# Enhancing School Visits to Museums through GVR: A Complementary Approach to Learning and Social Engagement

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- **Areas of expertise and interest: E-learning tools, Experimental Neuroscience, HCI, UX/PX in Simulation/Serious Games and VR environments for Education/Health;**

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# I. Introduction

- Science education often struggles to make learning engaging and meaningful;

- Museums offer an opportunity to bridge theory and practice but still rely mainly on individual and passive visits 🖼️ 👀

- Traditional teaching methods focus on lectures and memorization, limiting students' active participation 🧠 💤

# I. Introduction

- The lack of practical and exploratory resources further restricts opportunities for hands-on learning 🛠️🔍❌
- As a result, students have fewer chances to develop critical thinking, creativity, and socio-emotional skills;
- Gamified Virtual Reality (GVR) emerges as a promising interactive and immersive learning approach.

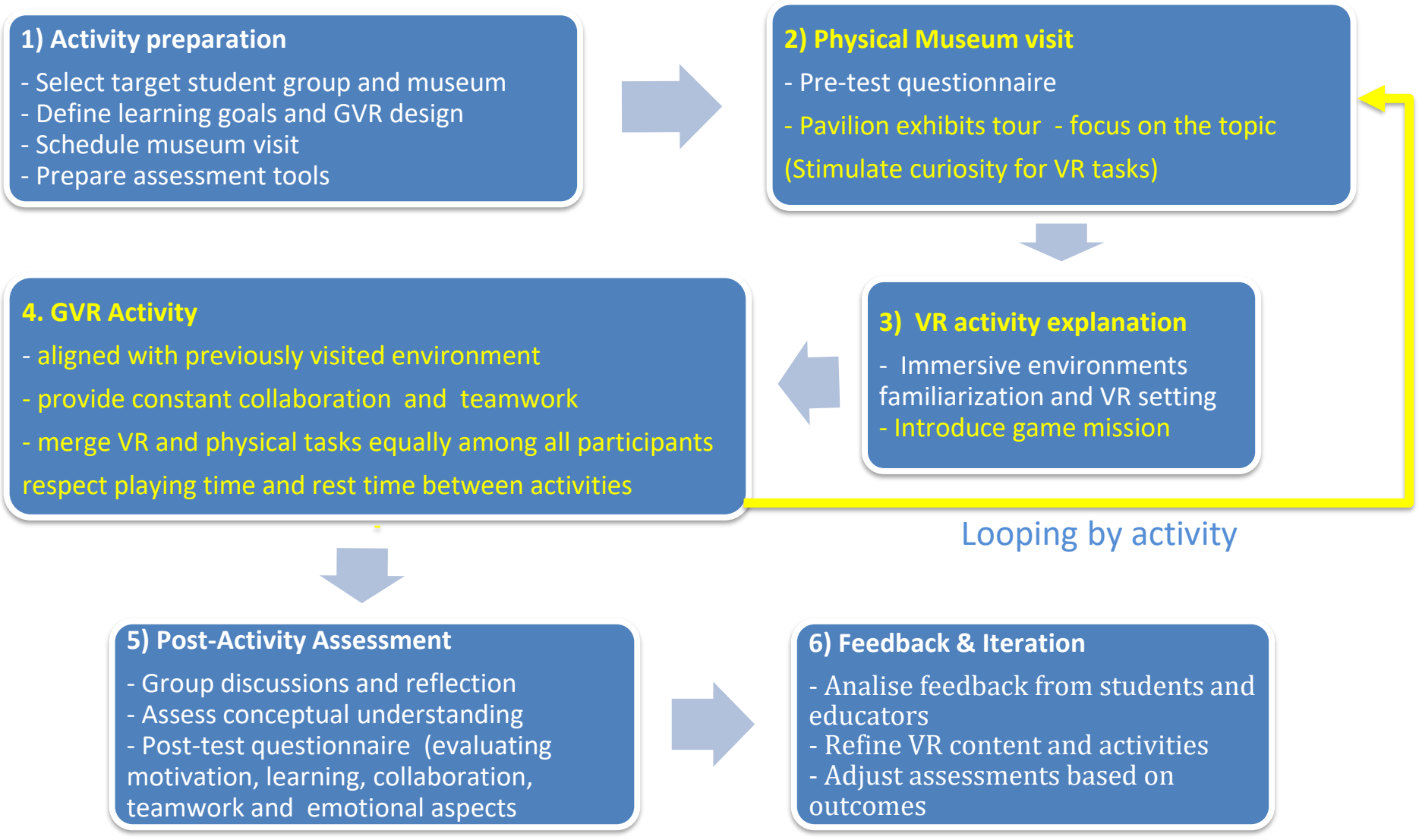
# VR & Gamification Potential in Museums

