Comprehensive Report on Best Practices for VR in Education

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Introduction

As the landscape of education continues to evolve, the integration of Virtual Reality (VR) into teaching and therapeutic practices has emerged as a powerful approach, particularly in the realm of special educational needs (SEN). VR offers immersive, interactive experiences that can dramatically enhance the learning environment for students who face cognitive, motor, or social-emotional challenges. By creating virtual spaces where students can practice motor skills, engage in cognitive exercises, or participate in simulations of real-world tasks, VR opens new pathways for personalized, engaging, and adaptable learning.

This report brings together best practices from five Erasmus+ partner countries — **Turkey, Greece, Poland, Italy, and Spain** — each of which has implemented VR-based interventions to support SEN students. The key findings from these countries reveal how VR can effectively improve motor skills, boost cognitive functions, and foster social-emotional development. The purpose of this report is to identify common themes, successful strategies, and outcomes from these VR-based interventions that can be adapted and applied to the Erasmus+ VR-SEN project.

The adoption of VR in education is especially significant for SEN students who benefit from individualized attention and learning environments that can be tailored to their specific needs. Traditional education and therapy methods often struggle to engage these students in a meaningful way, while VR offers the potential to transform the learning process by making it immersive and interactive. Whether through motor skills training for children with cerebral palsy (CP), cognitive rehabilitation for students with autism spectrum disorder (ASD), or physical activity programs for children with developmental disabilities (DD), the countries involved in this study have shown that VR has a profound and positive impact on learning outcomes.

Moreover, the flexibility and adaptability of VR environments allow educators and therapists to customize the content and interaction based on the specific needs of each student. This customization makes VR a particularly powerful tool in inclusive education, where students with different types and levels of disabilities can engage in the same learning experiences with appropriate modifications. As VR technology continues to advance, its potential applications in education are likely to expand, offering even more opportunities for improving educational equity and accessibility.

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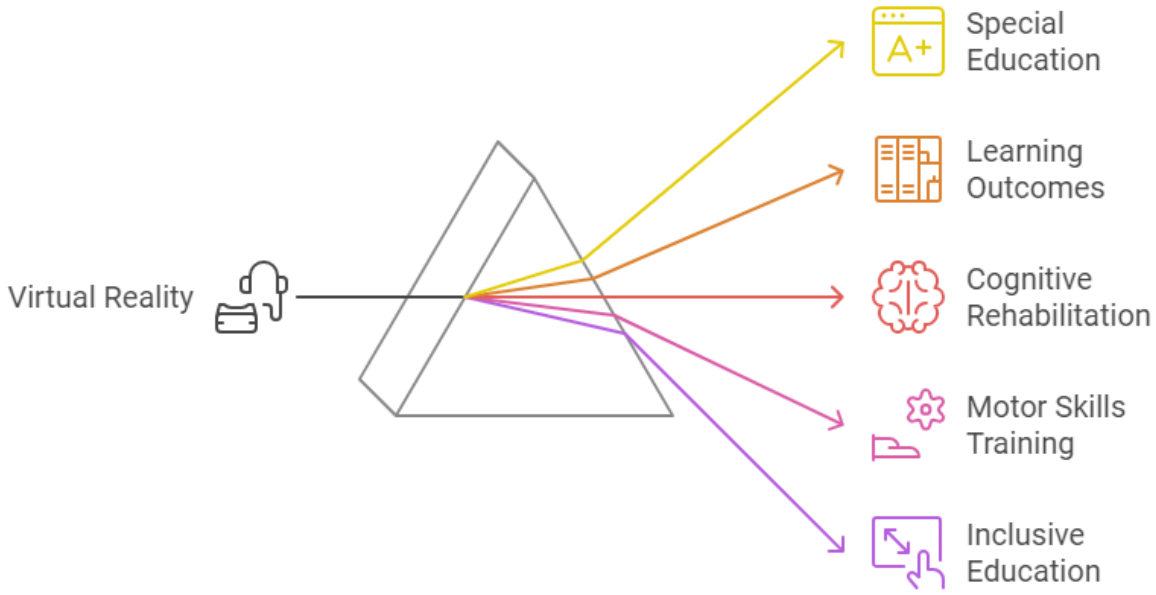

Common Results Across Partner Countries

Across the five partner countries, several consistent outcomes emerged from the implementation of VR in educational and therapeutic settings for students with special needs. These common results emphasize the broad potential of VR as a transformative tool in SEN education:

- **1. Enhanced Motor Skills**: VR interventions consistently resulted in improved motor skills, both gross and fine. Whether the focus was on hand-eye coordination, balance, or dexterity, VR provided students with engaging environments where they could practice and refine motor skills in a risk-free setting.
- **2. Increased Student Engagement**: A notable outcome across all interventions was the significant increase in student engagement and motivation. The immersive nature of VR, coupled with gamification and interactive elements, made learning more enjoyable and accessible, leading to higher participation and better outcomes in motor and cognitive training.
- **3. Cognitive and Social-Emotional Development**: VR was also effective in supporting cognitive development and social-emotional learning, particularly for students with ASD and intellectual disabilities. Activities designed to improve

emotion recognition, attention, and problem-solving through virtual interactions helped students build skills that are essential for their social and academic success.

- **4. Customizable and Adaptable Learning Experiences**: One of VR's greatest strengths is its ability to be tailored to individual student needs. This adaptability was highlighted in all countries, as educators and therapists used VR to adjust the difficulty level, provide real-time feedback, and create personalized learning experiences that aligned with each student's abilities and goals.
- **5. Effective Complement to Traditional Therapy**: In several cases, VR was used in conjunction with traditional therapeutic methods, such as occupational therapy, to enhance the overall effectiveness of treatment. The combination of VR and traditional methods often resulted in superior outcomes compared to conventional therapy alone, particularly in motor rehabilitation and daily life skill development.

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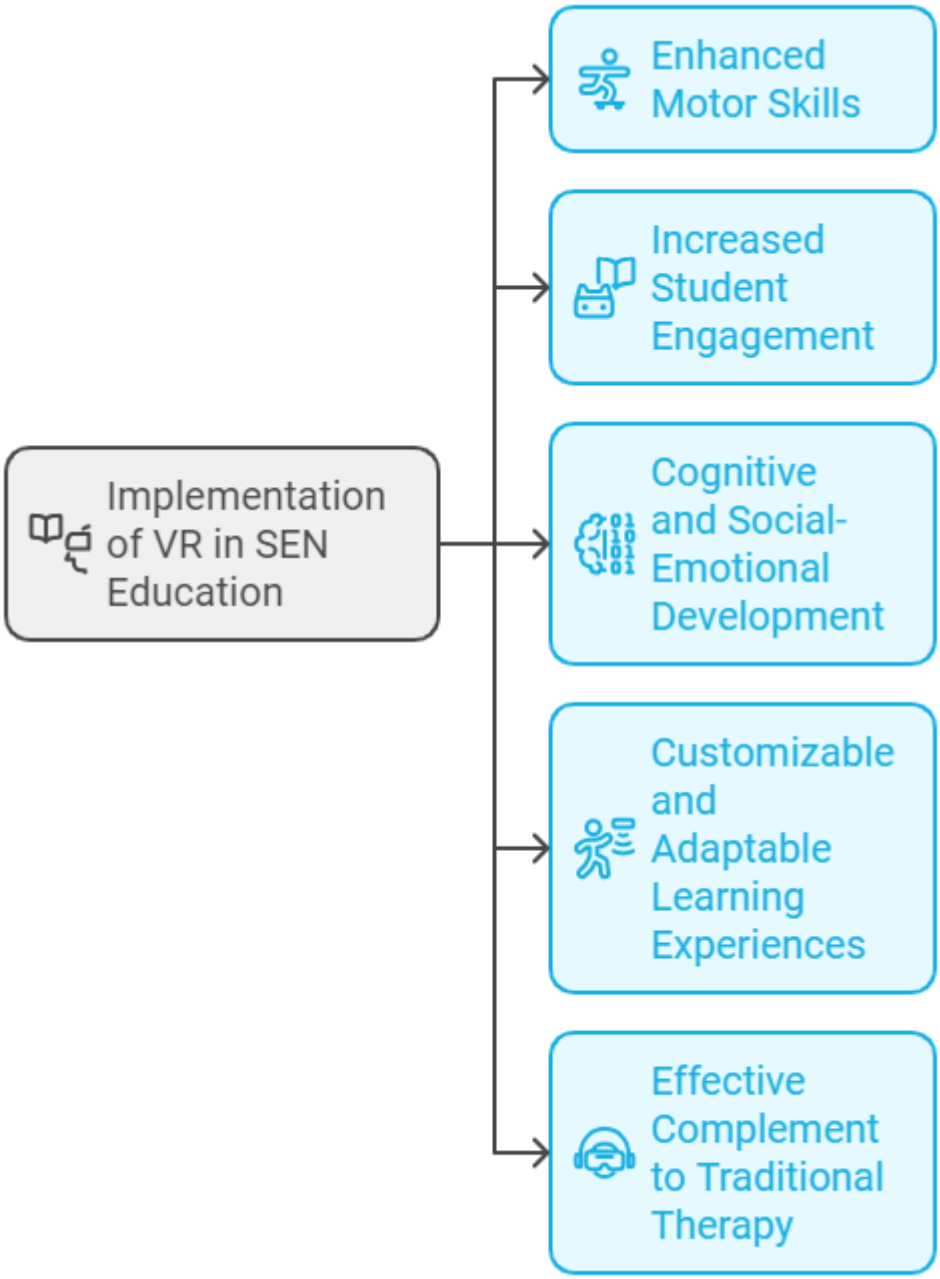

