XR
IN EDUCATION

SURF

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WELCOME TO THE WORLD OF XR EDUCATION

Enthusiastic users, added value for education, many wonderful projects and a future full of promises. The use of XR in education is flourishing.

SURF noticed this during its implementation of the Open and Online Education Incentive Scheme on behalf of the Dutch Ministry of Education, Culture and Science. This scheme enables research universities and universities of applied sciences to experiment with different forms of online education and the sharing and reuse of Open Educational Resources. The final cycle of the scheme started in 2022. During this cycle, it became apparent that more than half of the projects were devoted to XR. In previous subsidy cycles, there were only a few projects.

Project leaders who started XR projects in 2022 are facing various issues, such as: how can I get colleagues excited about XR? How do I move from experiment to scale-up? How do I make sure the content is easy to share with others? Similar experience was gained in the Acceleration Plan for Educational Innovation with ICT in 2020–2022. We have collected various examples of XR in education. Here, too, we saw some great experiments, but equally many questions.

To go deeper into these questions, we organised a "pressure cooker session" at the end of 2022, in which we asked leaders in education about solutions, needs and opportunities. We developed the information we gathered and present it in this issue.

What is striking is the overwhelming enthusiasm of the people who are now working on XR in education. XR offers new opportunities and added value for education, and this issue reflects that. We also look at the various XR challenges that still lie ahead.

The issue is tailored to the developments that are to come. We hope we can work on these challenges together with the institutions, specifically as part of projects currently running under the Incentive Scheme.

Annette Peet en Sjieuwke Dankert
Project Managers Open and Online Education Incentive Scheme, SURF

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EXPERTS HAVE THEIR SAY

In this edition, we listen to students about their views on XR and we highlight various XR applications from a large and growing range. The stories in this edition have been created based on interviews with these individuals.

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Student Design for Interaction, TU Delft.

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John Walker
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WHAT IS XR AND WHAT CAN IT DO?

XR, or 'eXtended Reality' is both a technology in its own right as well as a term used for a combination of other reality altering technologies; combinations of virtual reality, augmented reality and mixed reality could all constitute XR.

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VR creates a fully computer-generated environment that replaces the real world. AR adds digital information or virtual objects to the physical world. MR goes one step further than AR by adding interaction between the user and virtual elements, which should be as natural as possible.

XR can be a great way to create special learning experiences for students. For example, VR simulations can give students access to environments that are difficult or inaccessible in real life. VR simulations offer students very practical training and practice opportunities in real-life conditions without any real pressure, risk or danger. These exercises can also be repeated indefinitely from any location and at any time.

Deep in the ocean

According to Arno Freeke, Coordinator of the VR Lab at Delft University of Technology, XR in education is primarily about enriching the learning environment and creating an experience that students cannot have in real life. "For example, you go into the heart of a nuclear power plant, deep into the ocean, high in the atmosphere or down to

a molecular level." The credo of Gert-Jan Verheij, Team Lead Visualisation at RUG, is that you should only use XR if it allows you to do something that is otherwise impossible, because only then does it become viable. "Don't do it just because you think XR is fun and it's new. That fun aspect will only work a few times. After that, the novelty will wear off. Nevertheless, I hear many people say they like VR and also want a headset. Look before you leap is what I say."

> *"You go into the heart of a nuclear power plant or down to a molecular level."*

AI generated image

A few hundred euros

According to SURF visualisation experts Paul Melis and Casper van Leeuwen, the technology has now reached the point where it can do a lot of cool things. "A few hundred euros get you a device you can use to play games and use educational apps with interaction and good image quality. Gaming engines, which is the software used to develop games, are widely used for content creation. This makes it relatively easy to create your own content, such as a virtual 3D environment."

"Students are often open to exciting things in a virtual world."

Toxic substances

John Walker (SURF) also finds it important to take into account the fact that students are often open to exciting things in a virtual world. "Throwing things, jumping off a cliff and mixing poisonous substances in a lab – they'll be doing it all. Because it's both fun and safe. For students, VR is also an excellent way to give them the opportunity and space to fail. You shouldn't underestimate this, because it will help them to find answers and solutions far more quickly." According to Walker, the fun element is very much in line with the playfulness of XR and the room it offers to explore and discover new things. "At the same time, this is about education, which is also a serious matter. Educational tools need more than just shiny packaging."

Read more about eXtended Reality

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Educational Practice

- The power of XR

- Translate your education from real to virtual life

- Scaling up requires work on the front and back end

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THE POWER OF XR

XR is becoming increasingly integrated into education, even though its adoption is still in its infancy. More and more training programmes are looking to incorporate XR. We assessed all the aspects for this special edition and asked one central question: "What is XR's strength and added value for education in practice?"

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A second life

Gert-Jan Verheij (RUG) enjoys coming up with new educational concepts and using technology to take things one step further. "In the Virtual Kindergarten, a student with a VR headset sits in a circle of twenty children who regularly crawl under a chair, stand up and walk away. It's a good exercise to practice staying in control of the situation. The Virtual Kindergarten gives students several lives – to use a gaming term. If your first lesson ends in classroom chaos, you simply get to start over. In real life, it is quite hard to correct a poor first impression. That's not an issue in VR."

