creating digital representations of the physical world and are therefore often used interchangeably. The two concepts differ in scope and scale, however, as a digital twin typically refers to one object, system or environment, while a mirror world refers to an interlinked network of several digital twins working together.*

"Virtual world" is a term more often used interchangeably with Metaverse, as it can be interpreted in a relatively broad sense (compared to, for example, “Mirror World”). A virtual world is an immersive and interactive space where users, often in the shape of avatars, can interact with each

other, socialise, play, work and explore. Virtual worlds can be accessed through computers, gaming consoles, or virtual reality (VR) devices (with examples including the popular Second Life, Minecraft, and Fortnite). Virtual worlds are primarily user-driven and offer a wide range of immersive digital experiences and possibilities.

Crucially, the European Commission (EC) is currently developing its vision for virtual worlds, a term which, according to their definition, also encompasses Metaverses - implying there can be more than just one Metaverse. The definition by the EC for virtual worlds is: "*persistent, immersive environments, based on technologies including 3D and extended reality (XR), which make it possible to blend physical and digital worlds in real-time, for a variety of purposes such as designing, making simulations, collaborating, learning, socialising, carrying out transactions or providing entertainment*".

The EC uses the term virtual world to encompass a broader range of virtual environments beyond the Metaverse. The EC's reasoning for using the term Virtual Worlds, as opposed to Metaverse, is likely based on a wish to distance their vision for the next global wave of technological advancement from the company Meta, and the so-called "Zuckerverse". The EC is hardly alone in its attempt to distance its Metaverse vision from the company Meta, and several experts foresee that the term Virtual World(s) will end up being more popular than the (now somewhat loaded) term Metaverse.

The concept of Web 3.0 is another example of a term that is being used concerning the Metaverse – but the two terms should not be confused. Where Web 3.0 in many ways is considered the newest generation of the Internet, the Metaverse is more usefully described as a network merging the lines between the physical and the digital. Web 3.0 focuses on decentralisation and putting control of the internet in the hands of its users, while the Metaverse is a shared digital reality that enables immersive and interactive experiences. While they have some similarities and may intersect in certain aspects, they represent different concepts within the evolving landscape of the Metaverse technology.

Web 4.0 is another (emerging) term worth mentioning, while on the topic of the troublesome terminology connected to the Metaverse. Web 4.0 is mentioned by the EU concerning virtual worlds allowing integration between digital and real objects and environments, and enhanced interactions between humans and machines. It focuses on the evolution of the Internet and the integration of AI technologies by open technologies and standards.

In summary, while there may be some overlap and interconnections between different terms, their differences should not be overlooked. Cyberspace emphasizes the interconnected realm of digital communication, Web 3.0/4.0 refers specifically to the Internet, virtual worlds are immersive user-driven environments, and mirror worlds are digital replicas of the real world.

Overall, the Metaverse can be described as a future vision of a fully immersive and interconnected digital reality, using 3D and XR technologies to connect the digital world seamlessly to the physical while the other terms describe various aspects of virtual environments and digital communication. It is both understandable and, arguably, useful that we are seeing some confusion and disagreement around the definitions and terms used to describe the Metaverse. To illustrate, tech commentator Matthew Ball poetically claimed that "it's this very messiness that enables and results in such large-scale disruption".

2 A Metaverse by 2040?

There is no consensus on when the Metaverse will be realised in its fully mature form. Some experts predict that the Metaverse will be an important aspect of our daily life already by 2040, but what exactly this mature form will look like is still up for debate. For example, in a 2022 study, Pew Research Institute's Janna Anderson and Lee Raine present findings indicating that many experts "who expect augmented reality (AR), mixed reality (MR) and virtual reality (VR) to advance substantially, predicted those advances will come from a *natural evolution of the current innovations* that are underway". Andrew Koch elaborates on this, by stating that "I don't see the metaverse as being something as innovative or revolutionary as the internet was in the 1970s."

Others believe that the Metaverse might *never* fully emerge in the way today's advocates hope. Examples of the latter include Constellation Research analyst Steve Wilson's statement in a Pew study from 2022: "The metaverse is mostly hype. It is not well enough defined for us to make predictions about a 'fully immersive' experience being more important by 2040". In the same study, senior principal engineer Mark Nottingham similarly stated that "if it plays any role in future online life, based on what we see today the metaverse is likely to be 3D Facebook, more or less – a platform that a big tech company uses to monetize attention, in a winner-take-all marketplace" after referring to the metaverse as a "marketing confection with no basis in reality".