Best Practices from Turkey

Partner: Akdeniz University

1. Supporting Motor Skills in Children with ADHD through VR Applications

- **Description**: VR games like "Beat Saber" and "Danger Ball" were used to engage children with ADHD in motor skills training, resulting in improved hand-eye coordination, reaction speed, and balance.
- **Application to Project**: VR applications can be incorporated into the Erasmus+ project to improve motor coordination in students with ADHD.

2. VR for Motor Function Improvement in Cerebral Palsy (CP)

- **Description**: A Kinect-based VR intervention aimed to enhance both gross and fine motor skills in children with unilateral spastic cerebral palsy.
- **Application to Project**: This method can be adapted for VR-based motor rehabilitation in SEN students.

3. Teaching Pedestrian Skills to Children with Intellectual Disabilities

- **Description**: VR simulations were used to teach pedestrian skills to children with intellectual disabilities, successfully translating these skills into real-life contexts.
- **Application to Project**: This practice demonstrates how life skills can be taught using VR, which can be applied to various educational objectives in the project.

Best Practices from Greece

Partner: Diefthinsi Protovathmias Ekpaidefsis Fthiotidas

1. Wii-Based VR Training for Stroke Rehabilitation

- **Description**: Wii-based VR games were used to enhance upper-limb motor function and balance in stroke patients, with significant results in motor rehabilitation.
- **Application to Project**: This practice can be adapted to engage SEN students in fun, interactive motor skills training.

2. VR-Based Serious Games for Motor Learning in Autism Spectrum Disorder (ASD)

- **Description**: VR-based serious games were implemented to improve motor coordination in children with ASD, showing effective results in motor learning.
- **Application to Project**: Serious games can be tailored to improve motor skills for children with ASD.

3. VR-Incorporated Horse Riding Simulator (HRS) for Cerebral Palsy

- **Description**: This study combined a VR horse riding simulator with physical therapy to improve motor function and balance in children with cerebral palsy.
- **Application to Project**: VR simulators can be used for immersive motor rehabilitation.

Best Practices from Poland

Partner: Specjalny Ośrodek Szkolno-Wychowawczy w Świdniku

1. VR Interactive Whiteboard Lessons

- **Description**: VR lessons using goggles and motion controllers significantly enhanced student engagement and improved learning outcomes in early childhood education.
- **Application to Project**: This approach can be used to create immersive motor skills lessons for SEN students.

2. Cognitive Rehabilitation with Computer-Assisted Technologies (CAT)

- **Description**: CAT, including VR, supported cognitive rehabilitation in students with ASD and ADHD by improving attention, memory, and social-emotional skills.
- **Application to Project**: This method can be integrated to support both cognitive and motor skills development.

3. AR and VR for Intellectual Disabilities

- **Description**: AR and VR were used to improve motor skills and daily life activities for children with intellectual disabilities, offering customized, immersive experiences.
- **Application to Project**: These technologies can be used to provide tailored interventions for students with intellectual disabilities.

Best Practices from Italy

Partner: Igor Vitale International SRL

1. Augmented Reality for Autism Spectrum Disorder (ASD)

- **Description**: AR was used to improve social, cognitive, and motor skills in children with ASD by creating interactive environments for emotion recognition and social communication.
- **Application to Project**: AR can be used to complement VR interventions aimed at developing cognitive and emotional skills.

