Intellectual Output 1-Task 4

A complete report of a pedagogical framework for training SEN teachers

CONSORTIUM

This document has been produced by the consortium of the INTELed project

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Executive Summary

This report describes INTELed pedagogical framework and presents the fourth task of the first Intelectual Output (IO1) of the INTELed project. It is the result of the previous tasks carried out in this intellectual output, namely, IO1-T1: A state of the art on current practices in the education and training of SEN teachers in the involved countries (INTELed consortium, 2018a); IO1-T2: A review of embodied learning applied to supporting SEN children (INTELed consortium, 2018b) and IO1-T3, a list of tools and educational resources for the support of SEN children (INTELed consortium, 2018c). This pedagogical framework is the basis for second intellectual output, IO2, devoted to the development of the INTELed methodological framework and resources for teacher training.

The INTELed pedagogical framework is structured in three main aspects: (a) the theoretical background regarding embodied learning; (b) the identification of the embodied interaction resources and tools that are best suited to support the envisioned learning approaches; and (c) the description of the educational context(s) where the project will be put in practice. The analysis of these aspects and the relationships between them frame a set of activities that will be carried out in the next INTELed outputs and their expected contributions. These activities and contributions are also presented, as they are part of INTELed pedagogical framework.

It is expected that the work carried out in the rest of the project will help to complement and to refine the pedagogical framework with new knowledge about the application of embodied learning approaches to inclusive learning contexts. For this reason, the content presented in this report can be considered an initial framework which will evolve during the project.

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1. Introduction

The INTELed project aims at supporting teachers in acquiring knowledge and skills about the use of interactive multi-sensory learning technologies for addressing the needs of SEN children in inclusive educational settings.

To that end, the first intellectual output of the project (IO1) is focused on proposing a pedagogical framework explaining the main concepts involved and the relations among them. This conceptual structure will serve as the basis for presenting the key ideas of the project to its primary users, i.e., in-service teachers (both SEN and mainstream ones) involved in the INTELed training events on how ICT multisensory technologies can be used for promoting learning in inclusive educational settings.

The pedagogical framework is the fourth task of IO1, and the result of the previous tasks carried out in this intellectual output, namely, IO1-T1: A state of the art on current practices in the education and training of SEN teachers in the involved countries (INTELed consortium, 2018a); IO1-T2: A review of embodied learning applied to supporting SEN children (INTELed consortium, 2018b) and IO1-T3, a list of tools and educational resources for the support of SEN children (INTELed consortium, 2018c). This pedagogical framework is the basis for second intellectual output, IO2, devoted to the development of the INTELed methodological framework and the resources for teacher training.

The framework is structured around three main aspects: (a) the theoretical background regarding embodied learning; (b) the identification of the embodied interaction resources and tools that are best suited to support the envisioned learning approaches; and (c) the description of the educational context(s) where the project will be put in practice. The analysis of these aspects and the relationships between them frame the activities to be carried out in the rest of the INTELed outputs and their expected contributions. These activities and contributions are also part of the framework.

The structure of the document is as follows. First, the document presents the structure of the pedagogical framework, and a short overview of the concepts involved in it, with references to the reports of previous tasks in IO1 where these concepts are described in depth. Then, the report describes the activities that will be carried out in the next outputs to face the challenges identified in the field, and the first set of guidelines or recommendations derived from the work carried out in these previous tasks. These recommendations will be taken into account in the work carried out in IO2 and IO3, and are by themselves outputs of the project to be shared with the community of practice built in IO4. Then, final remarks about the evolution of this framework during the project lifespan are presented.

2. Pedagogical framework for training SEN teachers

The three main areas covered by the INTELed pedagogical framework, which have been studied in IO1, are the theoretical background related to embodiment and its relation with learning, the characterization of the most appropriate ICT tools and resources to support the learning

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experiences foreseen in the project, and the educational contexts in which the pilot studies will take place. Figure 1 presents graphically the relevant components of these three areas, as well as the main activities in which INTELed will focus and the expected outcomes that will help to face the identified challenges. The rest of this section describes the three elements of the framework.