Drug lab

Students at the Dutch Police Academy urgently need to train in authentic settings, states Giny Verschoor, who works as a Product Owner Knowledge & Research and Virtual Training. "They spend a lot of the first nine months of the training programme at the academy with very little practice in the field. But of course they also want to use their skills. The great advantage of VR is that they can suddenly find themselves in a drug lab or at a crime scene.
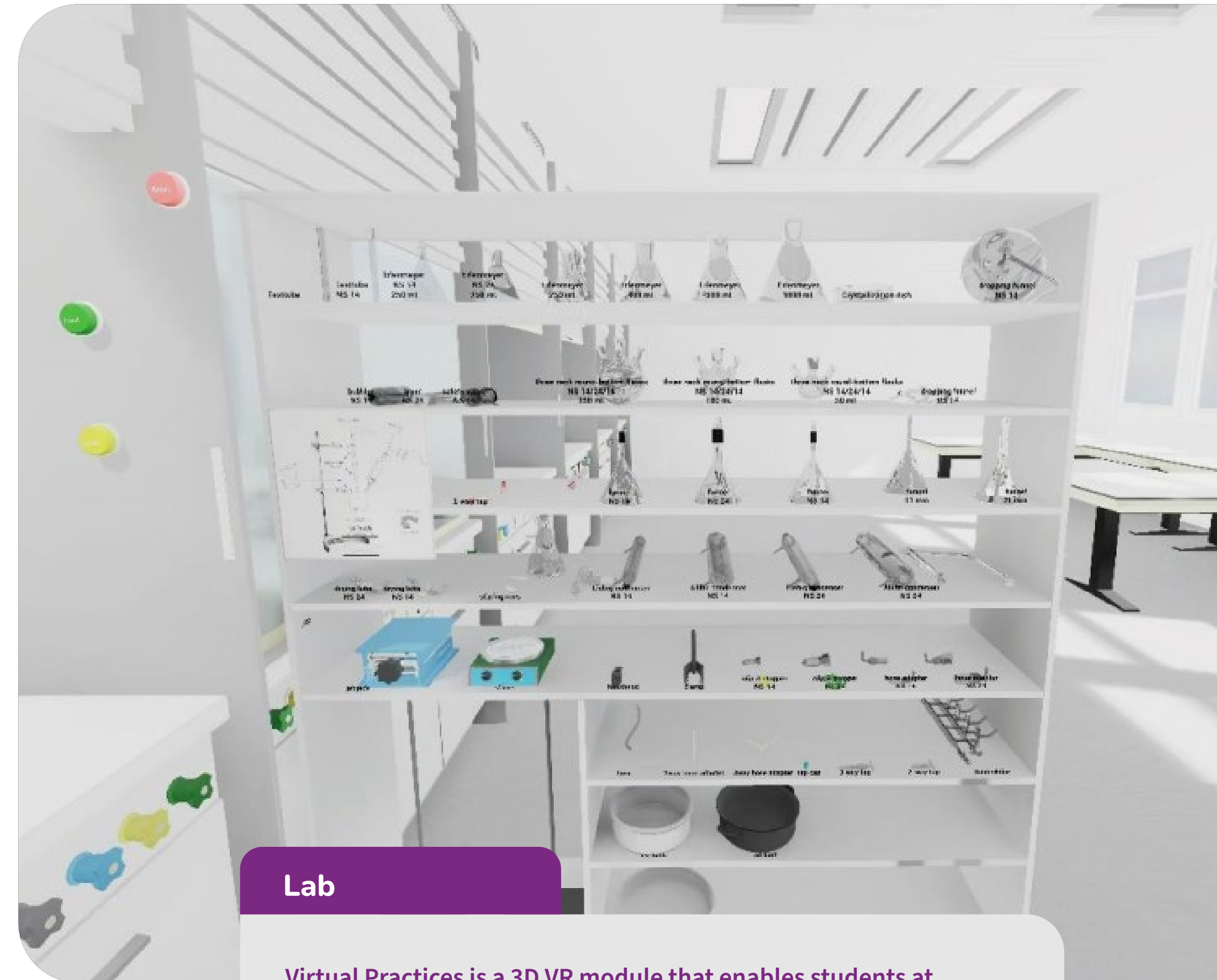
Lab

Virtual Practices is a 3D VR module that enables students at RUG and WUR to practice complex laboratory skills in a safe and realistic environment. This makes students better prepared to enter a physical lab or practice room with greater confidence.

Students like this, and the level of interaction also makes the teaching content stick in their minds." In her opinion, feedback plays an important role here. The Vrange VR module, for example, enables students to prepare for a firearms competency test. "It's not about teaching students how to be a better shot. Above all, it gives them confidence and knowledge about the rules and safety measures before they enter an actual shooting range for their first lesson. In essence, VR makes education more efficient. It also makes things easier for the lecturer, who can get straight to the point at the shooting range."

"Before students go into the field, they can practise their conversation techniques endlessly with Max, our virtual client."

A safe exercise environment

HAN Drama Therapy Lecturer Astrid Timman can see the tremendous benefits VR offers to her students. "Before they go into the field, they can practice their conversation techniques endlessly with Max, our virtual client." Professor of Biobased Chemistry and Technology Harry Bitter (WUR) is pleased that modern techniques enable him to add something

new to the regular image people have of a person in a white coat doing experiments in a lab. "Students can practice freely in a virtual lab. It doesn't matter if glass falls on the ground or if the entire thing explodes. I like the fact that we can offer students a safe training environment so they are better prepared for the real lab."

"A virtual simulation can be a trigger to develop more empathy."

Developing empathy

John Walker (SURF) says not much is known about the impact technology and XR have on (professional) relationships. However, it's a well known fact that XR can add value to therapeutic sessions. "For example, a perpetrator can experience what it is like to be in a victims role. This is useful in cases of bullying and misogynistic or racist behaviour. A virtual simulation may be a trigger to develop more empathy."

Credible

One XR success factor that should not be underestimated is that the virtual environment you create must be as credible as possible. "That's very important. As a student, do you really feel like you're in a nuclear power plant or at a shipyard? Every detail has to be just right," Arno Freeke (TU Delft) says. Verchoor agrees wholeheartedly. "Although we don't have the money to build an almost perfect virtual world as in Call of Duty, we have to make sure the details in our VR modules are right: a weapon, uniform or police car, for example. If this is not the case, it will put off both the lecturers and students. You should also ask yourselves how realistic you want to be and what you want to expose your students to. One example is thinking about how you want to deal with death in the VR module."

Less of a practical burden

XR's added value in education ultimately pays off in practice. According to Maurice Magnée of HAN, the first step in DUTCH*'s ambitious plan is to replace half the current practical training hours of surgical assistants, anaesthetic technicians and radiodiagnostic lab technicians with physical and/or virtual simulations. Step two is to scale this up to other healthcare professionals. "This reduces

the practical burden significantly, which is a good thing given the enormous workload and lack of work placements in the care sector. The importance of VR is increasing anyway because of more and more digitalisation in healthcare."

