VISION NEEDS ANALYSIS

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1. Introduction

This report is part of the project VISION – Virtual Interface for Smart Interaction Online. VISION is a two-year (6.2021 – 6.2023) Strategic Partnership funded by the European Union's Erasmus+ Program in response to their special call for the COVID-19 situation.

The digitization of higher education (HE) has become a vital necessity since the COVID-19 pandemic began and with it the HE sector has faced both various challenges and opportunities. VISION's aim is to provide innovative online teaching and learning tools to higher education teachers (HETs) and higher education students (HESs) to meet individual learning requirements, accompany ongoing learning processes and make personalized learning the primary consideration in digital instruction in a pedagogically meaningful and competence-oriented way.

This will be accomplished through three tools:

1. A unique AI-based authoring tool (The Vision) will be developed through which HETs can easily create interactive, visually and didactically valuable courses that promote personalized learning and can be integrated into any learning management system (LMS).

2. A course-specific Chatbot Tutor (The Visionary) will be produced to serve as a communication interface between students and teachers. It will supplement courses with automated academic-support addressing HESs' distinct learning needs, interests, aspirations, individual backgrounds and requirements. It will also link to the authoring tool to provide dynamic and personalized updates for each student.

3. An e-course (The Visionar) will be developed so that teachers can easily understand and utilize the above-mentioned tools to develop professionally and facilitate quality online learning that meets their pedagogical needs.

The digital skills strengthened through the VISION project will enhance the online teaching and learning experience for both HE students and teachers long-term, which is indispensable, especially in today's uncertain times. HETs will learn to apply their digital competences in real time scenarios through a virtual environment, thereby significantly impacting the learning

paths of their students, and they will gain a greater understanding of their students' individual e-learning progress. HESs will benefit from personalized learning arrangements, accompanied learning processes, adaptive and student-oriented feedback and tutoring support as well as a dynamic digital learning environment.

VISION is run by a consortium of four partners:
  - o   Austria: University of Graz (Coordinator) and Smart-Study GmbH
  - o   Germany: Dresden University of Technology
  - o   The Netherlands: University of Amsterdam

The first draft of this report is a literature review summarizing the digitization of the current higher education space. The report focuses specifically on authoring tools, chatbots and the training of HETs. The desk research from this report was used as a basis for the development of the VISION project proposal.

2. The Digitization of Higher Education

2.1 General Trend Towards Digitization

As digital technologies become more ingrained in our everyday lives, higher education institutions (HEIs) have a duty to strengthen their systems to harness the full potential of innovation and contribute to producing and building knowledge. HEIs are establishments where a vast amount of advancements in technologies are born, therefore, a country's level of innovation is highly dependent on the relationship between the HEIs and technology in all areas (Grosseck et al., 2020: 565). The Austrian Federal Ministry of Education, Science and Research highlights the ways in which HEIs have always led the charge in advancing modern technology through their role as knowledge providers and producers.

> The Internet is a prime example of this. The date of its "birth" is often referred to as October 29, 1969, the day on which scientists at the University of California Los Angeles (UCLA) succeeded in transmitting the first messages over the scientific network Arpanet. The same applies to the World Wide Web, whose first plans were presented by the British physicist and computer scientist Tim Berners-Lee on March 12, 1989, at the CERN nuclear research center in Geneva,

where he was conducting research at the time. (Bundesministerium für Bildung, Wissenschaft und Forschung, 2020)

Integrating digitization into all disciplines, subjects and levels of HE is crucial to contributing to digital innovation as is continues to affect research, teaching, and learning. Just as HEIs expect their students to grow and learn to meet future societal needs and find employment, they too must rise to the challenge. As advancements in technology transform qualifications in the work force, it is estimated that 65% of today's primary school children will work in jobs that do not currently exist (Saykili 2019: 5). Therefore, HEIs must review their current structures and determine how they can adapt to better suit the needs and requirements of the 21st century and understand what is means to be an educator and what it means to be educated (Saykili 2019: 3). In the International Association of Universities' (IAU) report on the current state of higher education in the digital era, 1,039 respondents from 127 countries were asked whether they 'believed that higher education plays an important role in shaping digital transformation' to which approximately 58% strongly agreed with the statement, 35% somewhat agreed and only a small few disagreed (5% somewhat disagree/ 1% strongly disagree), highlighting how important HEIs themselves see the impact digitization has on higher education and society. (Jensen, 2019). Evolving and advancing digitization at HEIs should not, however, be seen as a strain on the students, staff, or institutions, but rather a tool for growth and progress.

One area digitization has already proven to greatly enhance is teaching and learning activities, especially through the expansion of access to education for all. Sitting in a lecture hall or lab to attend a course is no longer always necessary and exams can be completed from anywhere at any time. Teachers who are unavailable due to work-related travel for conferences and meetings can leverage digital tools to hold class remotely or ensure their students are obtaining the knowledge in a diverse number of ways that were not available even five to ten years ago. Students who have difficulties commuting to campus or those who benefit from at home instruction can harness these digital tools to fully utilize the educational system, expanding HE to more groups and making it more inclusive.

Digitization has also made research results more accessible. In the Austrian Federal Ministry of Education, Science and Research's 2020 report on digital and social transformation projects in the country, approximately one-third of the 35 funded projects are exclusively in the area of digitization and the majority deal with "open science" initiatives (Bundesministerium für

Bildung, Wissenschaft und Forschung 2020: 11). These initiatives can help ensure the freest possible access to scientific publications and research data. The more HEIs guarantee this broad access to knowledge and advancements, the faster society as a whole can grow and learn from it.