2.1. Theories of embodiment and learning

The theoretical foundations of INTELed stem from the theories of embodiment and their confluence with theories of learning, that have resulted in the ideas of *embodied learning* (Leitan & Chaffey, 2014). Embodied learning is a contemporary theory of learning which emphasizes the use of the body in the educational practice (Anderson, 2003; Wilson, 2002). The concept of *kinesthesic learning* (Ayala, Mendívil, Salinas, & Rios, 2013), although with different theoretical roots, can be used as a synonym, with an emphasis in promoting sensorimotor perception as a means of learning.

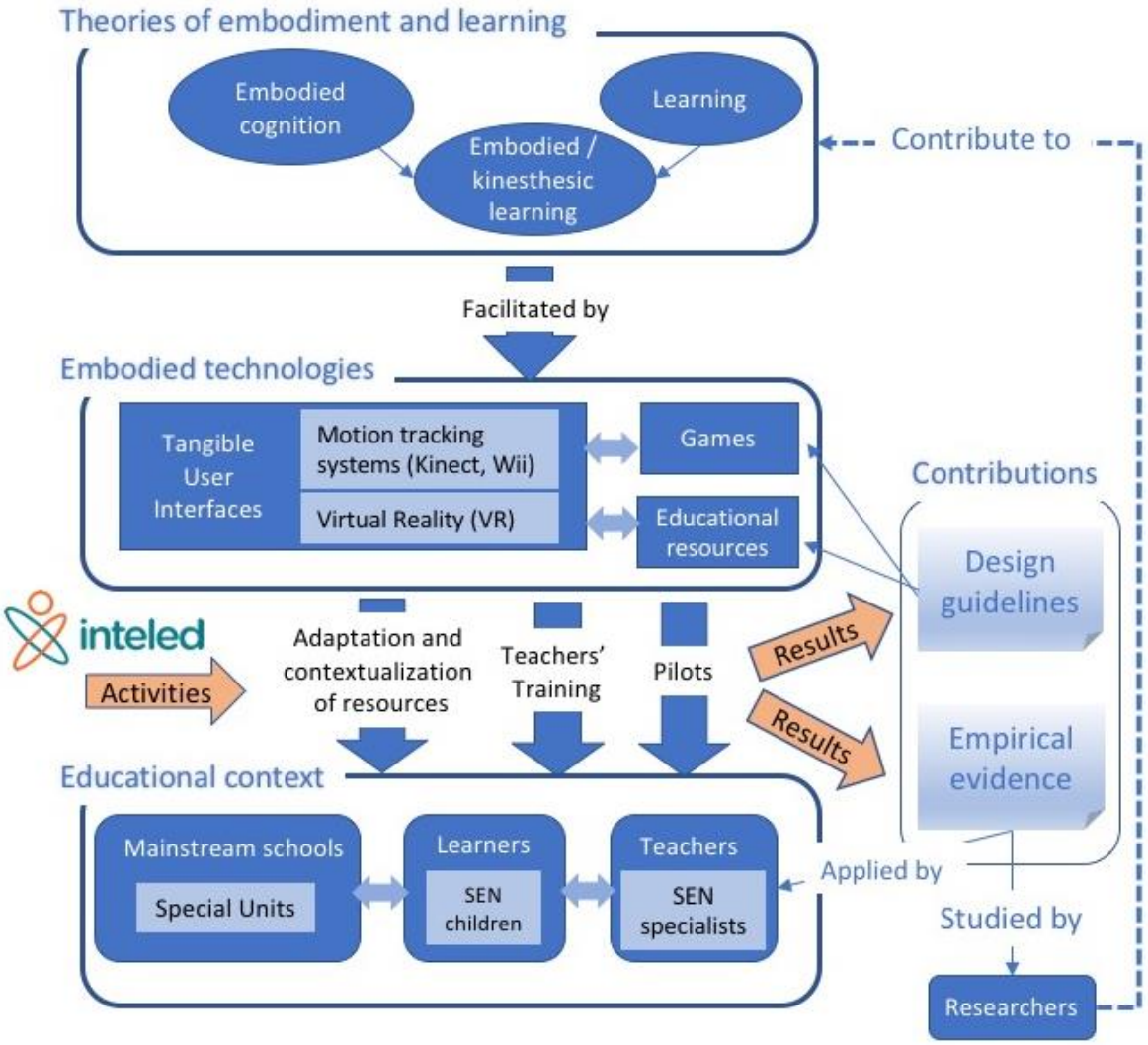

Figure 1. INTELed pedagogical framework, summarizing the work carried out in O1

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Although the concept of embodied learning is intuitively understood, the actual characteristics that have to be met by a learning activity in order to consider it a case of embodied learning are not yet completely defined. In O1-T2 (INTELed consortium, 2018b) we draw on Lindgren & Johnson-Glenberg, (2013) to identify these characteristics:

- the sensorimotor activity,
- the relevance of gestures to the theme that is to be reproduced, and
- the emotional involvement of the participant in the whole process.

These characteristics should be taken into account by the consortium when designing the educational proposals and interventions during the project.

An open issue that has been identified in the review carried out in IO1-T2 (INTELed consortium, 2018b) is that there is limited empirical research studying the use of embodied technologies in real classroom settings, which is one aspect in which the project INTELed is meant to contribute.

2.2. Technologies supporting embodied learning

The emergence of new forms of interactive technologies has increased the interest in the theories of embodiment, as these technologies are seen as a new opportunity of implementing and studying the theory of embodied learning.

The review presented in IO1-T2 shows that the definition of these technologies is rather blurred. In IO1-T2 we propose the term “Tangible User Interfaces” (TUI) (Ishii & Ullmer, 1997) as the most widely accepted to refer to them. A TUI is an interface in which a user interacts with a digital system through the manipulation of a physical object, including his own body, augmenting the physical world by coupling digital information and everyday physical objects and environments.