How cool is this?

This added value for educational practice is also accompanied by a real wow factor. "Once employees have put on their headset or glasses and experienced what VR is and can be, they'll be sold on the idea," Freeke says . Verschoor confirms this. "We now have hundreds of people working with VR, and almost everyone thinks: "Wow, how cool is this?" If there is any criticism, it is usually about the content: is that shooting position correct?"

*DUTCH (Digital United Training Concepts for Healthcare) is a collective of University Medical Centres, educational institutions, top clinical and general hospitals, (technical) universities and public and private third parties in the field of educational and medical technology. DUTCH aims to transform the education, further training and reskillling trajectories of healthcare professionals with scalable digital learning resources and physical and virtual simulation.

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student speaking

Getting started with a virtual client

"I got involved with VR thanks to Astrid Timman, one of my lecturers at HAN. She started to create a virtual client and I had the opportunity to help. We had extensive brainstorming sessions on what such a client should be able to do and what students needed to be able to practice. When our virtual client Max arrived, we tested it thoroughly.

When we started the project, I was curious but also a little sceptical. Would a virtual client really work? Sometimes it seemed a bit ambitious. My doubts disappeared when Max arrived and I got to practise with him myself. I was very impressed. Later I helped Astrid with her research into the effect of VR in various training courses. As far as I'm concerned, practising in VR is fun, interesting, safe and a very good way to prepare for real life."

Clair Dikken is currently studying Psychology at Radboud University and already has a Drama Therapy qualification from HAN

TRANSLATE YOUR EDUCATION FROM REAL TO VIRTUAL LIFE

There are several things to consider when working with XR in the educational field. One important issue is how to translate your education programme into an XR application and who to involve in this endeavour.

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Astrid Timman (HAN) has worked as a therapist for many years. "I'm actually still doing what I used to do: I come up with situations and scenarios for people so they can practice what is difficult for them. I used to do this in real life. Now I do it in a virtual world. The switch to VR was a minor step for me."

> *"We want to come up with situations and scenarios for people so they can practice what they find difficult."*

The same path

As a drama therapy lecturer at HAN, Timman follows the same path for the development of her VR education as for regular education. "You first determine your final qualifications. Then you translate those into learning outcomes, assessment forms and learning situations. Then you look at the technical possibilities, what you want to measure, what story and words you want to use, what the feedback options are and what effect you want to have."

Root canals

Radboud UMC has developed an XR tool that can be used in various training courses. The Dentistry department has a VR module that enables students to understand and practice treating root canals in 3D models.

Trajectories that are nice and challenging

Devising and developing XR concepts and modules for education calls for programmers, developers, educationalists, lecturers and preferably also students to work together. "These are nice but often challenging development trajectories. This is because you always have to deliver custom work. This requires a lot of manpower and skills in terms of programming and all kinds of graphics. At RUG, the visualisation team working on XR consists of six people," states Gert-Jan Verheij.

Having the opportunity and permission to fail

John Walker (SURF) says it is very valuable when students themselves contribute to the development of applications through co-creation. "After all, they are the ones who will be using the applications and they are in a perfect position to clearly indicate the most important success and fun factors. For students, VR is also an excellent way to give them the opportunity and space to fail. You shouldn't underestimate this, because it will help them to find answers and solutions far more quickly."

Commitment and motivation

Arno Freeke (Delft University of Technology) also stresses the importance of co-creation. "Students are very important to us. Our lab emerged from their assistance and pioneering contributions. They can truly achieve a great deal. And, fortunately, some have decided to stick around. We offer students an optional course in which they design a virtual world." Timman also actively involves her students in the development of VR modules. "I always leave a lot of initiative with the students. That is also in line with my educational vision: to be at the forefront of things and create education together. That also leads to more commitment and motivation among students."

"It is very valuable when students themselves contribute to the development of applications through co-creation."

A detailed scenario

Timman also collaborates a lot with her students when it comes to storytelling. "For the development of our VR module to practise conversational techniques with clients, I asked students to play out all kinds of situations. We filmed them all and then started to develop the scenario for Max, our virtual client. We elaborate on these scenarios in great detail. As a student, there's a lot to pay attention to in such conversations. What do you say and what don't you say? When do you say something and in what tone? How do you respond to non-verbal signs and are you following the right steps? These are all things students can earn marks for. In other words, a good story and a comprehensive script are very important."

Burns

Medicine and Nursing students at Radboud UMC can use an AR – module to look at burn victims from all sides, assess their burns and practise treating them. A 3D model with photos of previous cases is used for this.

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"Sometimes it is a classic script and sometimes it is a process description."

From script to process description

As far as storytelling is concerned, Freeke adds that for XR, one picture is sometimes worth a thousand words. "These pictures are often the story. That's not all, of course. For example, does the student understand how the controls work and exactly what they need to do in a task? The storyline can be very different from one application to the next. Sometimes it's a classic script and sometimes it's a process description. And the educational philosophy, didactics and learning objective are increasingly becoming part of the story now."

Didactic and psychological aspects

Walker believes simulations can be further improved and broadened by paying more attention to storytelling. "We can do this with engaging and inspiring stories and by focusing more on the didactic and psychological aspects as well. This will hopefully also give the arts and humanities a place in the metaverse."

student speaking

Less stress, more confidence

"I am involved in courses in which students practice arguing their case with the PleitVRij app. I take care of all kinds of things, make sure everything runs smoothly in terms of organisation, and help the students. It started out as an ordinary student job, but now I really enjoy it. I have always been interested in technology, so that is a factor, too. The app now has a new courtroom. It is a very realistic simulation of the real courtroom in Groningen. It's very hard to see the difference with the real thing.

It is a great exercise for students to experience the courtroom in VR before they go out into the real world. It makes the experience less stressful and gives them more confidence. Education with VR is exciting and certain to become much bigger in the future. When students put on their headset for the first time, they always need a little while to get used to it, but then they all enjoy it."