Digitization can also continue playing a larger role in making HEIs more efficient and user friendly, from the administrative level up to research, teaching and learning. In the same aforementioned report, the Ministry highlights projects such as "Mobile First" at the Vienna University of Economics and Business (WU), which is harnessing smart phones as tools to unlock a variety of activities on campus such as obtaining information, printing documents, receiving information or opening doors (Bundesministerium für Bildung, Wissenschaft und Forschung 2020: 61). Likewise, when the COVID-19 pandemic hit, the University of Amsterdam (UvA) posted a question among their staff: How could they scale high-quality educational processes to massive student cohorts without increasing the teaching workload, knowing that moving to an online and/or hybrid educational paradigm has historically increased the teaching workload? Dr. Erwin van Vliet (UvA VISION project member) is currently working on answering this question with a project called IGuideME. The aim of IGuideME is to provide students with personal feedback through the use of a digital application in combination with a specific blended learning and teaching method to stimulate intrinsic motivation and self-regulation. This is linked to a LMS which activates and motivates students through reward (gamification) and by providing personal feedback based on learning analytics. Additionally, the Dresden University of Technology has been working on a project called tech4comp since 2018 led by Professor Thomas Köhler (TUD VISION project member). The project deals with the interdisciplinary question of how the acquisition of skills for a higher number of students in selected subject areas at universities can be supported by means of hybrid technology supported learning environments.

While digitalization can be a tremendous tool in promoting educational advancement, HEIs must also be aware of the challenges it introduces. If HEIs do not properly implement policies, planning, training, technical support, updates, and resource allocation, digitization will be seen as less of a tool and more of just a buzz word (Saykili 2019: 4).

Unfortunately, technology is not a great equalizer, and one challenge is ensuring that proposed digitization strategies match the needs of teachers and students which they aim to benefit. As

stated previously, it can enormously enhance the learning experience and provide greater access to those who previously had none, but the "opportunities for exploring and leveraging the potential of technology are very different from one country to another and within countries, which means there is a great risk of exacerbating divides" (Jensen 2019: 8). Digitization in HE must therefore be discussed at the global, national, local, and institutional level. At the institutional level, for example, HEIs must decide whether the national HE framework is applicable to digital advancement at their particular institution and whether or not it will help or hinder students, teachers and staff in their path towards innovation. In the IAU's report, only 16% of respondents said that the national regulatory policies in their countries highly supported the transition to the digital era and only 7% said the national frameworks were highly financially supportive of this transition (Jensen 2019: 14). Therefore, implementing a national goal of increasing the number of virtual classrooms, for example, may improve an HEI's innovation status, but if there is no funding for teacher training in this format and/or students do not have strong enough internet connections to fully engage in the course, then true digital transformation is not really occurring.

Secondly, digital literacy among HETs is an integral element in digitization, but one that may not always be widely supported, accepted, or financed. It is no longer sufficient for HETs to only be a master in their field, digitization also requires a new set of skills and qualifications that transform the teacher into a learning facilitator. To adapt to digitization, HETs must now utilize the technology available to them (e.g., social media, open educational resources, massive online open courses, sophisticated learning management systems, big data, learning analytics, and adaptive learning) in ways that enhance and advance 21st century learning for their students. HETs are expected to navigate this environment, but it requires a great deal of new skills to do so.

> What HEIs need to do in this context is to take the necessary steps in determining the roles that the instructor needs to play and the skills he/she needs to develop and take action in supporting the instructor as he/she puts these new roles into action. Yet, the current structure of the HEIs does not support these new roles and skills since research and publications-based evaluation schemes don't potentially allow for a transition from 'teaching' to 'facilitating learning'. (Saykili 2019: 8-9)

HETs already have teaching, researching, and publishing duties, therefore adding on an entirely new skill set can be seen as overwhelming and unnecessary. Of the eight key challenges to digital transformation outlined by the IAU's 2019 report, an institutional culture that is slow to change or adapt to new technologies was the second most important obstacle (47% of respondents), the reluctance or lack of interest from faculty and/or staff was the fourth biggest obstacle (29% of respondents) and the lack of capacity building opportunities the fifth biggest obstacle (28% of respondents) (Jensen, 2019: 42). HEIs are not only responsible for familiarizing and training HETs with the necessary skills to excel at this task, but also for developing a "strategic orientation and a high level of awareness of this issue at all levels" (Bundesministerium für Bildung, Wissenschaft und Forschung 2020: 12). HEIs must fully understand how innovative 21st technology can impact their teachers and students, and they must build a space that encourages the use of this technology to its full potential.

> HEIs need to utilize the digital technologies not only for logistical administrative purposes but also as pedagogical tools for managing learning experiences and for the development of the 21st century skills that learners need to develop to better function in the society. Policy makers and administrators involved in HEIs should take steps in developing ethical, administrative and pedagogical policies and action plans for the integration of digital tools as pedagogical agents in learning spaces. HEIs need to foresee the future, plan ahead to take crucial steps and manage change while initiating the reforms required of them. (Saykili, 2019 10-11).

Fortunately, many HESs already have lives which are vastly digitized, making digital tools easier for them to implement into their education. Today's HESs enter the educational world surrounded by and comfortable with various digital tools and devices that shape the way they think and learn. Therefore, they expect their institutions to widely adopt new technologies to reflect the world they live in (Grosseck et al., 2020:566) and traditional teaching methods may not attract or hold their attention (Saykili 2019: 7).

