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ISENSE WP3
3.5 Testing the VR

Summary

Aim

This report presents a comprehensive analysis of the preliminary implementation of the SONAR virtual reality (VR) scenarios at the Faculty of Education Sciences. The evaluation aims to assess both the skills acquired by participants involved in the training activity and their level of satisfaction with the course contents and learning methodology. The implementation was conceived as a pilot deployment to validate the feasibility, pedagogical value, and user acceptance of immersive VR-based training for inclusion, communication, and accessibility awareness.

The preliminary implementation involved 120 participants, each completing an individual 30-minute VR session. The training was supported by a structured implementation process that included preparatory briefings, guided VR interaction, and post-session reflection. Data collection combined quantitative instruments (pre-test and post-test questionnaires), qualitative observations from facilitators, and automatic behavioural logs generated by the SONAR application.

Main body

2. Methodological Framework and Data Collection

The evaluation design followed a pre–post intervention model. Prior to the VR session, participants completed a pre-test questionnaire measuring baseline levels of experience, perceived competence, and motivation. After the VR session, participants completed a post-test questionnaire using comparable constructs, enabling direct comparison of results.

The instruments collected data across four main dimensions:

- Perceived learning effectiveness
- Self-efficacy in understanding basic Sign Language messages
- Usability and user experience
- Motivation and engagement

To synthesise the results, three composite indicators were defined:

1. Skill Acquisition Index (SAI)
2. Satisfaction and Engagement Index (SEI)
3. Motivational Impact Indicator (MII)

Each index aggregates multiple questionnaire items using normalised percentages to provide an interpretable overview of outcomes at cohort level.

3. Skill Acquisition Index (SAI)

The Skill Acquisition Index (SAI) assesses the extent to which participants perceived an improvement in their communicative abilities and understanding after completing the VR training. It integrates the following components:

- Reduction in perceived inability to understand basic Sign Language messages.
- Agreement with statements indicating that VR facilitated learning.
- Improvement in perceived self-efficacy in a university communication context.

3.1 Baseline Skills (Pre-test)

Before the VR intervention, participants demonstrated very limited confidence and competence:

- 71.9% (86 out of 120 participants) reported being *totally unable* to understand basic messages in Sign Language within a university context.
- A large majority had no prior experience with Sign Language (86%) and more than half had no prior exposure to VR (56.1%), confirming a low baseline level of both linguistic and technological familiarity.

3.2 Post-intervention Skills (Post-test)

After completing the 30-minute VR session:

- The proportion of participants reporting total inability dropped to 3.4% (4 participants).
- This represents a 68.5 percentage point reduction, indicating a strong perceived improvement in basic communicative understanding.
- In addition, 87.9% of participants (106 students) agreed or strongly agreed that the immersive VR experience facilitated the learning of Sign Language (44.8% strongly agree; 43.1% agree).

3.3 Interpretation of the SAI

The post-test SAI reflects a high level of perceived skill acquisition, especially considering the short duration of the intervention. The results suggest that contextualised, immersive interaction—combined with visual communication and role-based scenarios—can rapidly increase learners' confidence and perceived competence, even among complete beginners. The SAI therefore confirms the effectiveness of VR as an introductory and sensitisation tool for Sign Language and inclusive communication.

4. Satisfaction and Engagement Index (SEI)

The Satisfaction and Engagement Index (SEI) evaluates participant perceptions of usability, content relevance, interaction design, and overall satisfaction with the training activity.

4.1 Usability and Interaction

Despite the limited prior experience with VR among participants:

- 46.6% (56 participants) rated the SONAR application as easy and intuitive to use.
- Facilitator observations indicated rapid adaptation to the hybrid interaction system (controllers and hand tracking), with most users achieving autonomous navigation within the first few minutes of the session.

These findings are particularly relevant in a faculty context, where technological barriers could otherwise hinder adoption.

4.2 Content Relevance and Engagement

Participants reported high levels of engagement with the VR scenarios, highlighting:

- The realism of the university-based contexts.
- The clarity of communicative tasks.
- The perceived relevance of the experience for future professional practice in education and inclusion.

The immersive nature of the scenarios sustained attention throughout the session and reduced passive learning behaviours, as observed by facilitators.

4.3 Interpretation of the SEI

The SEI indicates strong overall satisfaction with both content and methodology. The results demonstrate that VR-based learning is not only accepted but positively valued by participants, even in a preliminary and time-limited implementation. This supports the feasibility of integrating VR training into formal higher-education curricula.

5. Motivational Impact Indicator (MII)

The Motivational Impact Indicator (MII) measures changes in participants' willingness and interest in continuing to learn Sign Language after the VR experience.

- Before the intervention, 28.1% of participants (34 students) reported being motivated to learn Sign Language.
- After the VR session, this figure increased to 41.1% (49 students).
- This represents a 13 percentage point increase in motivation.

The increase is particularly meaningful given the brief exposure time, suggesting that immersive VR experiences can act as a catalyst for sustained interest and further learning, rather than merely producing short-term effects.