Julia Pasman is doing a master's degree in IT Law at RUG

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Court

Law students at RUG, VU and UU practise arguing their case in the PleitVRij VR module. The students get to practise together at a hearing in a virtual courtroom and give each other real-time feedback with a specially developed app.

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SCALING UP REQUIRES WORK ON THE FRONT AND BACK END

Despite several successful sales strategies (see the story 'Headset, roadshow and vision'), XR still plays rather a modest role in education. For the time being, there are a lot of small projects and pilots involving small groups of students. At present, there is virtually no talk about scaling up to large groups. However, that is exactly what Maurice Magnée of HAN wants to do in the new academic year. "Our ambition is to have 500 nursing students complete a VR training programme as part of their first-year teaching module. It's a challenge, but I'm confident it will work."

> *"We want 500 nursing students to do a VR training programme."*

AI generated image

One of the XR challenges for the next few years is to scale up education to larger groups of students. Maurice Magnée of HAN is only too happy to take on that challenge.

Low literacy

HAN has a VR module based on the topic of low literacy. It allows students and lecturers of different courses to practice discussing this topic with their clients and patients.

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Complex subject

According to Magnée, there are several reasons why things have not yet been scaled up. "When it comes to scaling up VR, there are quite a few obstacles. First of all, there is the physical side of things: 500 headsets, for example, are quite expensive. If you have them, you're not there yet. Because all applications need to be installed on the right headsets. And these headsets also need to be managed, kept up to date and properly covered in a legal sense. It's all pretty complex."

> *"It would be great if we had an education-related VR app store in the future."*

App store and operating system

According to Magnée, there are scale-up challenges both at the front and back ends. "The front end is about making the VR apps easy to find and accessible to lecturers and students. It would be great if we had an education-related VR app store in the future. The back end is mainly about having a well-organised operating system for all applications. For example, the technical management and logistics of the headsets are very labour-intensive, particularly when it comes to 500 headsets. It's *one hell of a job*."

Anatomy on Monday

"I would like to see a system that allows you to program 10 or 20 headsets for the anatomy module on Monday at the touch of a button and a module of conversation techniques on Thursday. Right now, you need to log in separately and each time again for each app. It would be great if we could also have a kind of Eduroam for XR in the future so you can log in with a single password anywhere in the world and access all applications securely, regardless of the type or brand of VR headset you are using."

Preschoolers

The Virtual Kindergarten Class of RUG enables students of its primary school teacher training course to practise class management strategies based on different classroom scenarios. For example, they present disruptive situations to students so they can practice and try out various scientific class management theories.

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Start with XR

- Headset, roadshow and vision

- The successes and challenges of XR

AI generated image

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HEADSET, ROADSHOW AND VISION

You can still have some excellent plans to enrich your education with XR, but it is also very important to be able to sell those plans to others. And this goes well beyond a presentation or video. You should let people experience what XR is for themselves. When they do that, they will very likely be sold on it afterwards.

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When it comes to selling, the Dutch Police Academy is a particularly inspiring example. According to Knowledge & Research and Virtual Training Product Owner Giny Verschoor, the Policy Academy has always been involved in innovative education and digital learning. When a new type of basic training arrived, they wanted to take the next step. And it was widely embraced almost immediately.

Digital investigation

The Dutch Police Academy's basic training programme was reduced from three years to two. This is partly due to the need for more police officers on the street and the growth of digital investigating. "It was a good time for us to develop new learning paths and modules using VR." The VR modules in the new basic training programme have been set up, developed and implemented over two years.

Experience

"We rolled everything out and ensured a good transition with a roadshow to all nine Dutch Police Academy locations. It wasn't a question of providing some headsets and letting people do their thing. We showed everyone everything. Above all, we let them experience what VR is and what it can do in great detail."

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Enthusiasm

At the beginning of the entire process, we did the same thing with the police academy's management. According to Verschoor, this immediately generated enthusiasm and commitment. "When you want to sell your VR education plans, don't just do it with a presentation or video. VR only truly comes to life when you put on that headset."

Roadmap

A roadshow was not just a success for the police. Casper van Leeuwen and Paul Melis took 'XR on Tour' on the road to research universities and universities of applied sciences on behalf of SURF. "It was a great, interactive way to network and introduce participants to the possibilities with demos and conversations." XR on Tour led to a lively exchange of experiences, insights and future plans. SIG Virtuality also developed a handy roadmap (Dutch only).

Campaign

VR Lab Coordinator Arno Freeke and his people also went out on the road in Delft to announce the happy XR message. "For our awareness campaign, we took our PC everywhere to show a lot of people what you

can do with XR." Thanks to this campaign and the support from the executive board, more and more people are finding their way to the VR Zone of Freeke and his team. "We are also convinced that once employees have put a VR headset on, they will be sold on the idea."

Vision and business case

The development of the new VR-based learning routes and modules are always guided by the vision of the Dutch Police Academy: a VR module in education is learning and training without being restricted to a specific time or location in an authentic context. According to Verschoor, it is extremely important to develop your own vision at all times. "Ours emerged in around one day. It is rock-solid and acts as an excellent reference framework for everything we do in the field of VR. We also always make sure you have a good business case."

> *"Our vision emerged in around one day. It is rock-solid and acts as an excellent reference framework for everything we do."*

student speaking

Practising one-to-one conversations in a safe environment

"The first time I came into contact with VR was in a lecture that paid specific attention to the subject. That aroused my interest. I think Speech-Language Pathology studies are sometimes a little too limited, and I believe a VR module can be a very valuable addition. We already use VR apps, but they are not specifically aimed at Speech-Language Pathology. We have an app with a virtual client, an app that deals with dementia and an app that focuses on low literacy.

It's great to experience them and practice with them. However, these apps are aimed at clinicians rather than clients or patients. For me, it would be just as interesting to have apps for them. One example would be an app for people who stutter, so they can practice having a one-to-one conversation or giving a presentation to a large group in a safe environment as much as they want. VR has many more possibilities and I would like to contribute to this. AI would be a good way to do this. I am now also taking courses on the subject at Radboud University."