Therefore, while these new digital pedagogies can enhance the student experience, HEIs must consider it an important priority and integrate it into the strategic plan appropriately. According to Grosseck et al. (2020), every HEI should structure its digitization strategy around fulfilling three main goals: "digital infrastructure, the development of its academic staff's skills to use digitally-based methods in their teaching and the improvement of its students' digital skills" (Grosseck et al., 2020: 567).

2.2 Higher Education's Response to COVID-19

The Coronavirus (COVID-19) outbreak in December 2019 was classified as a global pandemic by the World Health Organization (WHO) in March 2020 and by April 2020, schools and HEIs around the world began responding by closing physical school buildings. By April 1, 2020, schools and HEIs were closed in 185 countries, affecting 1,542,412,000 learners or 89.4% of total enrolled learners (Giorgio Marinoni, et al., 2020: 8). Remote teaching was put into practice and education shifted online in what was often classified as "online distance education" or "virtual school." Bozkurt & Sharma (2020) state, however, that terminology is an extremely important aspect when discussing this shift and will play a role in the future of how we perceive online learning. They argue that online distance education 'involves more than simply uploading educational content' and it is rather a 'learning process that provides learners agency, responsibility, flexibility and choice' and 'requires careful planning, designing and determination of aims to create an effective learning ecology.' The shift to online learning that occurred as a result of COVID-19 was rather 'emergency remote teaching' (Bozkurt & Sharma, 2020: 2-3).

In HE especially, this shift became a necessity as HEIs around the world were considered most adept (e.g., due to the mature age of students, funding of universities, pre-existing LMSs in use) to moving all teaching and learning activities online. Before COVID-19, online distance learning was generally seen as an optional and more flexible option for HESs, however emergency remote learning became more of an obligation (Bozkurt & Sharma, 2020: 2) with various barriers to entry.

The majority of HETs, however, were largely unprepared to make the shift to online teaching for such a large number of students. Before the pandemic, offering fully online courses was not a high priority for HEIs and was mostly only implemented by open universities. Hybrid and blended learning were more common among HEIs before 2020, and the use of online resources to support in-person courses was the most mainstream method of integrating technology (Jensen, 2019: 30). In response to the pandemic, HETs therefore had major difficulties adapting to new teaching methodologies, modifying their course structures, arranging attractive digital learning environments, assessing student progress, keeping students motivated, and engaging them online in a meaningful and pedagogical way (Tang et al., 2020: 2-3). Essentially, the

majority of HEIs were implementing emergency remote learning rather than pedagogically sound online distance learning systems that had been previously developed and tested.

According to the IAU's global survey report on the impact of COVID-19 on HE, how successful HEIs were in their shift to online distance learning could be seen through a few interconnected elements.

- o *Level of technical infrastructure and accessibility:* HETs and HESs must have access to strong internet connections and digital tools (e.g., computers, tablets, mobile phones) to effectively participate in distance learning. Even at those HEIs where the majority do have this access, there is still a discrepancy among some HETs and HESs, and therefore equal opportunities cannot be provided.

- o *HET's distance learning competences and pedagogies*: HETs cannot seamlessly transfer classroom methods to online distance learning; it requires a drastically different pedagogy. Therefore, HETs were and are unprepared and need training and continuing education to inform their teaching. Since the majority of HEIs did not have a structure already in place to quickly and easily train HETs on this topic, this resulted in 'learning by doing approaches or attempting to imitate what would have been the face-to-face way of proceeding, yet using distance mode.'

- o *The field of study:* Specific fields of study such as clinical medicine, veterinary studies and other fields dependent on lab work as well as those in the field of arts (e.g., music) experience a more difficult time making the shift to online distance learning. Even in those HEIs which have the infrastructure in place to excel in online distance learning, the 'quality of the learning experience will depend very much from one discipline of study to the other in the current context.'

(Giorgio Marinoni, et al., 2020: 24-26)

Higher education students have been facing their own set of challenges in response to COVID-19 as well. There has been a major decline in face-to-face engagement, and even if HESs attend online classes, it does not guarantee they have understood the lesson. And with less opportunity for personalized feedback and fewer assessments of their individual work, it is more likely to decrease their motivation and effectiveness. HESs also faced multiple learning formats

designed by teachers who (as previously stated) had not been trained in online distance learning, making the overall quality and efficiency of online teaching weak (Tang et al., 2020: 2-3). Engaging in critical classroom discussions and participating in student-teacher interactions are also crucial elements in helping students maintain a successful learning process. With the shift to online courses, this aspect was often lost or extremely challenging to execute. Surveys conducted by Uni Graz (Salmhofer 2020) and Smart-Study (Rieger 2020) showed that HETs were faced with the challenge of not being able to reach all students through online learning, and HESs were dissatisfied with the communication and Q&A opportunities of their LMSs. Both felt isolated through the sudden change in teaching and were not prepared for communication outside of the face-to-face classroom.

With these challenges however, the HE sector also has great opportunity for growth. Already, this switch to emergency remote learning has led to the capacity building of both HETs and HESs who have been utilizing various online tools and systems they may have otherwise never had contact with. While the move to emergency remote learning may have been obligatory at first, it is possible that 'a shift in mindset is happening or that this experience has opened a new horizon of opportunities for teaching and learning' (Giorgio Marinoni, et al., 2020: 26). Respondents in the IAU's COVID-19 Global Impact Survey believe HEIs will now be more motivated to explore the potential of online learning and digitilization opportunities with a specific focus on 'innovation in the field of teaching pedagogies as well as the delivery modalities of teaching and learning' (Giorgio Marinoni, et al., 2020: 26).