Tech commentator Matthew Ball, on the other hand, states that the Metaverse is best understood as "a quasi-successor state to the mobile internet", that the development of the Metaverse has been clunky, and that its usefulness is debatable. Nevertheless, Ball provides further interesting insights into the temporal dimension of the Metaverse, when he asserts that while the Metaverse is gradually taking shape, its full-fledged manifestation is yet to be realised. He predicts that the Metaverse will revolutionise numerous sectors and become an integral part of people's lives, but that this transformative evolution will take time, with a projected timeline of several decades until its complete emergence. Copenhagen Institute for Future Studies, on the other envisions that the fully-fledged vision of the Metaverse is expected to take between 5 and 10 years to come to fruition regarding the timeline of the Metaverse in their recent Delphi study, which is also in line with Gartner's expectations.

With a similarly short-term vision, XR Today highlights that the Metaverse is already making significant strides. In particular, within the gaming industry there is already existing utilisation of the Metaverse concepts, which serves as a promising starting point for further exploration. However, sceptics caution against prematurely labelling the current landscape as an embodiment of the Metaverse. Seeking Alpha is among those who argue that while certain elements of the Metaverse are in use today, such as gaming platforms and other virtual spaces, whether we will ever see a complete realisation of the Metaverse, as envisioned by its proponents, is still highly uncertain.

Despite expectations regarding the timeline and a high degree of confusion at this point, the Metaverse has the potential to transform society positively, and it is interesting and necessary to look at its likely, and even remotely possible, roads ahead.

Conclusion

The current landscape of the Metaverse is in a state of transition, with glimpses of its potential already present in various domains (for example in the gaming industry). While some argue that we are already starting to immerse ourselves in the Metaverse, the prevailing consensus is that its full realisation is yet to come. The timeline for a mature Metaverse extends several years, if not decades, into the future, and it necessitates significant advancements in technology, policy transformations, and regulatory innovations. Metaverse is a complex, multidimensional concept that demands careful navigation to ensure inclusivity, security, and alignment with different societal values. However, by considering the temporal dimensions and addressing its many challenges along the way, we can collectively shape a Metaverse that enriches human experiences and opens up new frontiers of human development.

The concept of the Metaverse has captured the collective imagination, raising fundamental questions about its current existence, the timeline for its complete realisation, and the necessary conditions to pave the way towards its full-fledged maturity. This short overview serves as a stepping stone for future research, as further examination of industry perspectives undoubtedly is necessary to fully grasp the present state and the likely path that lies ahead.

3 Institutions' view on the Metaverse in education and research

As part of this short deep dive into the evolving landscape of Metaverse, we interviewed four professionals from four institutions about their views on the concept of the Metaverse in higher education and research. Three main themes were discussed, namely: (the issue of) defining Metaverse in a cohesive way, what are prerequisites for a mature Metaverse in education and research, and when, based on the interviewees' vision, we will see a mature Metaverse.

A lack of a clear definition

When first researching the emergence of Metaverse, one is met with an abundance of terms, concepts, and definitions. Moreover, the word "Metaverse" and its loaded connotations seem to be losing popularity along with the infamous company Meta. It was our assumption, therefore, that the chosen interviewees would vary in their preferred terminology. This assumption turned out to be wrong, however, as all professionals gladly used the word "Metaverse". Agreement on the use of the word did not result in a cohesive definition of said word, however. All professionals differed in their definitions of the term "Metaverse", as well as in their opinion about defining the term in general.

Ian Biscoe, artist, designer and engineer at Eindhoven Design Academy, illustrated this well, with his statement saying: "Everybody wants to use the term 'Metaverse', and nobody knows what it means". He continued by arguing that the Metaverse will not be one clear-cut, easily definable thing – a view complementing that came from Monika Theron, innovator and ed-tech specialist at Leiden University, who stated the term Metaverse means different things for different people, and that its definition will be shaped by its level of intrusiveness in the lives of its future users.

Theron also argued that the reason we lack a clear definition of the Metaverse at this point is caused by the fact that the (potential) users of the Metaverse do not see its value yet. This echoes a sentiment shared by most interviewees; that the Metaverse is still at an infant stage and defining it now would be useless at best. Once we have figured out the purpose and benefit of the Metaverse, we will land at an attainable definition – not the other way around. At the same time, Theron pointed out an interesting aspect of the definition debate; despite the benefits of not locking in a definition just yet, it might be valuable for the development of the Metaverse if the discourse narrows down the possible definitions and concepts somewhat – for the sake of moving forward.

