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Bit the Spectrum

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Use of technologies in the education of students with Autism Spectrum Disorder

Part of the Report on Skills in ICT sector, VET and special education

(T1.1: a desk research)

IRSEI · Otto von Guericke Universität Magdeburg · Skills Divers · 3D Bear · Ammattiopisto Luovi

Table of Contents

Introduction

BIT THE SPECTRUM (BTS) is an Erasmus+ Project that promotes social inclusion through the use of the most modern e-technologies in specific and innovative therapies for students with Autism Spectrum Disorder (ASD). The project is unique in its purpose, as it brings together experts in Information and Communications Technology (ICT) and experts working with Autism Spectrum Disorder for increasing the quality of the Vocational Education and Training (VET) teaching process addressed to students belonging to this target group. BIT THE SPECTRUM focuses on the use of Augmented Reality (AR) and Virtual Reality (VR) for this aim; tools that are lately becoming more common in learning environments.

Autism spectrum disorder is a developmental disability that can cause significant social, communication and behavioral challenges. There is often nothing about how people with ASD look that sets them apart from other people but people with ASD may communicate, interact, behave and learn in ways that are different from most other people. Therefore, it is essential to make a progress in the standards of the education of people belonging to this social group, in this case focusing our effort on upgrading the skills and tools of the professionals dedicated to their training.

BIT THE SPECTRUM will impact different target groups: Schools and VET Institutes, NGOs or associations working with people with ASD, Social Enterprises providing tools for special needs, and end users, learners with ASD.

This report will gather various Academic Literature and Good Practices among European Projects and other kind of programs that show positive and effective uses of those technologies (Augmented Reality and Virtual Reality) in the support of people with Special Educational Needs (SEN). These optimistic results entail a starting point of research that will lead the consortium into the development of new and innovative outcomes that will increase the quality of inclusive education and the cooperation between different European entities working on the field of education and technology development.

Finally, this research will shortly describe some of the latest existing data in the form of statistics, strategies and guidelines about autism in Europe, to better understand the scenario on the presence of this disorder in the Union and in the BIT THE SPECTRUM partner countries.

Academic Literature: research and evidences about the use of VR/AR for individuals with ASD

In this chapter, we are going to provide a small review of the main articles and studies dealing with the use of technologies with people in the Autism Spectrum Disorder (ASD) among the academic literature. The 9 papers reported in the text below must not be considered as an exhaustive list of scientific research on the use of Virtual and Augmented Reality in the ASD; the aim of this chapter is to simply give an overview of what has been recently discovered by the main academics working in the field.

An immersive virtual reality educational intervention on people with autism spectrum disorders (ASD) for the development of communication skills and problem solving (2019)

Reference:

Herrero, J. F., & Lorenzo, G. (2020). An immersive virtual reality educational intervention on people with autism spectrum disorders (ASD) for the development of communication skills and problem solving. *Education and Information Technologies*, *25(3)*, 1689-1722.

Summary:

This article proposes the use of an immersive virtual system in the education of students with ASD to train emotional and social skills. A group of 14 high functioning children with ASD was therefore selected and divided into two parties, a study group and a control group. The study group participants took part in immersive virtual reality intervention sessions carried out with head mounted display units. In two sessions, the participants were presented with different tasks and situations such as personal introductory or violence, taking place in a virtual environment that included interactive avatars (p. 1705). The results show, that immersive virtual reality corresponds well with the sensorial preferences of students with ASD and that it has the potential as an educational tool to improve their communication and social skills.

Notable: Use of a probabilistic evaluation approach (Herrero and Villar 2013, 2017).

Immersive Virtual Environments: a comparison of Mixed Reality and Virtual Reality headsets for ASD treatment

Reference:

Mascio, T. D., Tarantino, L., Gasperis, G. D., & Pino, C. (2019). Immersive virtual environments: a comparison of mixed reality and virtual reality headsets for ASD treatment. *International Conference in Methodologies and intelligent Systems for Technology Enhanced Learning*, 9th, 153-163.