Yrsa Niels studies Speech-Language Pathology at HAN

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THE SUCCESSES AND CHALLENGES OF XR

XR can be a good way to create special learning experiences for students and provide practical training opportunities under lifelike conditions and situations without any real pressure, risk or danger. The European Commission's 2023 report 'Extended reality: opportunities, success stories and challenges in health and education' describes the current state of affairs and assesses the strengths and weaknesses of the use of XR in both sectors.

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98% of respondents believe XR will make a significant contribution to the development of their sectors in the next five years. Below is a summary of the most important findings.

The successes

- XR can be used to train students in healthcare. The simulation of emergencies and operations as well as interaction opportunities with the human anatomy in 3D equip students to deal with real medical situations in a better way.

- XR expands creative possibilities in art and design. Students can create and explore clothes, architectural designs or paintings in a virtual environment.

- XR can be used to train soft skills such as effective communication, critical thinking, problem solving and teamwork.

- XR offers students with physical disabilities or health problems the opportunity to collaborate and virtually participate in learning processes in a safe environment without any health risks or the need to be physically present.

- XR can be used to make students aware of important social issues such as the environment and discrimination.

- XR can ensure a smoother, more effective learning process and offers plenty of opportunities for interaction to increase the students' engagement and motivation.

- XR helps to analyse test results and increases the accuracy of diagnosis. Illnesses can be detected more easily and more accurately in 3D using XR.

- Organisations can use XR for cost-effective training. XR is currently providing safer, more effective further training in aviation, the maritime industry, the armed forces and security services.

The challenges

- Awareness and acceptance of XR remains low. Training courses for lecturers and guidelines for integrating XR into training courses can change this.

- Private investors in the EU are often reluctant to finance XR solutions. A European venture capital fund for investments in XR companies in the education sector can make investing attractive.

- XR does not always provide independent or inclusive access. Accessibility requirements and guidelines in European XR research projects are required to change this.

- There is a lack of skilled professionals, especially designers and developers. This requires a plan for further XR training and education and more funding for XR-related education programmes and topics at all levels of higher education.

- More projects are needed to investigate the potential negative impacts and ethical considerations related to the use of XR. The results can be used to develop concrete recommendations for EU policies, for instance.

- Further research is needed in areas such as sensory enlargement and neurophysiological changes, human and avatar relationships, the integration of XR with AI and data protection issues.

- Certain types of XR experiences collect and use large amounts of (personal) data, which is associated with ethical and privacy-related risks. Guidelines should be developed on the procedures to be followed when testing, developing, distributing and applying solutions with new technologies.

student speaking

The possibilities are endless

"My bachelor degree included modelling. I loved doing that, but I soon wanted to do more than just create 2D graphics. I was looking for a student job at the time and saw a vacancy for a virtual reality assistant at what is now the XR Zone . That's how I got involved. The great thing about VR is that you can quite easily build a great environment that is very realistic. There are no restrictions and you don't have to spend a lot of money on physical parts. My dissertation will also be about VR.

I now work at the XR Zone a lot, as it is attracting more and more employees and students. I think XR will play an increasingly important role in education. The possibilities are endless. Architects are already creating complete virtual buildings they can walk through with potential customers and clients. It is also very useful in civil engineering. It's the only way forward, really."

Bas Ammerlaan is doing a master's degree in Design for Interaction at TU Delft

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Aircraft

Aviation Services students at Deltion College practise how to deal with an aircraft fire in a VR module. Students have evaluted the module, which was developed in collaboration with KLM, as very realistic and safe. It offers an environment in which they can make mistakes and learn from them.

Cooperation

- Customisation, speed and Europe

AI generated image

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CUSTOMISATION, SPEED AND EUROPE

At first glance, it seems entirely logical that we should collaborate in terms of XR in education. There are considerable challenges, the work is intensive, the human resources are limited and the need for new applications and uses is steadily increasing. However, collaboration is far from self-evident.

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This is true within our education institutions themselves and on a national and international level. It is rarely a question of unwillingness, but rather a fear of the unknown or simply a lack of time and resources. What's great is that the collaboration that does exist already is genuinely paying off and encouraging others to do the same.

State of mind

"Collaboration is very natural for us, because we are developing open source. It also has to do with a certain state of mind. We strongly believe in the benefits of sharing, especially in the long term," says Arno Freeke (TU Delft). Gert-Jan Verheij (RUG) agrees. "In terms of VR, it's also great when you can build on someone else's work. That is the case with the Virtual Kindergarten Class. I was made aware of a class management app that had been developed in Germany. Our colleagues there didn't mind giving us the source code and framework."

Clear arrangements

Giny Verschoor also believes in the strength and added value of collaboration. "The Dutch Police Academy has always been working on innovative education and digital learning. In the past, we did this in collaboration with students from Windesheim University of Applied Sciences, for example.

Campus

Spacial Sciences students at RUG can design their ideal Zernike Campus in Mercator City. They adapt roads, remove old buildings, construct new buildings and improve the safety of the community without placing a single shovel in the ground.

We have now asked Utrecht University to research whether education with VR has more of an effect than regular education. When working with commercial parties, it is also very important to make clear arrangements about things such as licences and source codes. We have learned in that regard."

> *"We strongly believe in the benefits of sharing."*

Encouraged and supported

Working on XR is challenging. It requires customisation and you need people with sufficient knowledge and experience. According to Verheij, it is also important to work together and develop applications you can share with each other. "At PleitVRrij, we have done this with Utrecht University and the Vrije Universiteit. If you collaborate with other institutions, it is particularly important that you are on the same page and your organisation encourages and supports you in terms of both content and governance."