2. VR Rehabilitation for Children with Brain Injuries

- **Description**: VR was used for upper-limb rehabilitation in children with brain injuries, significantly improving dexterity and daily activity performance.
- **Application to Project**: This approach can be integrated into the project to enhance fine motor skills in children with disabilities.

3. VR-Based Procedural Learning for Intellectual Disabilities

- **Description**: VR was used for action observation and procedural learning in children with intellectual disabilities, improving both motor and cognitive abilities.
- **Application to Project**: This practice can be adapted to provide action-based learning experiences in the Project.

Best Practices from Spain

Partner: CEIP Federico García Lorca

1. VR Mirror Visual Feedback for Cerebral Palsy

- **Description**: Mirror visual feedback in a VR setting was used to improve motor function in adults with cerebral palsy, enhancing upper-limb flexibility and motor control.
- **Application to Project**: This approach can be adapted to support motor rehabilitation in children with cerebral palsy.

2. VR Exergaming for Motor Skills in Developmental Disabilities

- **Description**: A VR-based physical activity program using stationary bikes helped improve locomotor skills in children with developmental disabilities.
- **Application to Project**: VR exergaming can be integrated to engage students in physical activities that promote motor skills.

3. VR Rehabilitation for Upper Extremity Function in Cerebral Palsy

- **Description**: Combining VR with conventional occupational therapy led to significant improvements in upper extremity function in children with cerebral palsy.
- **Application to Project**: This practice can be used to improve fine motor skills and promote independent living

Conclusion

The best practices collected from **Turkey, Greece, Poland, Italy, and Spain** offer compelling evidence of VR's transformative potential in supporting students with special educational needs. The wide range of applications — from improving motor skills and cognitive functions to fostering social-emotional development and independence — underscores the versatility of VR as both an educational and therapeutic tool. The common findings across the partner countries highlight several key themes that can be integrated into the Erasmus+ VR-SEN project.

First and foremost, **VR consistently led to significant improvements in motor skills**, whether through specialized rehabilitation programs for children with cerebral palsy or interactive games for children with developmental disabilities. By providing students with immersive environments that encourage repetition, practice, and real-time feedback, VR proved to be an effective medium for motor training and rehabilitation. The personalized nature of VR allowed educators and therapists to adjust activities based on each student's abilities, ensuring that every child could participate in and benefit from the interventions.

Moreover, **VR's ability to increase engagement and motivation** was a critical factor in its success across all interventions. For students who often struggle to engage with traditional learning methods, VR provided an exciting and dynamic alternative. The gamified elements of many VR interventions kept students motivated, transforming otherwise monotonous exercises into fun and stimulating activities. This level of engagement is particularly important for children with attention disorders or ASD, as it helps maintain focus and facilitates more consistent learning experiences.

In addition to motor skill development, **VR also played a significant role in supporting cognitive and social-emotional learning**. Through carefully designed VR environments, students were able to practice recognizing emotions, solving problems, and navigating social interactions in a safe and controlled setting. This capacity for real-world simulation is one of VR's greatest strengths, allowing students to develop essential life skills that are transferable beyond the classroom or therapy session.

Another vital takeaway from the report is **the flexibility and customizability of VR**. Educators and therapists across all partner countries highlighted the importance of adapting VR content to meet the diverse needs of students. Whether adjusting the difficulty level of tasks, providing immediate feedback, or creating specific virtual environments, VR allowed for a highly personalized approach to learning and therapy. This adaptability ensures that students with a wide range of disabilities can benefit from VR-based interventions.

Finally, **VR's ability to complement traditional therapy methods** cannot be overlooked. In several cases, VR was used in conjunction with existing therapeutic practices, such as occupational therapy, to enhance outcomes. The combined approach often resulted in more significant improvements than traditional therapy alone, particularly in areas such as upper-limb function, daily life activities, and cognitive recovery.

As we move forward with the Erasmus+ VR-SEN project, the insights gained from these best practices will be instrumental in shaping a curriculum that is both **innovative and inclusive**. By leveraging the full potential of VR, we can create learning environments that are engaging, adaptive, and effective for students with a wide range of special educational needs. The goal is to provide every student with the tools and opportunities to reach their full potential, and VR offers a unique and powerful way to achieve this.