Summary:

Mascio et al. compares two well established IVR tools in form of the head mount displays Oculus Rift and HoloLens concerning their usability, acceptability and engagement as educational tools for people with ASD. The test group consisted of 6 male individuals in the ages 21-23, all high functioning and diagnosed with ASD according to DSM V [3] (p.4). The results in the area of

acceptability were similarly good. Neither the attachment of the devices nor their use caused negative sensory or physiological experiences (p.7). In terms of usability the HoloLens seems to have benefits regarding the autonomy in managing the device (p.7). While only minor differences in the understanding of the possibilities can be noted between the devices, the Oculus Rift performs better in the area of interactive abilities (p.7). When it comes to engagement, the Oculus Rift got higher scores across the board but especially in "suspension of disbelief" (p.8).

Mascio et al. conclude that both devices are accepted and general usable with only a short training. While the Oculus Rift may be more suitable for learning applications due to the higher level of engagement, HoloLens could be utilised as a prosthetic tool to enhance coping capacities in social situations (p.9).

Design of a Virtual Reality Driving Environment to Assess Performance of Teenagers with ASD

Reference:

Wade, J., Bian, D., Zhang, L., Swanson, A., Sarkar, M., Warren, Z., & Sarkar, N. (2014). Design of a virtual reality driving environment to assess performance of teenagers with ASD. *International conference on universal access in human-computer interaction*, 466-474.

Summary:

Wade et al. designed a Virtual Reality driving simulator with the aim to improve driving skills of people with ASD. Equipped with various sensors, the simulator is able to distinguish behavioural patterns between participants with ASD and a control group. This could be the basis for an exercise protocol that is designed to meet the needs of teenage drivers with ASD (p.473).

Sense of presence and atypical social judgments in immersive virtual environments. Responses of adolescents with Autism Spectrum Disorders

Reference:

Wallace, S., Parsons, S., Westbury, A., White, K., White, K., & Bailey, A. (2010). Sense of presence and atypical social judgments in immersive virtual environments: Responses of adolescents with Autism Spectrum Disorders. *Autism*, *14(3)*, 199-213.

Summary:

A study looking at whether students with autism perceive IVEs (Immersive Virtual Environments) differently than typically developing children, based on cognitive, perceptual and sensory differences (p.199). Furthermore, the question is addressed whether IVEs can simulate ecological valid and valuable social situations. A group of ten children with ASD and a control group of 14 typically developing children got introduced to three different IVEs with socially desirable und undesirable characters and did report their sense of presence and the social attractiveness of those virtual characters. Both groups stated similar levels of presence and no negative sensory experiences. While the control group rated the social desirable characters as more socially attractive, students with ASD found the socially undesirable characters equally socially attractive. Wallace et al. conclude that those results indicate promising potentials of IVEs in education of students with ASD.

Avatar Assistant: Improving Social Skills in Students with an ASD Through a Computer-Based Intervention

Reference:

Hopkins, I. M., Gower, M. W., Perez, T. A., Smith, D. S., Amthor, F. R., Casey Wimsatt, F., & Biasini, F. J. (2011). Avatar assistant: improving social skills in students with an ASD through a computer-based intervention. *Journal of autism and developmental disorders*, *41(11)*, 1543-1555.

Summary:

Hopkins et al. assessed the computer-based social skills training program "FaceSay" regarding its efficiency. Children with low-functioning (LFA) as well as high-functioning autism (HFA) participated in the training and had the opportunity to improve their social skills abilities. Focal points were attention to eye gaze, discriminating facial expressions and recognizing faces and emotions in FaceSay's structured environment. While children with LFA improved in terms of emotion recognition and social interaction, children with HFA also improved in the third area, facial recognition.

The Effect of Interactivity on Learning Physical Actions in Virtual Reality

Reference:

Bailenson, J., Patel, K., Nielsen, A., Bajscy, R., Jung, S. H., & Kurillo, G. (2008). *The effect of interactivity on learning physical actions in virtual reality. Media Psychology, 11(3)*, 354-376.