The classification of devices as whether they can be considered or not TUIs is also issue of discussion. For example, gesture-based interfaces could be considered a basic kind of TUI, which would open up the field of embodied interaction to almost any kind of device used nowadays (tablets, mobile phones, etc.). However, this approach would broaden too much the scope of the project, loosing the opportunity to focus on the specific affordances of the technologies implementing higher degrees of embodiment.

To respond to this issue, we drew on the taxonomy proposed by Johnson-Glenberg, Megowan-Romanowicz, Birchfield, & Savio-Ramos, (2016) presented in section 3 of IO1-t2 (INTELed consortium, 2018b), that classifies the technologies in four levels, depending on three aspects:

- the amount of sensorimotor engagement;
- the amount of gestural congruency;
- the amount of immersion.

Based on this classification, the INTELed consortium proposed to focus on the technologies with high levels of achievement in the taxonomy, i.e., motion-based interactive interfaces, (e.g., Kinect, Wii, and Leap Motion) as well as technologies implementing virtual reality (VR).

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Once the scope of the project was defined, the work in IO1 was complemented with a review of available resources for embodied learning applied to SEN children (INTELed consortium, 2018c). This review shows that, although there exist proposals based on VR (Cai, Chiew, Nay, Indhumathi, and Huang (2017), most of the available resources are games implemented for Kinect cameras. The reason for the choice of this particular technology is given by Ojeda-Castelo, Piedra-Fernández, Iribarne, and Bernal-Bravo, (2018). They analyzed the benefits of Kinect cameras against similar technologies and they found that Kinect cameras offer good levels of accuracy in identifying the body movements, an open API, a voice-recognition system and an RGB camera, and it does not need calibration. Moreover, Kinect cameras are relatively affordable, and cheaper than other specific technologies that are used in special education.