COVID-19 has made it more widely evident that digitization is not a solution in itself, and it must be applied to the ever-changing teaching and learning-centric needs, contexts and the availability and accessibly of tools and infrastructure. While digitalization did 'save the day' and there were 'incredible innovative approaches to issues faced' (Bozkurt & Sharma, 2020: 3), a long-term shift to digitization in HE requires a more comprehensive plan, especially one that supports the training of HETs.

3. The Current Higher Education Digital Landscape in the Context of VISION

There is an ever-increasing amount of digital tools being introduced into the HE space (e.g., e-portfolios, MOOCs, blogs, virtual words). For the purpose of this needs analysis, only authoring tools and chatbots will be closely analyzed.

3.1 Authoring Tools

Authoring tools are software programs that allow users to create their own digital content. In the field of education, authoring tools help in the creation of e-learning courses and enable 'anyone, not just computer programmers, to create and package engaging pieces of e-learning material and deliver them to the end user' (E-Learning Market Trends and Forecast 2017-2021, 2016: 17). There is no shortage of authoring tools on the market for educators designing their courses. The reality is, however, that the majority of HETs utilize the learning management systems their institutions provide. Open source LMSs like Moodle, Canvas, or Open edX, all have basic built-in authoring tools. These systems, while useful, are designed with more traditional forms of content in mind such as posting PowerPoint presentations or creating short quizzes.

With the development of more advanced authoring tools, HETs now have the ability to create and implement more engaging e-learning content for their courses, which was previously only available through professional developers (Orsborn, 2017: 47). In addition to more attractive content, advanced authoring tools can help HETs save time, simplify their planning processes, increase student motivation, and assess their students better and more holistically. With the shift to more students learning online due to COVID-19, HETs will certainly benefit from this technology and can more easily use authoring tools to build online course content that is more than just an afterthought, but rather a central hub where learning occurs beyond the standard course parameters.

There are several authoring tools already on the market for implementation into e-learning courses. Each has a varying degree of functions determining the quality of the materials available (e.g., customization options, variety of formats, built-in design, branching options), how fast and efficient the tool is to use, and its scalability (e.g., editing and reusing materials, import and export features). Two of the most popular and widely used authoring tools in the development of e-learning courses are Adobe Captivate and Articulate Storyline (Khademi et al., 2011; Penfold, 2021).
Adobe Captivate is a desktop application for Windows and Mac with SCORM e-learning software supporting HTML5, SCORM, AICC, and xAPI (TinCan). It encompasses a growing assortment of features such as 'ready-to-go' slide content, virtual reality (VR) quizzes and other

interactive elements through VR headsets, interactive videos and 360⁰ images and videos (*Adobe Captivate Tech Specs*, 2021). Articulate Storyline is a Windows desktop authoring tool which harnesses the look and feel of PowerPoint. It is SCORM compliant supports AICC and xAPI (TinCan). Its features include access to a massive media content library, slide templates to assist with quick content development, and several assessment tools to monitor student progress (*Storyline 360 Features*, 2021).

In addition to the authoring tools mentioned above, there are also so-called intelligent tutoring systems (ITS) that are entering the e-learning market which harness the power of artificial intelligence (AI) and often utilize authoring tools in their design (Dermeval et al., 2017: 337). ITS are 'meta-cognition technologies that simulate the behavior of a human mentor and provide personalized responses, remediation, and interventions in real time based on the knowledge, behavior, and cognitive abilities of a particular user' (Adkins, 2016: 80). Querium is one such system which uses AI to offer students coaching and real-time assessment. Querium collects student data entries and provides teachers with information on the problems students are facing so that they can create lessons plans accordingly (Adkins, 2016: 83).

Systems like Querium, ALEKS from McGraw Hill or ASSISTment from Worcester Polytechnic Institute (Baker, 2016: 601) accompany students throughout their learning processes and are designed to optimize learning results, giving teachers feedback along the way. In this way, these tools can help HETs individualize the teaching and learning experience in ways that otherwise could not be accomplished, at least not without an incredible investment of time and resources, something the majority of HETs do not have at their disposal. Well-designed ITS or more advanced (or smart) authoring tools can contribute to deeper learning experiences that help HETs 'determine learning styles, interests, and pinpoint the challenges and difficulties each individual is having' (Saykili 2019: 10). These tools therefore do not replace the teacher or the knowledge he or she holds, but they instead leverage technology to complement successful instructional models that are already in place (Dermeval et al., 2017: 337).

3.2 Chatbots

A chatbot is a computer program designed to simulate intelligent auditory or contextual conversations with its users. For the purpose of this report, the term "chatbot" will be used, but other established names include chatterbot, conversational agent, conversational system,

pedagogical agent, intelligent pedagogical agent, talkbot, and artificial conversational entity. Chatbots are often discussed together with or alongside ITS and AI, specifically Artificial Intelligence Markup Language (AIML) (Jung et al., 2020: 488; Roos, 2018: 1). Chatbots have already successfully entered many various fields including medicine and the product and service industry. By 2024, the chatbot industry is projected to reach 994.5 million U.S. dollars (Winkler & Soellner, 2018: 3).