Summary:

Virtual reality as a new learning tool specifically determined for training individuals in physical movements is the substance of this study. Two characteristics of VR are focused: extensive movement tracking options and the possibility to render many degrees of freedom to human motion in real time. The results of these two studies, which were carried out with the help of an image-based tele-immersive system, are promising. In the first experiment, participants registered a better learning outcome than in a video learning condition due to the ability of seeing the own avatar from a third person perspective. In Arrangement 2, a virtual mirror was added to the VR to allow participants even more angles for their self-observation. Those measures also resulted in better learning conditions then a video learning setup.

Augmented reality-based video-modeling storybook of nonverbal facial cues for children with autism spectrum disorder to improve their perceptions and judgments of facial expressions and emotions

Reference:

Chen, C. H., Lee, I. J., & Lin, L. Y. (2016). Augmented reality-based video-modelling storybook of nonverbal facial cues for children with autism spectrum disorder to improve their perceptions and judgments of facial expressions and emotions. *Computers in Human Behavior*, *55*, 477-485.

Summary:

The reduced ability of people with ASD to understand the emotions of others may has its cause in the fact that they cannot, or only barely, perceive or evaluate crucial nonverbal behaviors. Chen et al. designed an AR-based video modelling storybook to enhance the attention of children with ASD to nonverbal social cues. AR is used for the elaboration of social features as well as to keep the focus on the essentials of the video. Participants showed a higher attraction and maintenance to nonverbal social cues and a better understanding of facial expressions after the three-phased study.

Augmented reality plus concept map technique to teach children with ASD to use social cues when meeting and greeting

Reference:

Lee, I. J., Chen, C. H., Wang, C. P., & Chung, C. H. (2018). Augmented reality plus concept map technique to teach children with ASD to use social cues when meeting and greeting. *The Asia-Pacific Education Researcher*, 27(3), 227-243.

Summary:

Similar to Chen et al. (2016) this study focuses on the challenges that people with ASD have with nonverbal cues. Specifically, the reduced ability of social greetings is examined. The advantages of AR in attracting the attention of children with ASD and allowing them to concentrate on social cues is combined with a concept map strategy to create a training tool. This tool facilitates the training of an appropriate reciprocation in social greeting situations. Results showed substantial increases in target responses during the intervention phases and moderate effects in greeting responses of the participating children with ASD.

Effectiveness of virtual reality for teaching street-crossing skills to children and adolescents with autism

Reference:

Josman, N., Ben-Chaim, H. M., Friedrich, S., & Weiss, P. L. (2008). Effectiveness of virtual reality for teaching street-crossing skills to children and adolescents with autism. *International Journal on Disability and Human Development, 7(1),* 49-56.

Summary:

Besides challenges in social interaction many children with ASD also show difficulties with crucial everyday life situations such as street crossing. Virtual Reality facilitates to learn this skill without the potential dangers of the real world while enabling a variable complexity of tasks.

Josman et al. examined whether children with ASD are capable of learning and utilising the necessary skills for a street crossing, using a desktop street-crossing virtual environment.
After the intervention phase the experimental group made substantial improvements in their virtual street crossing skills. Half of the experimental group made considerable improvements in their real life pedestrian behavior.

Good Practices among European Projects

In this section we are going to see some examples of projects and relative outputs which have contributed to foster the use of e-tech in the education of people with Special Educational Needs (SEN). Some of these projects have been recognized by the European Commission agencies as "best practices" or even "story of success".

VR@School - Future schools using the power of Virtual and Augmented Reality for education and training in the classroom - *2018-1-RO01-KA201-049411*

BACKGROUND

This Erasmus+ project has been granted to a consortium led by a Romanian school, with other schools and organizations from Italy, Romania, Lithuania and Portugal; it was implemented between the years 2018 and 2021. The project was aimed to introduce a new concept in educational technology: Virtual and Augmented Reality. VR@School is a ground-breaking project offering a student-teacher friendly interface, practical resources and guidelines, embedded educational

resources and simple-to-use VR lessons designed to help raise engagement and increase knowledge retention for students.