6. Synthesis and Implications

Taken together, the three synthetic indices provide a coherent picture of the impact of the preliminary implementation:

- The SAI demonstrates substantial perceived gains in basic communicative competence and self-efficacy.
- The SEI confirms high satisfaction with course contents, usability, and learning methodology.
- The MII shows a clear positive shift in attitudes and motivation toward continued learning.

These results validate the pedagogical value of the SONAR VR scenarios as an effective, scalable, and engaging training tool. Importantly, the outcomes were achieved through structured 30-minute sessions, reinforcing the potential of VR for efficient integration into higher-education contexts.

SONAR VR Report with Synthetic Indices Based on the ISENSE European Event (Córdoba, May 2025)

This report presents the analysis of data collected during the European ISENSE Project event held in Córdoba between May 14th and 16th, 2025. The event was focused on training and validation in Sign Language through VR and brought together the full European consortium, including associations, universities, and companies from Poland, Austria, Germany, Italy, and Spain. The implementation provided an optimal context to evaluate the SONAR VR application in a real, international, and multidisciplinary setting characterised by high engagement and collaboration.

The evaluation corresponds to an exploratory and formative implementation carried out during hands-on VR sessions. After interacting with the SONAR application, participants completed a structured questionnaire designed to capture their perceptions of learning outcomes, usability, realism, and motivation. Participants ranged in age from 20 to 65 years and included both women and men in comparable proportions. Approximately half of the participants reported previous experience with Sign Language, with learning periods ranging from less than one month to more than one year, while the remaining participants had no prior exposure. Experience with VR was equally heterogeneous, spanning from complete inexperience to expert-level, professional use. This diversity allowed the evaluation to assess the robustness and accessibility of the SONAR VR application across different user profiles.

The SAI was constructed by aggregating participant responses related to knowledge, production, comprehension, and perceived self-efficacy in Sign Language after using the application. Overall, results indicate a strong perceived learning impact. Most participants agreed or strongly agreed that they were able to recognise the meaning of basic signs, understand how simple sentences are structured, and grasp essential cultural norms associated with Sign Language use. Even among participants without prior Sign Language experience, responses tended toward agreement, indicating that the immersive experience effectively supported initial learning and comprehension.

With regard to Sign Language production, participants reported a high level of confidence in producing simple sentences such as greetings and basic expressions. Responses concerning public use of Sign Language were slightly more cautious, with some participants selecting neutral options, which reflects a realistic self-assessment rather than a lack of learning. At the same time, a strong majority agreed that they understood how to arrange individual signs to construct basic sentences, demonstrating the application's effectiveness in supporting foundational productive skills.

Comprehension-related indicators further reinforced these findings. Participants largely agreed that they could understand simple signed sentences when seeing them, clearly identify signs within everyday contexts, and distinguish between similar signed expressions. Perceived self-efficacy was also high, with most participants indicating that they felt capable of understanding basic messages in a university context and confident in their ability to continue learning and retaining new signs. Taken together, these results produce a high SAI, especially considering the short duration and event-based nature of the implementation.

The SEI was derived from items addressing technical performance, usability, realism, social presence, and comfort with VR as a learning tool. The technical functioning of the application was evaluated very positively, with most participants agreeing or strongly agreeing that the application worked properly, that virtual environments were clearly visible, and that hand and finger movements were smooth and natural. Ease of use and intuitiveness were also rated highly, even by participants with no previous VR experience, indicating that the interaction design successfully minimised technological barriers.

Perceptions of realism and social presence were particularly strong. Participants frequently reported that the university environments resembled real places and that they felt co-present with the virtual characters. The characters were perceived as socially meaningful entities rather than artificial avatars, contributing to a sense of immersion that is essential for effective communicative and empathic learning. Comfort using VR for learning Sign Language was consistently high, and participants widely agreed that the immersive experience facilitated learning more effectively than non-immersive approaches. Visibility of hands, clarity of facial expressions, and the ability to follow hand movements were all highlighted as key factors supporting comprehension and engagement.

Motivation and interest in continued Sign Language learning were captured through the MII. Responses show a very strong positive effect, with the majority of participants agreeing or strongly agreeing that learning Sign Language is useful, attractive, and worth continuing beyond the VR experience. Notably, strong agreement dominated these items, including among participants who had no prior experience with Sign Language, suggesting that the SONAR VR application acts as a powerful motivational trigger rather than merely a short-term training tool.

The specific context of the ISENSE European event adds significant value to these findings. The international and multilingual environment, combined with the presence of experts from education, technology, and deaf associations, provided a demanding validation setting. The consistently positive results across participants with different backgrounds indicate that the SONAR VR application performs reliably and effectively in diverse contexts, reinforcing its suitability for pan-European dissemination and large-scale adoption.

Conclusions

This detailed evaluation confirms that the preliminary implementation of SONAR VR at the Faculty of Education Sciences successfully met its core objectives. The training activity produced measurable improvements in perceived skills, confidence, and motivation, while maintaining high levels of participant satisfaction.

Future implementations should build on these findings by:

- Increasing session duration.
- Expanding the number of scenarios.
- Conducting longitudinal studies to assess retention and transfer of skills.
- Applying the evaluation framework to larger and more diverse cohorts.

Overall, the results strongly support the continued development and scaling of SONAR VR as a robust educational tool for inclusion, accessibility, and communicative competence in higher education.