The review to existing empirical work carried out in IO1-T2 shows that these technologies have been mostly employed in special schools or special units in mainstream schools, by therapists working with children with some kind of special need. The most frequent special needs addressed so far are: motor impairments, Autistic Spectrum Disorder (ASD) and other cognitive disabilities, as shown in the review presented in section 4 of IO1-T2, (INTELed consortium, 2018b). The results also show that there is still need of more empirical evidence on the effectiveness of these tools, and a lack of knowledge about their potential use and benefits in classrooms in the context of inclusive education.

2.3. Educational context

Taking into account the results from the review of the application of embodied learning to special education needs, INTELed faces a challenge that has been not yet sufficiently explored, by aiming at exploring how these technologies can be applied in inclusive schools. However, education of children with special needs differs among countries and with the specific cases, as described in IO1-T1 (INTELed consortium, 2018a). For this reason, INTELed will also address the application of embodied learning in special units situated in mainstream classrooms, where the children spend part of the time with the rest of the classmates and part of the time with the therapists in the dedicated special unit.

The educational context is completed with the description of the participants of the pedagogical activities carried out in the project. These participants will be teachers, on the one hand; and students, on the other. The teachers participating in the project will be both mainstream teachers that have children with special needs in their classrooms, as well as specialists working with these children in mainstream schools (either as assistants of the main teachers or in special units). The second group of users will be the children themselves. The project is primarily aimed at SEN students that share totally or partially their time with the rest of their classmates at the classroom. The project will have to address the needs of these classmates while planning and evaluating the interventions.

The analysis of the educational context, and more specifically of the teacher training practices in each country participating in INTELed carried out in IO1-T1 (INTELed consortium, 2018a) has helped to identify the requirements of teacher training in the context of the project. INTELed's teacher

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training events will have to provide support to the teachers in understanding and applying the principles of inclusive education; help them become familiar with the technological and pedagogical resources proposed by the consortium to implement course plans adapted to the children in their context, and to put in practice these plans and share the experiences in a community of practices. New educational resources will also be needed to complement the teacher training needs.

3. INTELed design guidelines - Initial version

The analysis of the three elements presented in the previous section helps to identify the main activities and challenges to be faced by the project, as well as the expected contributions derived from the activities, which are depicted in Figure 1.

3.1. INTELed main activities and challenges

The first challenge faced by the project is the adaptation of the ICT tools and resources. There is a need to adapt and contextualize the affordances of the selected tools and resources (mostly grounded on motion tracking systems such as Kinect and Leap Motion) to the educational contexts where the project will be enacted, i.e., inclusive schools and special units within mainstream schools. From the list of existing resources and tools provided by INTELed, the teachers and the specialists participating in the teacher training events will adapt and contextualize those more suitable to their needs and define the lesson plans to use them in their contexts. To respond to the challenges related to teachers' education regarding SEN and embodied learning, INTELed will provide a complete program of teacher training, addressing the identified requirements. The training program will include pilot studies where the participating teachers will be able to put in practice and validate the educational resources adapted by them to their particular context.

These activities will result in two main contributions. From the experience of the teachers applying the embodied learning technologies and the educational resources to the classrooms, INTELed aims at collecting further empirical evidence about how this approach applies to inclusive educational contexts, which is an unexplored issue. The project also aims at providing incremental evidence about the usage of these ICT tools and resources in special units, and eventually to explore whether the work carried out in these units can benefit the children when they are with their classmates at the classroom. These pieces of evidence can help other teachers (organized in INTELed's community of practice) learn from others' practices and apply them to their cases. The results from these experiences are also a very important input for researchers in embodied learning and may contribute to the theoretical foundations of this approach, which is still in need of more strong evidence and reflection. A second expected contribution of the project is the identification of a set of design guidelines for the tools and the educational resources for embodied learning applied to SEN children in inclusive educational contexts.

From the review to the literature already performed in this output, we have been able to identify a first set of design guidelines, that are presented in the next section. However, we expect that our experience in the implementation of the embodied tools and resources in real and innovative educational contexts during the second year of the project will help enrich the design guidelines.