AIMS

Evaluating the target group needs, the project proposes the following objectives:

- Open up teachers to the use of new technologies & online educational resources in their classes by offering them a ready-made collection of online tools & platforms to facilitate the teaching process &attract pupils to become more motivated & involved in learning. - Train teachers with the Virtual & Augmented Reality use in the classroom & motivate them to use this technology in the classroom.
- Develop VR lessons for science disciplines & for transversal topics with impact on a student's development such as: motivation to study/ job orientation/foreign languages/inclusive education/ prevention of school dropout.
- Guide school principals & teachers on how to implement the VR School Laboratory in their schools - Implement VR School Laboratories in the partners' schools & organize simulation lessons for science & transdisciplinary school disciplines using VR.

TARGET

In the presented context, the project involved the following target groups: teachers (including science teachers), students (secondary school), students with lower opportunities, from disadvantages areas/schools, with disabilities, in dropout situations or with poor school performance, school principals and trainers in school education.

OUTPUTS AND RESULTS

VR@School project offers the following products:

- O1: Teach@School Online Library - Educational Technology and Open Education Resources (50 OER catalogued and 40 lesson plans).

- O2: Teachers Guide on Virtual Reality in school education (1 Guide - 6 Modules, available in 5 languages (EN, RO, IT, LT, PT) , 6 video tutorials, 5 national trainings, 124 participants).

- O3: VR Educational Resources for science and transdisciplinary school disciplines (1 VR educational resources online App, 41 VR materials, 58 lesson plans in 5 languages, 15 school disciplines reached, over 100 students involved in simulations, 4 VR laboratories in 4 schools).

- 2 International Learning/Training Activities on Use of VR for teachers and on How to implement VR laboratories in your school, for teachers and school principals (53 participants).

- 5 Multiplier Events on VR@School - Virtual and Augmented Reality for education and training in the classroom (139 participants).

This project has been recognized as **Good Practices Example.**

The project outcomes are available at the following link of the Erasmus+ project results platform:https://erasmus-plus.ec.europa.eu/projects/eplus-project-details#project/2018-1-RO01-KA201-049411 or at the project website **vr-school.eu**

Brave New Words: innovative educational tools for training and teaching people with Special Learning Disorders.

2019-1-PL01-KA204-064981

BACKGROUND

Brave New Words is another Erasmus+ project (KA2, strategic partnership), which began in 2019 and will end in 2022, supported by a consortium composed also by SkillsDivers, one of the BIT THE SPECTURM partners, together with other partners from Bulgaria and Italy, and led by a Polish private University. The project aims to create innovative learning pathways that increase the quality of the work of educators and staff members dealing with students with Special Learning Disorders (SpLD), using 3D Printing and Augmented Reality (AR). SpLD is a type of Neurodevelopment Disorder that does not allow the ability to learn or use specific academic skills in one or more areas of reading, writing, math, listening comprehension, and expressive language, which are the bases for other academic learning. For this reason, students with SpLD need special and inclusive learning pathways

and tools for increasing their opportunities to reach proper learning outcomes. Furthermore, people often realize they have a learning disorder already in adulthood and this makes it more difficult to reach proper learning outcomes.

AIMS

The objectives of Brave New Words project are:

- Increasing the quality of the educational and "caregiving" process of staff working with people with SpLD.
- Providing proper tools to teachers, trainers and other staff members for working with people with SpLD.
- Increasing the quality of the learning process to people with SpLD.
- Increasing the quality of the adult inclusive education in the countries involved.
- Increasing the cooperation among different European entities working in the field of inclusiveness.
- Education and technology development.

TARGET

People with Special Learning Disorders, professionals and teachers dealing with that target.

OUTPUTS AND RESULTS

The use of 3D printing and AR technology will transform how people with SpLD will learn by offering a multi-sensory experience to them. For the development of multi-sensory methods and methodology, the new technologies (3D Printing and AR) can be useful tools for developing new inclusive tools.

The outputs that the project is developing are:

- O1: A Guideline for teachers and trainers about the use of 3D printing and Augmented Reality.
- O2: Set of exercises for using 3D printing and AR with people with SpLD.
- O3: Pilot phase
- O4: Set of webinars to maximize the impact of the final training version.