Big Lego box

Harry Bitter (WUR) investigates with fellow institutions whether the virtual exercise lab can be further expanded on. "The app is available to everyone, so that's not the challenge. The challenge is that everyone wants something different. I like to compare it to Lego. We now have the right blocks to make a car, where the car stands for one particular test. But people also want to be able to do other tests. They may want to build a boat or plane." Bitter's ultimately goal is to have a big Lego box with all sorts of different blocks that make multiple tests possible. "But who will design, build, fill, manage, maintain and update this box? Who will ensure all the equipment is up to date and available? It's best to have all this organised centrally, such as by SURF or a commercial party."

Connecting virtual worlds

Collaboration is certainly very important for technology such as XR, Gül Akcaova (SURF) says. "Many challenges await us in all kinds of areas, such as organisation, technology, purchasing, data, privacy, and laws and regulations." One of the challenges is to connect the different virtual worlds. "When you put on a VR headset in Amsterdam, can you take part in a session in Eindhoven or Groningen? If many students go online at the same time, the question is whether the network can handle this. We really need to take a serious look at that together."

Monitoring and Security

The Safety Academy Noordwest Veluwe (VANWV), part of Landstede MBO in Harderwijk, has developed various XR scenarios for intermediate vocational education, which are embedded in the curriculum of the various MBO Safety training courses. In one of the VR scenarios the 'Enforcer, Supervision and Safety' student trains the 'sanctioning action' protocol in various contexts and performs the associated actions. At the end of the scenario, the student sees their score and receives feedback on their performance.

Students from the 'Security' course practice skills in the VR scenario 'Fire and closing round'. The VR scenario 'Checkpoint' teaches students from the Safety and Workmanship specialisation to perform a checkpoint with the aim to remain calm and efficient while they are under pressure. The VANWV seeks cooperation with the other ROCs and the industry to jointly continue this de-velopment.

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European parties

XR ERA is an open, independent and international platform. The platform facilitates connections between people from higher education, research, industry and other fields at European level. This allows them to share resources and knowledge to create better XR experiences with a lasting impact. "An important reason for establishing XR ERA is Europe's increasing role in XR subsidies. In order to be eligible, you need to join forces with several European parties. In addition, we are collaborating more and more with parties outside Europe, such as the University of Michigan," Thomas Ginn of Leiden University adds.

Who is doing what at what level

Although the exchange of experiences, ideas and concepts is improving, Ginn believes it still doesn't happen enough. "It's still difficult to get a good idea of who is doing what at what level: in the Netherlands, internationally, and sometimes also within one's own institution. For example, I once found out that two faculties were working on exactly the same thing independently of each other. That's a waste of resources and should be avoided.

Stay strong

According to Paul Melis and Casper van Leeuwen (SURF), collaboration is also necessary to stay strong together. "We are very dependent on what the big tech players are developing. They have a lot of money to take major steps and flirt with many risks. Although we talk to them from time to time, we unfortunately have no influence on their roadmap. For them, education is only a small piece of the pie." This is another reason why they think it's great when education institutions in the Netherlands become even more closely connected. "On a technical level, we encourage this with the XR Developer Network."

Conversation

HAN has a VR module that allows students in healthcare and social programmes to practice motivational communication. The tool mainly focuses on basic conversation techniques, such as asking the right questions, knowing what phase patients are in, matching that phase and practising extensively.

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New way of training

Innovation in Care lecturer (HAN) Maurice Magnée is also an advocate for collaboration. "If every institution creates its own interface and modules, this takes a lot of time and money. If we work together, we can accelerate things considerably and save money in the long run." One of the places this type of collaboration is taking place is <u>DUTCH</u> (Digital United Training Concepts for Healthcare), a collective of University Medical Centres, educational institutions, top clinical and general hospitals, (technical) universities and public and private third parties in the field of educational and medical technology. "<u>DUTCH</u> aims to transform the education, further training and reskillling trajectories of healthcare professionals with scalable digital learning resources and physical and virtual simulation. It's a new way of training in the care sector."

> *"It is a new way of training in the care sector."*

Future issues

Educational Innovation Advisor Esther van der Linde (SURF) also believes it is important to strike a good balance between the problems of everyday life

and future issues. Both the low-hanging and high-hanging fruit deserve attention. "XR and technology developments are moving very quickly, so it is important to stay up to date, not least in relation to all the Big Tech plans and moves.

Data administration

According to Van der Linde, the hardware that Big Tech companies supply, the security and management of data, the headsets that are required and the necessary creative and technical people behind everything all require attention and solutions on a daily basis. "You have to tackle this together as much as possible. That is why SURF has organised XR on Tour and is facilitating networks such as SIG Virtuality and the <u>XR Developer Network</u>. At the same time, we need to focus on the future. The proper way to do this is based on an overarching question: What virtual environment are we creating together and do we want our students to use it in the near future?"

> *"Both the low-hanging and high-hanging fruit deserve our attention."*

Networks and communities

SURF is a cooperative. Collaboration is a logical part of the process, including when it comes to XR. Here are three examples.

• **SIG Virtuality**
<u>SIG Virtuality</u> aims to inspire its members and bring together the supply and demand among people as well as expertise for serious gaming, simulations and virtual world projects. SIG Virtuality is a community of representatives from education, government and industry

•**XR Developer Network**
The aim of the XR Developer Network is to bring together everyone who is working on XR for SURF member institutions with a technological focus, so that they can learn from each other, inspire each other, overcome technological challenges and further develop XR.

•**Learning practical skills with technology**
The community <u>Learning practice skills with technology</u> was established by the Acceleration Plan working group Digital Education in Practice Skills (DOiP). The community wants to facilitate connection and exchange between lecturers, researchers and supporters to achieve effective digital skills education.

Ethics

- The importance of data security should not be underestimated

AI generated image

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THE IMPORTANCE OF DATA SECURITY SHOULD NOT BE UNDERESTIMATED

XR in education is not just about new techniques, the most modern devices and added value in education; it is also about values and ethics.

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For example, how does XR affect the way education is organised and students' experiences? And how inclusive and secure is XR? John Walker (SURF) and Thomas Ginn (UL) deal with the ethical side of XR. According to them, there is still some room for improvement in this regard.