In the context of higher education, chatbots have proven to be extremely beneficial as a teaching, learning and administrative tool. This has been especially true in large courses with more than 100 students per teacher, where chatbots are able to solve the problem of individual student support when the teacher has limited time (Winkler & Soellner, 2018: 1). As the number of students per teacher continues to grow at universities, lack of individual student support is increasingly becoming a problem and lead to dissatisfied learners and higher dropout rates (Jung et al., 2020: 488; Winkler & Soellner, 2018: 3). Chatbots can help solve it by providing more focused or individual support in large classrooms, lecture halls or massive open online courses (MOOCs) with little additional financial or organizational support (Winkler & Soellner, 2018: 3). Research has also shown that the meaningful interactions chatbots facilitate can help establish learning communities that give students a 'sense of belonging' and encourage collaborative learning and connectivity (e.g., with the teacher, coursework, content) (Studente et al., 2020: 768).

Chatbots can also help bring learning from a passive process to an active one by engaging students in self-directed learning, motivating them to ask questions, and engaging in conversations about their study topic (Jung et al., 2020: 488). Students become proactive and improve the quality of their learning processes as well as the outcome. As chatbots engage synchronously with students on a one-to-one basis, it allows students to 'remain in the driver's seat and actively control their learning, which is a major success factor for effective learning according to the predominant constructivist learning theory' (Winkler & Soellner, 2018: 4). Students are already completely adapted to using chat technology, therefore engaging with a chatbots is not a far leap.

Chatbots are also extremely efficient at providing immediate feedback to students at all hours, which increases their satisfaction with learning and the course. (Jung et al., 2020:488). They can 'trigger metacognitive thinking processes' in students (especially important in building

lifelong learning skills) and go above and beyond the standard feedback a student might receive during the course of a semester. Formative feedback focused on reflection is one of the most crucial elements in motivating students and leads to more positive outcomes (Winkler & Soellner, 2018: 17-18). Feedback can also be provided to the teachers, whose teaching can be optimized by collecting a variety of information about the students including their learning styles and common problems (Sjöström et al., 2018: 2).

Both Jung et al (2020) and Roos (2018) categorize chatbots into having several roles in HE. The chatbot can act as a tutor who guides students, especially helping with topics they find difficult. In the evaluator role, the chatbot assesses student progress and gives feedback. As a respondent, the chatbot intelligently answers a student's questions. A moderator chatbot (or teacher communicator chatbot) works as a link between the student and teacher, relaying questions or comments on to the teacher, who then becomes the "human in the loop." A peer learner chatbot (or communicator chatbot) provides simple everyday conversations or dialogue. The overall theme in these roles is that chatbots provide guidance but leave the core of the instruction to the teacher (Jung et al., 2020: 488; Roos, 2018: 44). It is especially crucial to discuss these roles and teacher and student expectations before designing and implementing a chatbot so that all parties involved understand the goal is to extend the role of the teacher, rather than simply to replace the teacher. (Sjöström et al., 2018: 2)

In Roos' (2018) analysis of 14 published papers covering the roles and features of AIML-based chatbots from 2008-2017, it was found that the majority of chatbots had been integrated into a larger system including library systems, virtual environments, and e-learning systems rather than being stand-alone applications. Of those, e-learning systems were the most common integration form as they were seen as a convenient way to keep all the course tools in one place while providing the chatbot with streamlined access to the course materials and the students with easy access to the chatbot (as they already had logins to the e-learning systems and they already conducted tasks there). This is also when most student questions arise, while they are learning and studying the materials (Roos, 2018: 45).

There are HEIs currently using chatbots, with the majority developed to support administrative tasks such as admissions and student affairs rather than subject-specific assistance. Ivy is an 'artificially intelligent self-service chatbot for colleges and universities' which began by working with individual departments at HEIs such as the career office and academic advising.

As the chatbot learned and improved, it was deployed more broadly across entire university systems (McKenzie, 2019). Similarly, a Boston-based startup called AdmitHub has designed chatbot apps for multiple HETs to assist students with the application process (McKenzie, 2019), and the University of Vienna's chatbot helps students find 'information about university services quickly and easily' (University of Vienna, n.d.).

Some universities are opting for the services of larger companies like Google's Dialogflow or Amazon's Lex, while a few HEIs have developed their own sophisticated chatbots with proprietary technology (McKenzie, 2019) . In 2015, Georgia Tech started using technology from IBM's Watson platform to develop their own chatbot with the goal of increasing retention rates and providing fast feedback to HESs. Renamed Jill Watson, the chatbot answered frequently asked questions for students enrolled in a computer science course. Jill was able to free up the professor's and the teaching assistants' time so that they could concentrate on other tasks, and Jill also increased the engagement of the students, who asked more questions than before Jill (Maderer, 2016). In 2019, Stanford University created QuizBot, a 'dialogue-based agent that helps students learn factual knowledge in science, safety, and English vocabulary' with the goal of using AI to promote a more engaging way for students to learn. In their research, QuizBot was compared to traditional flashcard learning tools and resulted in students recognizing and recalling over 20% more correct answers and spending 2.6x more time studying with QuizBot (Ruan et al., 2019: 1).

When the COVID-19 pandemic began, Chatbots became extremely useful in fielding all of the questions HETs were receiving as administrators were overloaded. The situation highlighted the extremely useful attributes a chatbot can bring to an institution in terms of supporting faculty and staff while helping to engage students (Brereton, 2021).