The project's results are available at the link (section results): https://www.bravenewwords.infoproject.eu/

VR4INCLUSION - Social and Physical Inclusion of Paraplegic Youth by Using Virtual Reality

2017-3-TR01-KA205-048243

BACKGROUND

Another Erasmus+ project (KA2, Strategic partnership in the field of youth work), which took place from the 2017 to the 2020, involving partners from Turkey, Poland and Greece.

AIMS

The ultimate goal of the project was to strengthen young people with the Spinal Cord paralysis to get involved in social life and support them to be self-sufficient young people. This aim has achieved by bringing technology and sports together with innovative outputs.

TARGET

This project was addressed to people with disability such as the Spinal Cord Injury (SCI). A significant proportion of people with SC paralysis lose some or all of their ability to walk and have to use wheelchairs. This permanent damage leads to loss of muscle functions, sensation and autonomic functions.

OUTPUTS AND RESULTS

Three intellectual outputs have been developed to answer that need:

- A field research for analyzing the current situation.

- Three VR (Virtual Reality) mobile applications that help them overcome the inaction problem of Spinal Cord paralysis.

- A social inclusion program built using international, non-formal teaching methods complementary to the VR practice to be developed.

The project has demonstrated significant positive impacts on the target audience and related institutions and people in the short term. In the medium and long term, the outcomes will offer added value to the lives of spinal cord paralyzed young people and individuals, thanks to the differentiation of games and development for the google and Oculus store, cooperation with the local government and the disabled units of the academy and the sustainable work of the partners. This is also the first content within this scope, which is produced for the target audience and has achieved significant success in attracting the attention of the private sector, game developers, decision-makers and educators to this field.

This project has been recognized as **Good Practices Example.** More information about the project is available at the following links:
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ALERRT: Autism on the Line!

2020-01-ES01-KA202-082056

BACKGROUND

The ALERRT project, began in 2020 and promotes autism awareness among first responders and the development of mutual trust between autistic people and their families, and first responders. It is a project granted thanks to the Erasmus+ program (KA2, strategic partnership), involving partners from several countries: Spain (coordinator), Italy, Cyprus, Belgium, Czech Republic and Portugal.

AIMS

The project is in its implementation process, with the aim to achieve the following objectives:

- To deliver training courses to VET trainers and first responders which will equip them with the necessary skills and strategies to support and interact with people on the autism spectrum.
- To design, test and launch an innovative training package for VET trainers who will be training the first responders.
- To help families and caregivers of autistic people connect with first responders so that they can develop mutual understanding and trust.

TARGET

Autistic people and its families and caregivers; first responders health.

OUTPUTS AND RESULTS

The project is willing to use Virtual Reality to create training scenarios for first responders to use as an interactive learning tool for completing simulations on how to recognize and treat autistic people in emergency situations.

- O1. ALERRT VET Training Curriculum for first responders.

- O2. ALERRT VET Training Manual for first responders.

- O3. A virtual reality training scenarios for first responders to use as an interactive learning tool for completing simulations on how to recognize and treat autistic people in emergency situations.
- O4: A Safety Kit for autistic people and their families. Develop an e-learning platform in order to host all the materials created during the project.

The project is still in implementation, but you can have a complete experience of the project activities and goals visiting the website at the following link: https://autismontheline.com/

BACKGROUND

It is a project implemented between the 2018 and 2020 by a consortium led by a Polish school and composed by other schools from United Kingdom, Finland and Turkey.

AIMS

The main aim of the project was to familiarize students and teachers with the STEM methodology and to introduce innovative teaching methods in each school that would combine teaching of natural and mathematical sciences as a common paradigm based on the problems of the modern world, and not as separate school subjects. For this purpose, during the project implementation, the consortium conducted a number of workshops, classes, smaller projects and challenges that helped to understand that school knowledge should be treated holistically.

TARGET

Students aged 15-18.