Nevertheless, the two other interviewees seemed more confident in defining the concept of the Metaverse. For example, Pablo Ortiz, innovation manager at ErasmusX, liberally stated that "the Metaverse is simply another layer to the reality that we have", and that the main aspect determining what a Metaverse is, is that there must be some level of interaction between platforms and users. Ortiz also claimed that he would already consider a space part of a Metaverse once it "allows users to evolve, interact, create and own content across interconnected environments". Biscoe on the other hand claimed that we are already *in* the Metaverse, pointing specifically to Fortnite as an example. In his words "just because it's not VR doesn't mean it's not immersive".

4 What is needed for a mature Metaverse?

What exactly a mature Metaverse might look like for education and research, and what it might take us to get to that point, was a key discussion point in our conversations with the professionals, and the main findings are summarised below[1]. All interviewees had different, but somewhat complementary, ideas about what are prerequisites for education and research to be immersed in a mature Metaverse.

Firstly, there was broad agreement on the point that education and research need to identify their needs before it becomes useful to delve into the Metaverse and define what is lacking. Theron was among those pointing out that there is little value in simply applying Metaverse technology to our existing education systems without a clear educational intention behind doing so or a clear idea of what the Metaverse is adding to the education system. In other words, there is a danger at this point of creating solutions for problems that don't exist, simply for the sake of (for example) gamifying education methods. Moreover, "having a clear didactical and pedagogical approach is key when creating such an immersive environment. Educational developers need to be involved and willing to adapt to this new way of teaching and learning landscape. Not to mention management" adds Theron.

Jeffrey Lemmers, educationalist at Erasmus MC, took a more positive stance, as he highlighted the fact that the gaming industry is (most of the time) far ahead of the education sector and that the sector has a lot to learn from the gaming sector in this regard. Gamifying education might just be the necessary first step to integrate the education sector in the Metaverse. Building on this, Ortiz pointed out that a hindrance the education sector should keep in mind when exploring the Metaverse today is the so-called "real-world exceptionalism". This boils down to the fact that we are all (for now) bound to the physical world, with laws and norms rooted in the physical space, and an inherent human need for physical contact as Lemmers pointed out.

The development of the Metaverse, both in general as well as in the education sector, needs to consider this if it is to materialise in a useful way. It is not "enough" to gamify education in a Metaverse – there must be some added value and intention behind it. For example, the current debate around the Metaverse in education might, as Lemmers predicts, help us re-evaluate our teaching methods more generally. The traditional lecture hall setting has once and again been proven very inefficient compared to more interactive and immersive methods, and the use of the Metaverse in the education sector might help us move towards a more interactive education space.

Overall, what the Metaverse is going to look like in an education or research setting is very much up to the sector itself, and the value and potential it sees in adapting to this new technological wave. When we see a fully mature Metaverse, the education sector might have moved beyond the need for physical spaces at all, as Ortiz implied. More likely is that the physical space will still be in place to accommodate the digital reality, in some shape or form, according to Biscoe and Lemmers.

Being intentional and reflecting on where the Metaverse can *improve* education is, in other words, key. In addition to this, the interviewees identified a few other (more specific) focus areas that

[1] *Outlining the general social and technical requirements needed to reach a so-called mature Metaverse is beyond the scope of this research.*

need to be considered if a mature Metaverse is going to be of benefit to education and research. These conditions are listed below.

Infrastructure and architecture

Schools, universities, and educational institutions will need to adapt their physical spaces and equipment for the Metaverse purposes. For example, students from low-income backgrounds will need material support to keep up with the new technological reality, and universities will likely need to provide the physical space to conduct virtual education, at least until the technology becomes mainstream enough to be common in private homes as pointed out by Biscoe.

Skills

It is also key to invest in proper training and skills development if we are to integrate the education system into the Metaverse. There are two perspectives provided for this:
1) Lemmers is among those pointing out the importance of training older, less tech-savvy generations, to ensure an inclusive and efficient transition.
2) Theron says: “I think today's generation and their work and time is still relevant today. It’s the future we need to focus on however for the Metaverse to materialise. Remember we are building this for younger generations.”