3.3 Teacher Training in Higher Education Digitization

Creating and implementing technologies such as chatbots and authoring tools is a major first step towards innovation, but ensuring HETs have the necessary digital literacy skills is also a critical consideration. Digital literacy requires the ability to 'access digital media and information and communications technology (ICT), to understand and critically evaluate different aspects of digital media and media contents, and to communicate effectively in a variety of contexts' (Grünwald et al., 2016: 110). Supporting digital literacy in HEIs also

supports students by preparing them for working life, self-development and overall participation in society (Langset et al., 2018: 25).

Technology is rapidly evolving and with it teaching and learning environments have drastically changed, however the majority of HEIs are trying to apply new digital methods into existing structures that are part of an old model. In discussing a 2013 education report from Norway, Langset et al. highlights this disconnect.

> When used, technology is mostly limited to learning management systems (LMS) to administer learning, presentation tools to scaffold lectures, interactive tasks with instant feedback and digital portfolios to store and retrieve student work. Even if the teacher trainees belong to the digital generation, as coined by Tapscott (1998), they have limited knowledge about digital technology and social media when it comes to using these as tools to scaffold learning in didactical settings. (Langset et al., 2018: 25).

Incorporating new digital technologies into older models of teaching and learning lacks a pedagogically holistic approach that meets the needs of both the teachers and the students, and begs the question as to how HETs can serve the lifelong learners entering the workforce without being properly trained themselves (Bates, 2010: 21).

The rapid development of the digital landscape is one of the major reasons digital literacy is lacking among HETs. There are an ever-increasing amount of tools and technologies and HETs do not have sufficient time and/or skills to integrate them into their courses. Providing HETs with technological and pedagogical support is a major factor in the shift from a traditional to a more digitally literate model (Amhag et al., 2019: 206).

In order for teacher training in digitization to be successful, studies shows that HETs must see the value in the technology in order for them to incorporate it into their teaching. Additionally, when teachers are confident in the use of technology and are interested in further improving their digital teaching self-efficacy, they are more likely to have positive outcomes with technology in the classroom (Amhag et al., 2019: 203-205).

4. The VISION Project

There are currently great opportunities for advancing the integration of digitization in HE, especially in light of the COVID-19 pandemic. Since digitization is not a solution in itself, the project design for VISION was guided by the following questions: Which digital technologies can help solve problems facing HETs and HESs? Which innovative opportunities for further improving HE teaching and learning urgently have to be developed, offered and implemented into HEIs to ensure effective (digital) transformation processes? What do HE teachers need to be equipped with the necessary skills to leverage the current and emerging digital tools and enhance their professional practice in digital environments?

Even before the COVID-19 pandemic, teachers were increasingly expected to utilize digital technologies in the classroom to help students succeed. After the pandemic began, these expectations soared as physical learning environments migrated to virtual spaces. Therefore, the investment in digital teacher training and development has made this priority more imperative than ever before.

VISION has therefore identified three central challenges considerably affecting digital teaching and learning at HEIs:

1. *Untapped digital learning environments*: The majority of HETs are utilizing LMSs to post additional course content or store student work, but they are simply applying traditional teaching methods to new digital systems. They lack programs with dynamic features that track HESs' learning processes, progress and outcomes and provide a pedagogically holistic approach that meets the needs of both the teachers and the students.

2. *Lack of communication between HETs and HESs*: Due to time and temporal limitations, especially in larger courses, HETs are unable to build one-on-one relationships with all of their students. Therefore, HESs receive fewer accommodations for their individual learning styles and HETs have little understanding into their students' learning processes and outcomes.

3. *Outdated digital pedagogic competences*: HETs lack the digital didactical and methodical experiences and competences to enhance student- and target-oriented learning processes by efficiently using online tools.

To meet these challenges, HETs need to have access to updated knowledge, tools and systems that can be utilized without any prior technical expertise and without investing too much time. They will also need to understand how to employ a wide variety of educational methods that they previously used in the classroom in the digital format. Lastly, they need to be able to access their students' real time progress in the virtual space. Based on these needs, VISION has outlined the following objectives for HETs:

o Develop digital didactic competences
o Broaden understanding of students' individual e-learning progress
o Offer pedagogically effective and efficient online courses

HESs need real time assessment of their personal e-learning progress, well-designed adaptive course materials and greater access to support. Based on these needs, VISION has outlined the following objectives for HESs:

o Gain a deeper understanding of personal strengths and weaknesses
o Obtain access to innovative and effective learning materials
o Receive access to automated support for organizational, procedural and pedagogical communication

4.1 VISION's Tools

While there are several tools on the market catering to the needs of educators, VISION's innovation can be found in the comprehensive nature of three intellectual outputs that are being designed with the specific needs of HETs and HESs at the forefront. As mentioned in the introduction, the three tools include a unique AI-based authoring tool (The Vision), a course-specific Chatbot Tutor (The Visionary), and an e-course for HETs (The Visionar).

The Smart Authoring Tool developed by VISION will be supported by AI and will be specifically designed with the needs of HETs at the forefront. With the Smart Authoring Tool,

teachers will be able to create interactive, visually and didactically valuable courses that they can export in standard formats through Scorm and integrate into any LMS their university is using. With just a few clicks, they can create the pages of the course, as with a website modular system. Chapters and subchapters can then be assigned to these pages with free or defined order. Afterwards, multimedia and examination elements (such as videos, audio, flash cards) can be dragged and dropped into the individual pages. The design of the elements can then be adjusted with just a few clicks. Using the same principle, the layout of the course can also be adjusted using drag & drop and can then be previewed in different layouts.

Through the Smart Authoring Tool, both students and teachers will benefit.