OUTPUTS AND RESULTS

The goal was to develop 21st century skills among project participants, i.e. developing critical and analytical thinking, creativity, digital skills, teamwork, communication in an international team and leadership skills. Thanks to a very broad perspective and the diversification of activities carried out by the project participants for 30 months, they showed what employment opportunities are offered by the STEM area, what professions can be performed under this methodology, and we tried to convince participants that it is also a discipline for girls and not how it is widely believed that STEM is the most successful discipline of men. All activities carried out under the project concerned such STEM areas as: robotics, natural and mathematical sciences, software, mobile applications, programming and coding, nanotechnologies, natural language processing. The project has been awarded as **Good Practice Example**. More details about its results are available at the following links:

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Other Good Practices

Besides the Erasmus+ projects recognized as good practices by the EACEA for their commitment to the topic of our interest, it is important to highlight the initiatives that have produced relevant outputs in line with the purpose and the spirit of the "Bit the Spectrum" project.

Autisme en ligne / Autism online

The Autisme en ligne / Autism online project is a free and open access self-service information platform for professionals, and particularly targeted at mainstream primary school teachers. The project aims to share pedagogical and didactic knowledge in order to promote the inclusion of pupils with ASD in mainstream education. The content of the platform, which is provided in French and English, provides professionals and parents with a range of pedagogical paths to work through with pupils with ASD. Different tools, such as videos of teaching practices and testimonials from professionals, are used in the training. A multimedia library is also available on the platform.

The online platform is available at the following link:

https://www.autisme-en-ligne.eu/?lang=en

DE-ENIGMA: autistic children exploring emotions with robots

It is a successful Horizon 2020 project which overall aim was to realize robust, context-sensitive, multimodal and naturalistic human-robot interaction (HRI) aimed at enhancing the social imagination skills of children with autism. This extends and contrasts considerably to the current state of the art in

existing technological solutions to machine analysis of the facial, bodily, vocal and verbal behaviour that are used in (commercially and otherwise) available human-centric HRI applications. Realising an on-going effective dialogue between the child and the robot as part of a therapeutic process to teach the children socioemotional skills such as recognising and displaying appropriate emotions and social behaviours in relevant contexts also requires effective robot behaviour planning and execution. The design of effective robot behaviours for the target user group as well as maintaining a social dialogue for the purpose of developing the children's skills over the longer term is a more personalised and long-term oriented effort than has previously been realised. This goes beyond state of the art of longer-term interaction or agent-based therapies which currently do not involve adapting behaviours as part of an autonomous assessment loop of increasing user skill development.

More info is available at the following link: https://de-enigma.eu/

Statistics on ASD in Europe

COUNTRY	Children with ASD per 10.000 units
Germany:	72,8
Finland:	73,2
Spain:	73
Italy:	72

Table 1 - Prevalence per Country (per 10.000 Children) according to The Global Health Data Exchange1

The state of research regarding prevalence rates for specific countries is narrow. Despite the data The Global Health Data Exchange provides, the German Federal Environment Agency states that specific numbers on the prevalence of people with ASD in Germany are not available. On European level as well as for the USA and Canada there is already a data foundation which is updated regularly. Furthermore, prevalence rates differ from study to study due to vary in scientific methods and sample

[1] https://worldpopulationreview.com/country-rankings/autism-rates-by-country

limits. In addition, there are no uniform criteria that allows a global identical diagnose procedure, so cited specific numbers should always be examined in light of their origin and context. But, most results indicate that around 1 in 100 people are affected by ASD.

Example:
While The Global Health Data Exchange indicates a prevalence rate of 80,9 for the U.S., the Center for Disease Control announced in 2021 that the rate of ASD in the U.S. is 1 in 44 children, which would correspond to a prevalence of 227,3.