Equipment

As it looks today, the Metaverse will likely involve the use of XR headsets, and universities and educational institutions will need to adapt to this. As Lemmers pointed out, at this point in the development there is still a need to make all the various XR brands compatible with one another, and/or regulated and distributed in an organised way, for the Metaverse to function as intended and predicted in the education sphere.

Safety

Safety is another well-discussed topic when it comes to the Metaverse in general, and it is no less important in an educational setting. Everything from student data management to meeting culture needs to be carefully thought out and customised to each country’s privacy laws and regulations.

5 When will we find ourselves in a mature Metaverse for education and research?

Timeline is another hot topic in the realm of the Metaverse and is especially important to discuss in an educational setting – considering the sector's sometimes slow-moving tendencies. The interviewees varied quite a bit in their thoughts on when education and research in the Netherlands will find itself fully incorporating the Metaverse in its teaching and research.

Firstly, Ortiz pointed out that the timeline of the Metaverse development in the education sector depends completely on what we wish to achieve with it. If the goal is to have all educational institutions in the world incorporated into one large Metaverse, the timeline will be very long, and we would have to design a Metaverse that is perfectly accessible for anyone before we will be satisfied with the result. If we are happy with several smaller Metaverses of more limited scopes, however, it can be achieved with a shorter timeline in mind. Ortiz went on to deliberate on whether it might be a good idea to "think small" first and repeated that a precise timeline is near impossible to construct, as we are still lacking a clear definition of what it means to have a "mature Metaverse" in the first place.

Lemmers brought up an important point when he emphasised the fact that entire education systems need to move together to see a functional and mature Metaverse in the sector – not one institution at a time. With such large-scale technological developments that the Metaverse brings with it, it can't happen without widespread governmental support and widespread sector interest/pressure. Theron chimed in with the statement that "it can happen tomorrow or ten years from now, it all depends on who is blocking you". Only when we have the necessary policies, finances, and norms in place will we see a mature Metaverse at use in education and research. According to Lemmers, it is realistic to assume a mature Metaverse will be seen in the education sphere in anything from six to ten years from now, as education is typically around three years behind the gaming industry.

In conclusion, it is very difficult to imagine a clear timeline for when the education sector will be immersed in a mature Metaverse. What it is relatively safe to say is that it will happen once the Metaverse has reached a point of its development where it is, in Biscoe's words, "a net positive contributor to our quality of life and education". According to Theron, this means we will know the Metaverse has reached a point of maturity when it gives us a high-quality experience, a good reason to be there, the flexibility to choose what we see, hear and feel in the space, and the flexibility to choose what and who we are in the space. Finally, Lemmers provided a thought-provoking perspective, when he emphasised that the Netherlands is far behind the rest of the world when it comes to the Metaverse development in general and that now is the time to step up and get to the forefront of this new wave of technology. If the Netherlands doesn't do it, someone else most certainly will.

Appendix: Sources

Source	Title
FORBES	"Recognizing The Technological Revolution And Preparing For The 'Next Economy'"
Copenhagen Institute for Future Studies	"The Metaverse: Dive into the possible futures of the Metaverse & the Spatial Internet."
Techopedia	"Cyberspace: What does cyberspace mean?"
Digital Communications and Networks	"A new technology perspective of the Metaverse: Its essence, framework and challenges"
PEW Research Center	"Expert essays on metaverse possibilities"
IBM	"What is a digital twin?"
Techopedia	"Virtual World: What does virtual world mean?"
European Commission	"Virtual worlds (metaverses) – a vision for openness, safety and respect"
Politico	"Europe's agenda for… Not the Metaverse"
PEW Research Center	"The Metaverse in 2040"
Wired	"Mark Zuckerberg's Metaverse already sucks"
FORBES	"The Important Difference Between Web3 And The Metaverse"
Blockchain Council	"Web 3.0 Vs. Metaverse: A Detailed Comparison"
European Commission	"Towards the next technological transition: Commission presents EU strategy to lead on Web 4.0 and virtual worlds"
Matthew Ball	"Framework for the Metaverse"
PEW Research Centre	"The metaverse will not fully emerge as its advocates predict"
More than digital	"History and evolution of the metaverse concept"
TechTarget	"What is the metaverse? An explanation and in-depth guide"
SeekingAlpha	"What is the Metaverse? Its meaning and what you should know"