Higher education teachers will have:

- o Automated assessment: Grading can be done instantly through the tool as soon as a student completes an exercise and teachers can track their students' progress.
- o More time: Teachers will be able to quickly and easily take actions such as accessing content from previous semesters and dragging and dropping it to fit their current needs or getting a snapshot of a student's progress all in one click. This will certainly save them a great deal of administrative time and energy that can be freed up for more in-class engagement.
- o *Increased flexibility*: Feedback can be given through video or audio clips.
- o *Better analytics*: At a glance, teachers can see where students are struggling and where they are thriving, help them with key information that can inform class schedules and revision techniques.

Higher education students will have:

- o Access to unique content: Students will be motivated to complete the interactive assignments their teachers have posted, which are much more engaging than the uploading of static elements such as worksheets and PDFs.
- o Progress tracking: Often students do not have a concept of their development in real time. The Smart Authoring Tool will allow students to track their learning progress through data assessment tools and will update dynamically based on their needs.

What really sets the courses created by this tool apart, however, is their ability to dynamically update the students' learning paths based on the input from the Chatbot Tutor. When the Tutor is used in combination with the Smart Authoring Tool, each student's course view will update based on their personalized needs. The more the students interact with the Tutor, the more individual their content will be.

The Chatbot Tutor is an online educational tool powered by AI software that will simulate student-teacher interactions through a messaging application embedded directly in their LMS. As students communicate with the Tutor, the LMS will dynamically update to personalize their learning experience. The chatbot tutor becomes more efficient as the number of student questions increases and is particularly suitable for large lectures with large amounts of material and high student numbers, both in hybrid and distance learning.

Hence, the tutor is highly functional and efficient in those types of courses which, due to the large number of students, make individual exchange between teachers and learners largely impossible. In this sense, the chatbot can be used in all disciplines and also enables learning support in large events regardless of whether they are held synchronously or asynchronously. The use over several semesters as well as the extent of individual use increases its adaptability and its performance effectiveness. Using the Tutor, these interactions will actually be replicated on a large scale, creating a space where both students and teachers can benefit.

Higher education teachers will have:

- o *More time:* It will help teachers shift their time away from answering the frequent and often repetitive questions from students since the Chatbot Tutor will provide immediate answers. They can then invest that time in other crucial activities such as research projects or supervision of the group.
- o *Personalized data:* It will provide teachers with learning assessment on each of their students so they can gain a better understanding of their progress and identify areas that they may want to concentrate more on in class.
- o *Remarkable ease*: It can be easily implemented into their LMS without the necessity of any previous programming knowledge.

Higher education students will have

- Immediacy: Students will be able to interact with the Tutor 24/7. If a student's question cannot be answered, the course author will be notified via messenger or email and can answer it. With this answer, the chatbot improves continuously. Through this immediacy, the quality of the learning experience improves because knowledge is more readily available.
- *Personalization*: The learning bot will also be able to ask students about the content of the course. It will then be able to evaluate the students' answers and adapt to each student according to their needs and specific requirements. This element is something that would most likely be unavailable in large classrooms with many students.
- *Interaction*: If students do not have the ability to speak face-to-face with their teachers, they can of course resort to pathways such as emailing the questions or looking for answers in books, online or the course syllabus, just to name a few. These sources may provide them with an answer, but they are static and lack interactivity. The Chatbot Tutor will offer students a dialogue in which it can answer questions, explain a task, have a subject-specific conversation, deliver content from other sources, provide recommendations on learning materials or test the student. These types of interactions will enable the course participants to develop their knowledge in a way more static sources would not allow.

The innovative aspects are twofold. The first is the focus on creating and offer tools that allow any teacher to integrate the Tutor into their classes without difficulty and provide educational Tutor guidelines to successfully support coaching methods and students' learning. The second is content management based on the actual conversations with students. It will technically be possible to store, collect and analyze conversations from both macro and micro angles, which of course has to be aligned with data protection issues.

The Smart Authoring Tool and Chatbot Tutor provided by VISION are both meant to ease the setup of online distance learning for university teachers by offering tools which are simple to handle and time saving. However, they can only be helpful when users are capable of integrating these tools in their courses in a pedagogically professional way.

VISION's E-Course is therefore meant as support as well as addition to the Smart Authoring Tool and Chatbot Tutor, explaining the technical dimension of the tools, on the one hand, and the didactic dimension they offer, on the other. Only this way, the encouragement of learning processes and a continuation of qualitative teaching can be guaranteed.

Course participants will learn how to use the tools with the help of video tutorials as well as detailed written descriptions including screenshots of every single step. Accompanying these technical demonstrations will be information on the potential didactical value of the tools. The E-Course will be designed in a hands-on way so that the tools can directly be applied, which guarantees the transfer of theoretical knowledge to practical application in the various disciplines.

With the support of VISION's E-Course, both teachers and students will benefit in the following ways:

Higher education teachers will have:

- o *Technical support*: The E-Course offers a support system which ensures that HETs know how to operate the Smart Authoring Tool and the Chatbot Tutor, so that they can derive the maximum benefit from the tools' advantages and be less overburdened with online distance learning.
- o *Didactical support*: Moreover, the E-Course will provide HETs with the necessary didactical knowledge substantiating the Smart Authoring Tool and the Chatbot Tutor. It will show how the tools can be integrated in order to ensure an optimized support of their students' e-learning progress and, at the same time, how they can implement them in view of workload reduction for themselves. Various discipline-specific application possibilities will be outlined, and related opportunities and risks discussed.