- VR may transform passive exhibitions into immersive and interactive experiences 🥽🌍
- Gamification is able to add missions, challenges, and collaboration into museum visits 🎯🏆👥
- These tools can boost motivation, engagement, and retention of theoretical concepts 🚀🧠😄
- Furthermore, they tend to foster communication, problem-solving, and socio-emotional skills during group activities. 🔬🕹️

# II. State of the Art

- VR in museums improves interactivity and engagement (Wang, 2024; Zhou et al., 2022)
- Most studies focus on individual learning, lacking social aspects (Yang et al., 2020; Bekele et al., 2021)
- Gamified VR can promote cognitive and socio-emotional skills (Portuguez-Castro & Santos Garduño, 2024; Zhuang et al., 2024)
- Need for hybrid models integrating physical and digital visits (Yang et al., 2020)

# III. Proposed Hybrid Methodology



# Suggested GVR Activity – Natural History Museum: The intruder

1. **Physical Exploration**
   → Observe the correct species compositions in each habitat;

2. **Virtual Immersion**
   → In groups, one student using VR headsets, see virtual replicas intentionally altered, and try to find *intruder species;*

3. **Group Collaboration**
   → Classmates without VR, identify mismatches between the VR and revisited physical habitats;

4. **Problem Solving Task**
   → Groups identify all misplaced species and justify their reasoning taking note in the answer sheet;

5. **Feedback and Reflection**
   → The group discusses the outcome, corrects misconceptions, and consolidates learning about ecosystems and species habitat.


Semiarid VR Intruders: dragonfly and starfish

# Suggested GVR Activity – Natural History Museum: Minerals in My Life

**1 Physical Exploration**
→ Observe the mineral collection and their primary applications in daily life through displays and interactive explanations.

**2 Virtual Immersion**
→ In groups, one student using VR headsets, explore realistic 3D models of residential/workplace spaces identifying objects/products composed of minerals;

**3 Group Collaboration**
→ Classmates without VR, search in physical displays if the products founded in the VR environment has minerals in their composition;

**4 Problem Solving Task**
→ Groups identify which minerals are present or no in each virtual object, linking them to their real-life applications and taking note in the answer sheet;

**5 Feedback and Reflection**
→ Groups sharetheir findings and reflect on the importance of minerals in modern life.

VR Kitchen products: sugar, matchsticks and insecticide

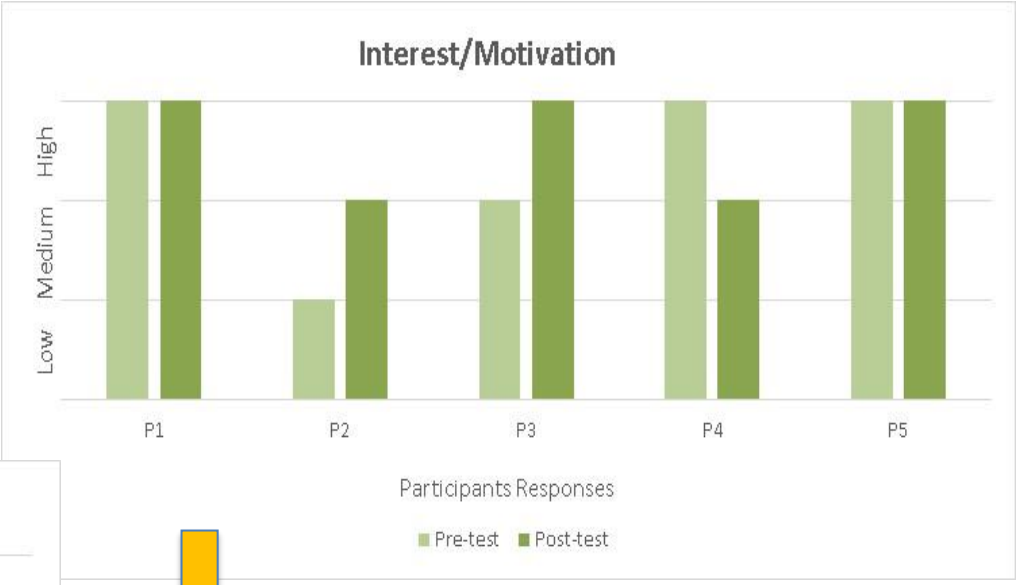
# IV. Expected Learning and Skills Benefits