User-friendly but scary

According to Ginn, there is a world of difference between public education institutions and the Big Tech market when it comes to XR, data and privacy. "We are rightly concerned about matters such as security and privacy, while the Big Tech lobby focuses on possibilities and opportunities, including towards the government." A good example is the free VR headsets that Big Tech companies regularly provide to education institutions. This is a nice gesture, but there is no such thing as a free lunch. "A simple VR headset can use 95 measuring points to build a unique and recognisable profile of a student in three minutes. This means, for example, that it will recognise the student the next time they use the headset, meaning they no longer need to log in. This may be highly user-friendly, but it is also rather scary. Incidentally, this is already technically possible, but it is not yet an option for users," says Ginn.

Drowning in data

Your profile and all your behaviour will be recorded and stored. Where does that data go and who can access it? Walker believes the importance of data security should not be underestimated. "We will soon be drowning in it, because everything will be stored. How you walk, how you talk, what your facial expression is – you name it. You need to protect yourself by making very clear arrangements with these companies." In any case, Ginn often worries about the influence of the Big Tech players. "For instance, when small companies come up with interesting innovations, they are often swiftly snapped up by one of the Big Tech companies. That company then determines whether or not the innovation will become available. In doing so, it also largely determines how institutions can shape and organise their education in the field of XR. Fortunately, open source companies are challenging Big Tech dominance."

Pharmacy

Pharmacy assistant students at Deltion College use a VR module to train their practical skills. The students get to work in a virtual pharmacy. As a result, they can integrate into the real environment more quickly when they start their work placement.

Scary movie

Ginn and Walker are both interested in what happens to students when they spend a lot of time in a virtual world. "Little is known about the effect of avatars or fierce and violent virtual worlds. They may cause students to develop differently, possibly even exhibit riskier behaviour or face psychological problems. You need to be careful with these things." They are inviting, but should not be too intense. According to Walker, this is a good starting point for using VR in education. "Think of VR as a kind of scary movie you show in the classroom. As a lecturer, you need to ask whether each student can handle it. What does it mean for them?"

"We will soon be drowning in data, because everything will be stored."

Citizens of the future

In the coming years, VR and headsets will undoubtedly play an increasingly important role in education. According to Walker, this will have an effect on the students. "They may appreciate the virtual world more than the real world and become lost in their imagination." When regularly confronted with things like weapons, racism and violence in the virtual world, Walker believes this may affect how students see and experience the real world. "They will probably deal with reality differently and in new ways. This can have a major impact on the choices they make, for example in a political sense. Through VR, we will shape students as well as our citizens of the future."

"An ethics committee can play an important role."

European level

Ginn believes an ethics committee can play an important role in terms of values and ethics. "The great thing is that universities already have experience with ethics committees in their research. It would be good to include digital education in that too." SURF could take a cross-institutional approach in the Netherlands, but Ginn thinks taking things to a European level is even better. "This is very much in line with Europe's current serious efforts with regard to its own data protection values, rules and legislation," Walker says. And when it comes to Europe, he thinks the development of a separate non-commercial metaverse is an attractive idea. "In any case, it would be a good way to make the world of XR more democratic and less capitalist."

Beliefs

According to Ginn and Walker, it is particularly important to get all ethical matters in order when XR becomes a permanent part of an educational programme. "You have to take into account that not every student can or wants to be part of that virtual world. They may reject it based on their beliefs or philosophy of life, or for physical or mental reasons. For example, what do you do with students who are blind or deaf, lack an arm or suffer from anxiety disorders or ADHD? These are not reasons to slow down XR developments in education, but they do deserve our serious attention."

"Through VR, we will shape students as well as our citizens of the future."

Further reading
- Values guide supports conversation on public values in digitisation
- Immersive technology in education: these values deserve attention (Dutch only)
- The Legal and Ethical Obligations of Implementing XR in Education

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Shipyard

TU Delft created a VR application that allows students of the Faculty of Mechanical, Maritime and Materials Engineering to practise assembly and logistics ship operations at a shipyard. The students identify and locate the necessary parts of the ship, provide transport and assemble the hull of the ship using a crane. During the exercises, they work together in a team and communicate with specially developed virtual walkie-talkies.

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The Future

- Animal testing, mixed reality and a VR headset on the checklist
- The time is now

AI generated image

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ANIMAL TESTING, MIXED REALITY AND A VR HEADSET ON THE CHECKLIST

XR is continuing to advance in education and is definitely here to stay. But what exactly does the future look like in this regard? We had a crystal ball chat with each of the interviewees about their hopes, wishes and expectations.

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According to Gert-Jan Verheij (RUG), XR will face several different challenges. Technology plays a major role, but should support the main goal. "First of all, you need to have enough people and expertise to develop, use, manage, update and secure your applications." In terms of content, Verheij thinks 3D animation is about to really take off. "It offers many opportunities to learn, research and practice, for example by replacing real animal testing with digital 3D animal testing or by exposing archaeological findings. RUG now has a theatre with a 3D screen and space for 19 people."

New balance

Harry Bitter (WUR) believes there will be a steady rise of XR in education. "VR offers safe exercise opportunities and can reduce fear of the real lab. This shows that you can work more efficiently with XR. You probably need less real lab time, while a new balance is struck between real and virtual lab work. This balance also applies to the various functions required for the real and virtual lab. Moreover, this is something that needs to be looked at by institutions together. That's how we help technology and each other move forward."

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No need to store everything

Gül Akcaova (SURF) believes it is a good idea for Europe to put legislation and regulations in place here. "However, we shouldn't try to control and decide everything ourselves, because we simply need Big Tech for certain things. It will therefore be challenging to decide what is and isn't permitted, for example when Apple offers its new products and services on the European market. We talk a lot about this with colleagues all over Europe. We really need to keep that future outlook in mind together."

"We will need a lot more of everything in the future."

Added value

Esther van der Linde's (SURF) future prospects include a growing number of applications and uses in the field of XR. She feels it is important to keep checking whether apps in development are not just fun, but truly add value in education. "And we have to look at that added value more and more in relation to the jobs that students will be doing later. Is everything well aligned?"