European guidelines and strategies

The following guidelines and strategies are listed in order of relevance:

EU Strategy for the Rights of Persons with Disabilities 2021-2030

This strategy was built upon the results of the European Disability Strategy 2010-2020. The strategy focuses on the assuring that people with disabilities:

- enjoy their human rights
- have equal opportunities, equal access to participate in society and economy
- are able to decide where, how and with whom they live
- move freely in the EU regardless of their support needs
- and no longer experience discrimination

In case of the project "Bit the Spectrum", articles 5.2 and 5.3 of the strategy have the most significance. Article 5.2 thematizes equal access to, among others, education and acknowledges that there is a gap in EU law to ensure equal treatment of persons with disabilities not only but also in education. As a result, the Commission calls on member states to adopt the proposal for horizontal directive and to support the cooperation between the EU and the national UNCRPD frameworks.

Article 5.3 "Inclusive and accessible education" refers to the existing differences in learning outcomes between learners with and without disabilities and emphasizes the importance of equitable and inclusive education. The EU highlights inclusive education as one of the six axes of the European Education Areas, with the goal of improving employability and promoting lifelong learning. Among

others, the EU will enhance special education teacher training systems and provide a toolkit for inclusion in early childhood education and care.

Action Plan Educational Support and Inclusive Education (2019)

https://www.eursc.eu/Documents/2018-12-D-34-en-5.pdf
This action plan is the result of the 'Evaluation Report on the Implementation of the Educational Support Policy in the European Schools' report as well as the 'Inclusive Education in the European Schools' report. Considering the recommendations of both reports, this action plan provides a list of activities and measures to further strengthen educational support and inclusive education. These measures are ranked by their urgency and relevance. The actions noted cover the definition of the required qualification for educational support teachers, the improvement of qualification and training for teaching and non-teaching staff, accessibility, adaptability, enrollment and many other topics. While the short and mid-term actions should all have been implemented by the end of 2021, long-term actions are still ongoing.

Digital Education Action Plan (2021-2027)

https://education.ec.europa.eu/focus-topics/digital-education/action-plan As digital transformation has changed society and economy, it also requires the adaptation of
education to the new circumstances. But it is not only a necessity, but also an opportunity. While the Covid-19 pandemic has dramatically changed how education was implemented, it also showed what digital solutions are able to contribute. The Digital Education Action Plan acknowledges these developments and provides actions to support the sustainable and effective adaptation of education and training of the EU member states to the digital age. It is furthermore set to provide the infrastructure required for inclusive and resilient remote learning. In regards to the Bit the spectrum project both set priorities are of relevance:

Priority 1: Fostering the development of a high-performing digital education ecosystem As determined in the “Bit the Spectrum” description, the project aims to develop and provide digital learning environments using Augmented and Virtual Reality technology. The establishment of modern digital learning solutions is in line with actions 2 and 5. Priority 2: Enhancing digital skills and competences for the digital transformation The “Bit The Spectrum” project not only aims to provide state of the art digital educational solutions to experts and workers in the field but also to impart usable skills and competencies with digital educational solutions to teaching staff.

European skills agenda for sustainable competitiveness, social fairness and resilience (2020)

https://ec.europa.eu/migrant-integration/library-document/european-skills-agenda-sustainable-competitiveness-social-fairness-and-resilience_de

“Everyone has the right to quality and inclusive education, training and lifelong learning in order to maintain and acquire skills that enable them to participate fully in society and manage successfully transitions in the labour market.” Principle 1 of the European Pillar of Social Rights

The commitment of the EU to strengthen and engage in solutions for times most serious tasks, such as climate change or digital change, necessitates a shift of strategy and mindset. The European skills agenda for sustainable competitiveness, social fairness and resilience was developed to approach these tasks of a sustainable and digital transition. Condensed into 12 actions, the Agenda aims to ensure the right to training and lifelong learning through partnerships of States, companies and social partners. The development and extension of labour skills may be the major focus of the agenda. In Action 4 the commission proposes a modern EU policy for VET with attention on social fairness, inclusiveness and equal opportunities. This action highlights the importance of proper skills for young people on the labour market and promotes the inclusion of vulnerable groups. Therefore, a set of

activities are determined to be implemented at EU level focusing on a VET reform that allows digital readiness including staff and infrastructure.