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3.2. First approach to the INTELed design guidelines

As aforementioned, the review work carried out in IO1 has yielded a set of guidelines for the design and implementation of embodied learning experiences applied to SEN children.

A first group of recommendations refers to the best ways of designing of ICT educational resources and tools (mainly games) so that they comply with the requirements set by SEN children and their teachers.

Malinverni et al. (2017) proposed an inclusive design approach aimed at improving the poor quality of existing video games oriented to children with special needs (more concretely, ASD). The method presents strategies to integrate the expertise of the therapists, contributions of children, and experience of designers. Their objective was to design games that were at the same time effective in terms of therapeutic objectives and enjoyable for children.

Bossavit and Pina (2014) present a framework, which aims at facing the challenge of adaptability, by including a set of actions that enable the system to create users' profiles and then, offer adapted games according to each user's profile.

Altanis, Boloudakis, Retalis, and Nikou, (2013) make two recommendations related to the design of games for children with SEN, which they applied to the design of the games included in the Kinems suite.

- Adaptability to the content, the gestures and the game elements. The teacher or therapist should be able to modify the settings of the game on the fly so that the game can be adapted to the learners' needs.
- Integration of learning analytics modules for monitoring and assessment. The data from the interaction (score, mistakes, replay of the interaction movements) can be stored so that the educators can see the children's progress as it is depicted with learning and kinetic analytics.

A second set of design guidelines refers to how to adapt games to the needs of children with SEN.

Malinverni et al. (2017) applied their inclusive design approach to the design of the game "Pico's Adventures" and carried out an exploratory study with 10 children. From this experience they derived a set of guidelines and suggestions for future work in the design of therapeutic games for children with ASD:

- To promote behaviors related with social request, it is advisable to design cooperative game mechanics where different resources are distributed between the players to achieve a common goal.
- Game mechanics that use physical contact should be avoided, as they may hinder social communication by promoting an instrumental use of the other player.

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- To facilitate social initiation potential solutions can be found in the use of surprising and unexpected elements.

- To promote exploration and avoid repetitive behaviors, relevant design solutions a can be found in the use of "peephole" strategies.

Bartoli, Corradi, Garzotto, and Valoriani, (2013) propose a set of principles that should be considered at the time of evaluating the appropriateness of a game. These are: distress (the sense of mental or emotional suffering and anxiety); positive emotion, need for intervention agency (autonomy) and usability gap (correctness of actions with respect to game logic and interaction rules). Although these are not design guidelines, the principles help guide the design and selection of games for a particular set of users.

A third set of guidelines refer to the principles of therapeutic interventions that could be applied when designing games for children with SEN. For example, the approach followed by Altanis et al. (2013) is grounded on 4 principles of therapeutic-educational intervention:

- Repetitive exercises
- Personalized flow of learning activities
- Combination of visual, auditory and kinesiology stimuli
- Step-wise activities with frequent feedback and reinforcement

A final set of recommendations could be oriented to help SEN teachers and therapists orchestrate their classes when using these technologies and educational resources in settings different from the one-to-one model typical in special units. However, there are no guidelines like those, which is coherent with the fact that this type of inclusive scenarios is yet unexplored. INTELed project aims at contributing to this challenge.

4. Final remarks and future work

This document has presented a summary of the work carried out in IO1, synthesised it in the form of a pedagogical framework, which is depicted graphically and described in the text. The report includes a first approach to the set of guidelines for the design and enactment of embodied pedagogical resources in inclusive learning situations.

The pedagogical framework describes the current state of INTELed partners' understanding of the issues related to the project and will serve as a basis for the methodological framework defined in IO2. It will be also useful to present the main ideas of the project to different stakeholders, and specially, to the teachers involved in the teacher training events and piloting experiences.

It is expected that the framework will evolve with the implementation of the teacher training events and especially with the implementation of the INTELed pilots. The refinement to the framework will be published in new versions that will result from the intellectual outputs that follow IO1.

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