VR sets

Giny Verschoor (Dutch Political Academy) has a lot in the pipeline this year. "In addition to basic police training, we will also focus on higher education, for example in the field of forensic investigation. And we will take some VR sets to every police station where second-year students gain their practical experience." Verschoor thinks mixed reality is really going to take off and is curious about the latest generation of VR headsets that can switch between the virtual and real worlds. "I also hope that in the future, our students will be able to log in to their headsets to track and log their progress in their portfolio."

"A headset leasing system and a single app library for all institutions."

Politie: BlueSuit en Drug lab

Dutch police uses many VR applications in education, training and operations. They use the Police in VR module to inspire new colleagues and show all aspects of police work. BlueSuit is a multiplayer scenario training module that is used to train decision-making and other skills. The Politieplank module is used to experience how to deal with stress at great height. There is also module that allows participants to experience the world of a person with a mild intellectual disability. The Drug lab VR module allows participants to enter a drug lab in a safe, interactive way and learn to recognise the dangers based on different scenarios.

SURF

A single app library

Maurice Magneé (HAN) also has high hopes for a headset login system. "It would also be nice if assessments could be done in a VR environment in the future. This makes VR a significant part of education rather than just a practice tool." Astrid Timman (HAN) agrees. "It would be perfect if VR headsets are included on the course supplies checklist as standard. A headset leasing system would also be great along with a single app library for all institutions."

Playfulness

Arno Freeke (TU Delft) believes VR can be run from the cloud in the future and multiplayer experiences will give lecturers more control. "We will need a lot more of everything in the future. A lot more headsets, a lot more applications and a lot more adoption in education." Freeke is looking towards a bright future. "I always stay up to date on the latest developments. No two days are the same, and there is a lot of playfulness there as well. How nice is that?"

> *"VR and AR in a single device will be a very strong combination for training purposes."*

Clear arrangements

Akcaova is curious about the future of the metaverse. "How do we want to relate to it and what does it mean to the students, not least in a social sense? In the metaverse, for example, there is no government, so who ultimately decides what is and isn't possible? We need to make very clear arrangements in that regard."

A combination of VR and AR

Thomas Ginn sees the combination of VR and AR in one device as a major leap forward – and not just for training purposes. "Being able to get in and out of immersive experiences spontaneously makes it easy to stay in touch with the real world. For example, students can wear a headset for longer periods because they can see and communicate with each other using the AR features. They can then immediately step into a VR experience and be 'out of this world', because the device also offers that option." Ginn also expects the major tech companies will continue to buy new innovations. "Hopefully there will be enough alternatives from the open source field."

SURF

Connected to each other

According to Paul Melis and Casper van Leeuwen (SURF), the challenges for the future include standardisation, management and content. "Content still costs a lot of time and money. We expect AI to accelerate this significantly in the future." They also expect that in the long term, different applications will be connected to each other and devices will increasingly start moving in the same direction. They hope everything will become easier as well. "Connecting, logging into and (re)starting devices are often still a hassle."

World peace

The emergence of technical solutions and virtual worlds is inevitable for John Walker (SURF). "We now know that you can do things faster, cheaper and more efficiently in a virtual world. An important question is whether it is actually better than in the real world. XR is very nice, but it's not a miracle cure. World peace is not going to happen in the metaverse."

Scenarios with ChatGPT

Another interesting future perspective is the combination of XR with other technologies such as AI, digital twins and the Internet of Things. Van der Linde wonders what this will mean for education. "For example, imagine that the scenarios in XR are increasingly created with an AI chatbot like ChatGpt. That sounds great, but how will having to deal with an artificial person affect the students? We don't know yet, but we do need to investigate that."

Best of both worlds

Bitter has a reassuring message to those who are concerned about the rise of XR in education. "Virtual labs will never completely replace real labs. It is not something we should strive for either, because a real lab remains unique: the smells, the atmosphere, the people, the conversations in the background, laughter, the radio. You can never include all that in an app. Combining a real and virtual lab gives you the best of both worlds."

THE FUTURE

THE TIME IS NOW

Virtually all education institutions are now involved with XR. That's great to see. There is so much to experiment with and there are all kinds of cool applications. Students practice their knowledge and skills in magnificent virtual worlds such as the human body, a courtroom, a lab and even the past. And there are more and more possibilities on the table. If your education institution has not ventured into the world of XR yet, then now is the time to get started.

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Using XR means inventing situations and scenarios for students so they can repeatedly practice what they find difficult. It is particularly valuable when students themselves get to contribute to the development of applications through co-creation.

Collaboration is always crucial. It's about sharing the benefits, staying strong together and working on a new way of training. Both the low-hanging and high-hanging fruit deserve attention. Collaboration also leads to a lively exchange of experiences, insights and future plans.

It is also important to continue to work based on a vision. A proper vision can emerge quickly, be rock-solid and act as an excellent reference framework for everything you do. And don't forget your sales technique. Organise a roadshow and bring headsets, because VR only truly comes to life when you put a headset on.

We don't need to be afraid of the future, but we do need to stay alert. Through VR, we will shape students as well as our citizens of the future. And because everything is stored, we have to be mindful that we do not start drowning in data soon.

XR in education. Now is the time. Are you joining the movement? We'd love to hear from you.

This, too, deserves our undivided attention. An ethics committee can play an important role in this.

The future is not just a matter of doing much more in all sorts of areas. It's also about 3D animal testing, the merging of VR and AR in one device, the VR headset on the course supplies checklist, one app library for all institutions, good arrangements with Big Tech, more focus on Europe and the combination of XR with other technologies.

SURF believes in the future of XR for education. We want to take significant steps in the coming years together with education institutions and all other stakeholders.

One tool we will use for this is Npuls, an eight-year programme aimed at improving education in vocational training, higher professional education and scientific education by taking advantage of the opportunities offered by digitalisation. Knowledge sharing, collaboration and experimentation are important pillars of the programme,and all senior secondary vocational education (MBO) institutions, universities of applied sciences and research universities are involved.

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