Higher education students will have:

- o *Quality teaching*: By supplying HETs with the necessary technical and didactical knowledge of the Smart Authoring Tool and the Chatbot Tutor, students will profit from a high quality of teaching, which will encourage their maximum participation in the online course.

The project's E-Course is designed in a way that it reaches HETs from a variety of fields of study. Paired with the fact that it is an online format should guarantee its transferability even when implemented in project external institutions. However, to ensure this effective transferability, both the selection of measures/technical solutions to transfer plus an evaluation of the efforts and resources required for them to succeed will be included, taking into

consideration the proper knowledge of both origin and receptor contexts (e.g. funding availability).

4.2 VISION's Impact

VISION improves the quality of digital education in HE institutions by providing innovative online teaching and learning tools to HETs and HESs to meet individual learning requirements, accompany ongoing learning processes and make personalized learning the primary consideration in digital instruction in a pedagogically meaningful and competence-oriented way. The flexible, adaptive and student-oriented feedback and tutoring support as well as the attractive digital learning environment allows for individual engagement and active involvement with long-term learning effects which is indispensable, especially in uncertain times like the COVID-19 pandemic, in order to continue to guarantee high quality teaching.

By using the Smart Authoring Tool, HETs can easily create online courses without prior technical knowledge, which requires less temporal investment in the preparation of the online learning arrangement and design. Furthermore, the Smart Authoring Tool is an indispensable interface for the uncomplicated and seamless integration of the Chatbot into the various HE LMS systems which otherwise would require special technical expertise and resources. In combination with the Chatbot Tutor, teachers are relieved of answering frequent and often repetitive questions from students which do not need direct interaction with the teacher, which allows them to focus on more intensely on decisive key areas of their pedagogical responsibilities. At the same time, they are offered an insight into the student's e-learning progress allowing them to identify strengths and weaknesses which can be directly used to assess their own e-didactical and methodical course design and contributes positively to the professional development of HETs.

The E-Course will guarantee the tools' sustainability by providing an easy-to-understand tutorial on how to use the tools from a technical point of view as well as from a didactical one, and thus ensure that teachers efficiently and in a learner- and target-oriented way implement them in their courses.

University students benefit from more technically and didactically appealing online courses which offer dynamic and comprehensible learning contents. They profit directly from the project through the Chatbot Tutor. By having the possibility to use a tool to answer questions

as well as receive feedback on their learning status 24/7, students are no longer dependent on the limited and fixed times of teachers' consultation hours to access much needed answers and evaluation. They get constant support for learning more efficiently and can improve their learning processes at any time.

Universities profit from the project through the increased capabilities of their teaching staff to create and realize high valued online teaching. This decidedly qualitative teaching guarantees in turn a successful participation of students.

The project's participating organizations will profit from the consortium's diverse expertise and thus become a valuable resource for their own organizations. The relationships established in the consortium will also provide beneficial connections for further projects between the participating organizations.

Additionally, the Ministries of Education as well as stakeholders in the field of economics & research benefit from highly qualified graduates. We envisage that this project will have considerable impact within the partner organizations, each region or country that the partners operate in and throughout the EU by implementing the three intellectual outputs into their various HE systems.

4.2.1 Institutional Impact

The new tools represent concrete contributions to innovation in the field of digitization and will lead to an improvement in the digital education. The partner countries will benefit from increased quality in digital HE courses since they will be equipped with innovative digital tools that supplement their existing LMS with formats and methods allowing for individualized capacity building in view of the achievement of discipline-specific as well as 21st century skills.

4.2.2 Local and Regional Impact

The above-mentioned skills are intended to help students keep up with the lightning-pace of today's modern markets. The improvement of digital learning arrangements digital competences of HE teachers results in a better learning situation for the HE students and ought to improve the standards of education in all regions. At the level of regions and nations, it is an important step to create a highly educated workforce for a new economy, in which

personalization and customization are vital features of products and services. It's increasingly important for societies to cater to the education needs of every young person, not just to those of traditional academic high-fliers. The price of not doing so could well be increased social inequality and slower economic growth. High quality of digital HE courses enhances the future workforce within communities and regions required to adapt and improve upon a modern work environment and to make productive contributions to the local and regional development and prosperity.

4.2.3 National Impact

Austria, Germany and the Netherlands face the challenges of digitization in order to remain attractive in the educational HE sector in the future. The Federal Governments have therefore given digitization high priority in the government programs. Supporting HETs with the necessary tools and the underlying technical as well as didactical expertise is meant to create a certain educational standard at institutions of higher education. The ministries of education gain innovative pedagogic distance-learning tools for their higher education institutions. HE institutions profit from a more agile way of teaching and learning, which is meant to increase interest and motivation, will recognize widening partnerships with foreign HEIs with the scope of introducing innovative digital education standards.

4.2.4 European and International Impact

By working within a transnational consortium, the project's impact will leave the national boundaries and influence institutions of higher education at a European level. Additionally, the involved institutions can learn from each other and export this gained knowledge within the project to their national context in order to create a common European standard of online teaching relating to good practice at institutions of higher education. This involves a process of identifying, assessing and sharing the gained expertise and experiences during the development of the VISION project and the transfer of this knowledge to other European and non-European HE institutions. The development of the VISION IOs is aligned with four international standards of digital competencies for educators including the EU standard (DigCompEDU), UNESCO: ICT for Competency Framework for Teachers, A Global Framework of Reference on Digital Literacy Skills for Indicator 4.4.2 and International Society for Technology in Education Standards for Educators.

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