Written Declaration on Autism of the European Parliament (2015)

https://www.autismeurope.org/blog/2015/09/01/the-european-parliament-written-declaration-on-autism/

In September 2015, the European Parliament officially adopted the Written Declaration on Autism. With the overwhelming support of 418 MEP's, the foundation was laid for the expansion and deepening of actions and services for people with autism in the European Union. This Written Declaration defines the preliminary stage and call for a European strategy for autism. The declaration acknowledges the effects of autism and confirms the understanding that early intervention can help overcome symptoms and significantly improve the level of independence of people with autism. Therefore, the European Union and its members are urged to commit to a strategic direction that is going to support an accurate detection and diagnosis of autism in Europe as well as a holistic approach to tackle the challenges of people with autism throughout their life. This strategy should encourage research, prevalence studies and best practice exchange regarding evidence-based interventions for children as well as support and habilitation services for adults.

The written declaration was followed by a conference in the European Parliament in 2015, which was attended by representatives for people with autism as well as delegates of the European Commission. During the conference for the ASDEU programme in 2018, Aurélie Baranger, Director of Autism-Europe, presented a list of key recommendations for a holistic strategic approach. To date, the European Union has not yet agreed on such a strategy.

Further European & National strategies

The purpose of this document is a wide-ranging but detailed overview of the situation at hand of shareholders, interest groups and of course people with ASD. The state of academic research, the outlines of other good practice projects as well as the ambitions of European Union are laid out in previous chapters. The following list of further literature contains information on national activities as well as other noteworthy data.

Spanish Strategy for people with Autism Spectrum Disorder: Spain first national Strategy for autism

http://www.autismo.org.es/sites/default/files/tea-01.pdf

Policy and Legislation on the Education for Children with Autism Spectrum Disorder in Finland: Overview of the policy and legislation that govern education in Finland.

Reference: Kärnä, E. (2019). Policy and Legislation on the Education for Children with Autism Spectrum Disorder in Finland. *Educating Students with Autism Spectrum Disorder in China and Finland*, 13-21.

Italy: Strategic agenda for Autism Spectrum Disorders: a public health and policy perspective

Only a brochure of said Agenda could be found: https://www.salute.gov.it/imgs/C_17_EventiStampa_216_programma_itemProgramma_0_fileAllegatoProgramma.pdf

UK: The national strategy for autistic children, young people and adults: 2021 to 2026

https://www.gov.uk/government/publications/national-strategy-for-autistic-children-young-people-and-adults-2021-to-2026/the-national-strategy-for-autistic-children-young-people-and-adults-2021-to-2026

Autism Europe: Non-profit organisation whose main objective is to advance the rights of autistic people and their families to help improve their quality of life

https://www.autismeurope.org

Summary and conclusions

During this document, the consortium has analyzed the most relevant academic literature and good practices around the topic of e-technologies in Special Education, more concretely in the Autism Spectrum Disorder. Moreover, additional information such as statistic data, European and national strategies and guidelines have been exposed to better understand the context and the reference points of this study.

Autism Spectrum Disorder needs recognition, support and innovative interventions. From the results obtained in this research, it is possible to conclude that e-technologies applied to education in general and special education in particular are greatly beneficial. Specially, in the cases where those technologies were applied to students with ASD, the use of 360 immersive virtual environments were proved to be positive and effective. Tangible improvements in the cognitive, perceptual and social skills of this target group have been addressed through the use virtual and augmented realities and interactive learning tools.

It is fair to recognize the results obtained by the different entities that have been working on the topic in the last recent years, as those organizations have contributed to increasing the quality of the work of professionals dealing with ASD students and they have fostered the use of e-tech in the education of people with Special Educational Needs (SEN). However, the idea of using Augmented and Virtual Reality to support VET teachers and professionals dealing with ASD students is an innovative approach that has not equal in the wide range of good practices and results that have come out from the most recent Erasmus+ projects (and others).

BIT THE SPECTRUM will create innovative learning pathways, using both of the technologies detailed in the previous chapters, increasing the quality of the work of educators and staff members in the VET inclusive education that deal with learners with Autism Spectrum Disorder.

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Links

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- vr-school.eu
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THANK YOU!