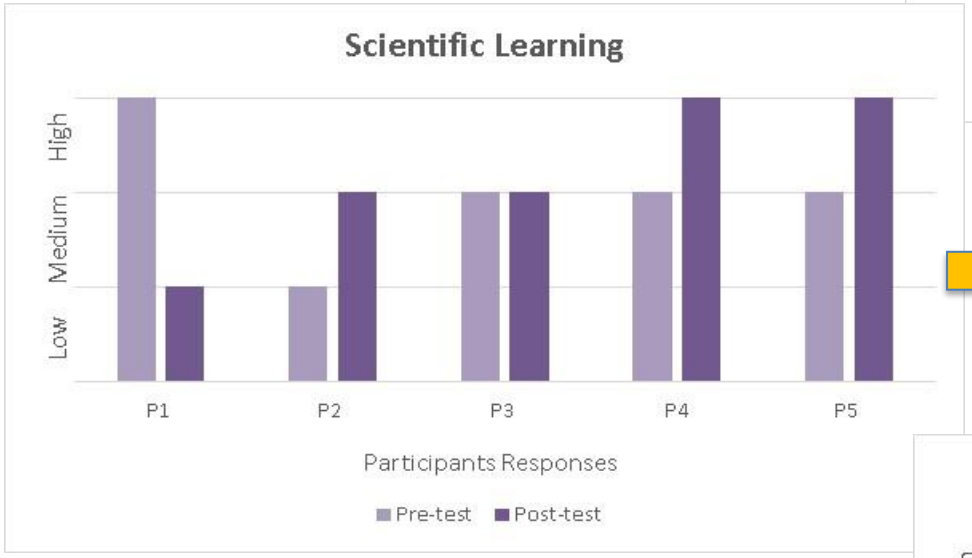
- Transforms passive observation into active and interactive learning 👀 ➔ 🥽 🤹 🧑‍🔬
- Boosts motivation and improves understanding of theoretical concepts 😕 ➔ 🚀 🧠 😀
- Fosters communication, collaboration, and problem-solving skills 🧍 🧍 ➔ 👥 💬 🧩
- Enhances cognitive and socio-emotional skills for meaningful learning 🧠 💡 🤝 ❤️ 😊

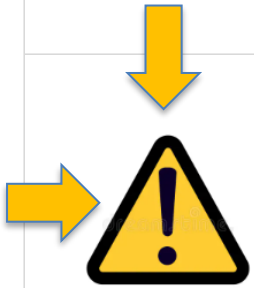
# Pilot Study

- Sample:  5 students  (3 girls and 2 boys group with high intellectual abilities) from an Educational Center – Almeria City/ Spain;
- Age: 8 -12 years;
- Activity location: Natural History Pavilion – Almeria University.

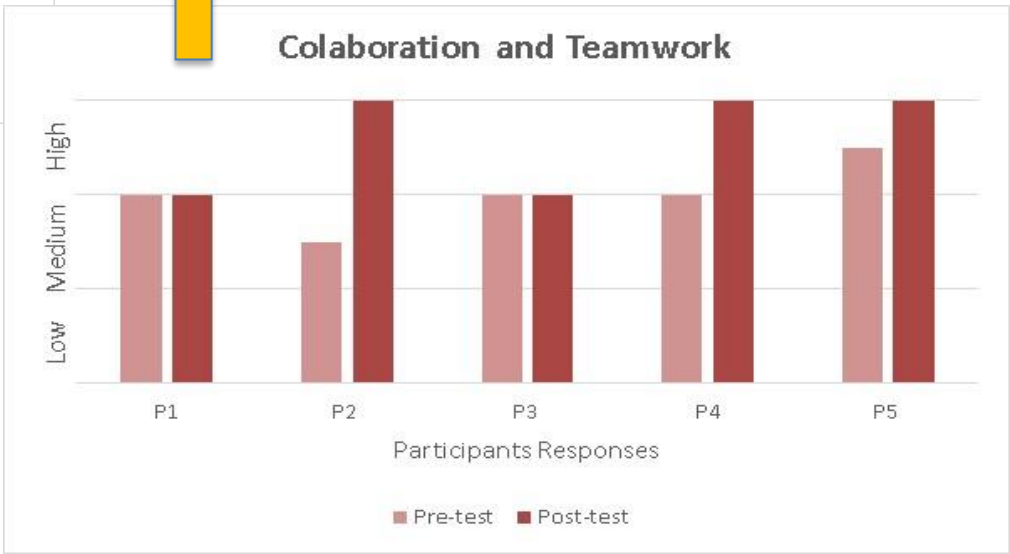
# Pilot Study - Results



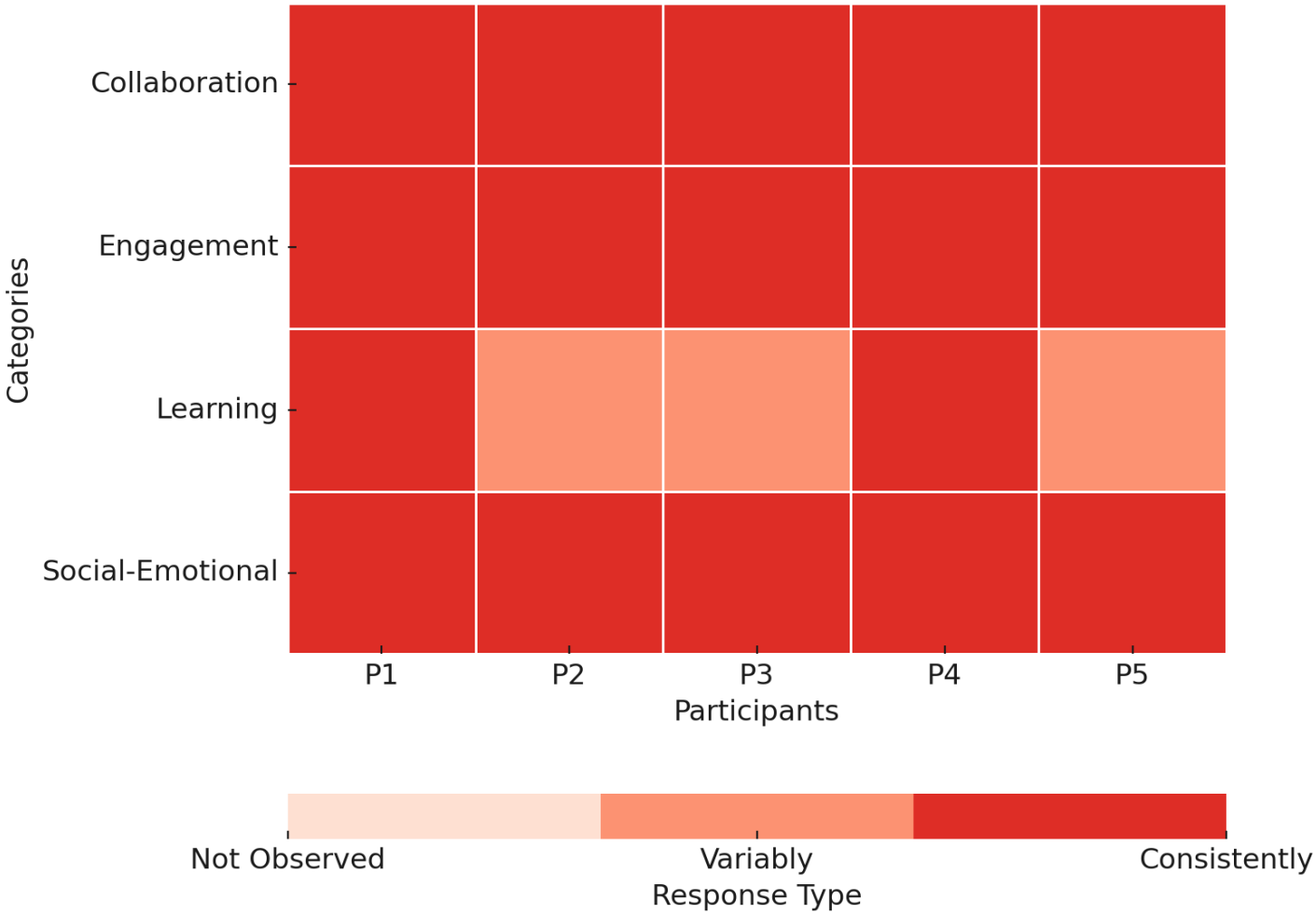
- High expectations (frustration)
- Different levels of knowledge (grade level)




**Did you enjoy the activity?**

# Pilot Study - Results

**Records obtained from direct individual observations of participants conducted by the authors.**



## ✓ Limitations

- High costs of hardware and software;
- Limited adaptability of GVR to learner characteristics (age, educational level, and socio-emotional differences) if not properly designed.

## ✓ Challenges

- Consolidate interdisciplinary and institutional cooperation to ensure wider implementation;
- Pedagogical planning, technological training for educators, and breaking learning routines.

# V. Conclusion

- **GVR** has the potential to enhance learning experiences in museums;
- In hybrid formats, it may serve as a consistent strategy for integrating theoretical knowledge with practical applications;
- Its use may foster active engagement, collaboration, and socio-emotional skill development;
- When properly adapted, this methodology can support diverse learner profiles.

## ✓ Future Directions

- Investigate the long-term impact of the methodology;
- Compare effectiveness across different age groups and socio-emotional contexts;
- Integrate technological tools such as AI and eye-tracking to enable personalized VR experiences;
- Expand the model to other disciplines such as art and history;
- Build and consolidate institutional partnerships to achieve scalability.

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# THANK YOU !!!

We sincerely thank you for your attention and interest in our research.

Should you have any questions or wish to discuss the topic further, please do not hesitate to contact us.

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