Intellectual Output 3-Task 5

Collection of good practices

Executive Summary

The INTELed project aimed at providing teachers with knowledge and skills about the use of interactive and embodied learning technologies oriented to students with and without disabilities in the context of inclusive and special education. Through the INTELed method, the participating teachers were trained to address the needs of ALL their students, with and without disabilities in inclusive education settings.

Subsequently, the trained teachers were asked to do pilots in their schools across the 4 participating countries (Cyprus, Greece, Italy and Spain), applying what they have learned during the INTELed training. In particular, the school pilots contributed in the evaluation and validation of the INTELed innovative training method at the partner countries, while at the same time allowed the collection of best practices.

Upon completing their school pilots, the participating teachers were invited to a local, close event organized in each partner-country. During the event, SEN teachers were encouraged to discuss lessons learned from their experiences and share good practices that emerged from the use of the INTELed method in authentic school environments.

Cases of good practice from each partner-country were subsequently fully documented as "Best Practices" to be shared between the partners and became available in the project's website for open access. This report focuses on the presentation of the INTELed best practices, collected during the school pilots as well as of the cases of good practice in the four consortium partner countries: Cyprus (P1-Cyprus University of Technology), Greece (P2-University of Piraeus), Italy (P3-CESIE) and Spain (P4-University of Valladolid).

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1. Introduction

Despite the tremendous educational affordances of embodied digital apps in inclusive education, their implementation and integration in authentic educational settings is not yet a systematic area of research. Embodied digital apps are usually proprietary and inaccessible as they are mostly developed for research purposes and are often based on expensive and technology-demanding installations (e.g. virtual/mixed reality rooms) (Karakostas, Palaigeorgiou, & Kompatsiaris, 2017). Likewise, existing research in relation to the investigation of embodied digital apps has been limited and fragmented, taken place in highly-controlled laboratory settings or out-of-school contexts, employing small student samples (Georgiou & Ioannou, 2018; Malinverni & Pares, 2014).

As such, it is not a surprise that a critical examination of existing empirical studies has indicated that due to the small sample size, the statistical power was not always sufficient for the analyses conducted, for verifying and generalizing the positive findings identified or for establishing the learning effectiveness of embodied digital apps in comparison to current instructional forms (Hwang et al., 2014; Johnson-Glenberg, Birchfield, Megowan-Romanowicz, & Snow, 2015). In addition, in a recent review effort, Georgiou and Ioannou (2019) found that, as embodied digital learning apps are usually employed in the context of out-of-school activities or in laboratory settings for experimental purposes, there is an unprecedented lack of empirical research investigating how these digital innovations could be integrated more effectively in the school classrooms. However, for this field to grow and become a more mainstream one, research should be oriented toward the successful integration, classroom orchestration and evaluation of embodied digital learning apps in inclusive educational settings, considering the school curricula, both content-wise and time-wise.

Considering the state-of-the-art literature, the INTELed project aimed at deepening research in the emerging area of embodied digital learning apps inclusive education. More specifically, the project aspired at conducting cutting-edge research contributing to scale up the implementation and effective integration of embodied digital apps in inclusive education settings. To accomplish this overarching research goal, the INTELed European project aimed at training special and general education in-service teachers in acquiring knowledge and skills about the use of multi-sensory technologies for addressing the needs of their students with (and without) disabilities in inclusive and special educational contexts. Teachers' training was accompanied by evidence of its effectiveness through pilot studies in schools at the four partner-countries. Via a set of school pilots led by the trained teachers, the project concluded with a large-scale evaluation, to result in a set of empirically-driven best practices (classroom orchestration guidelines and integration scenarios), establishing the learning effectiveness of the INTELed training method. In the next sections of this report we will provide a debrief of the INTELed best practices, collected during the school pilots as

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well as in the presentation of the cases of good practice in the four consortium partner countries: Cyprus (P1-Cyprus University of Technology), Greece (P2-University of Piraeus), Italy (P3-CESIE) and Spain (P4-University of Valladolid).

2. Presentation of lessons learned & sharing of good practices

Two main types of implementations emerged during the INTELed school pilots in the four consortium partner countries, according to the educational context in which the school pilots took place.

- **Implementations in general education settings:** The implementations which were enacted in the general education settings, focused on the integration of the selected embodied digital apps within the general education classroom, in order to engage ALL of the students (with and without disabilities) in the learning process via the embodied pedagogy.
- **Implementations in the special education settings:** On the other hand, the implementations which were enacted special education settings, focused on the integration of the selected embodied digital apps within the special education classrooms and units, in order to provide individual support to SEN students with more serious forms of disability via the embodied pedagogy.

Upon completing their school pilots, the participating INTELed teachers, were invited to a local, close event, during which the participating INTELed teachers were encouraged to discuss lessons learned during their school pilots. In particular, as part of this reflective activity teachers were asked to report a set of best practices and strategies that could contribute to more successful learning interventions in (a) general education settings and (b) special education settings.

Figures 1-2. Teachers in Cyprus reflecting and sharing their best practices

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An overview of the INTELed teachers in Cyprus sharing their impressions and best practices can be found in the following YouTube video: https://www.youtube.com/watch?v=uqt0x6AsoIk&t=9s

Figure 3. Screenshot from the YouTube video where Cyprus teachers share their impressions

What follows below is an overview of the good practices, which have emerged per each one of the two educational contexts.

2.1.1 General education: Sharing of good practices

The INTELed teachers who acted in the context of general education formulated more than twenty good practices, focusing on the successful integration of the embodied digital app as well as of the students with disabilities in their learning interventions. All of these good practices are presented below.

- Development of the learning interventions in the context of the collaborative/group learning and creation of learning stations: Students work together in groups of 3-4 students and visit each one of the learning stations following the station rotation model – the embodied digital learning app should be placed in one of the learning stations
- Very good organization of the lesson plan (e.g. design of activities, educational material, etc.) as well as of classroom layout (e.g. desks placement, lighting etc.)
- Learning stations: Be prepared for differentiating the learning activities provided at each learning station according to your students' learning needs
- All learning stations should retain the interest of the students and provide educational activities just as interesting as the learning station with the selected embodied digital app

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- The teacher should prepare additional activities per learning station so that any students who finish earlier can be involved in something else
- Small groups when organizing the lesson - e.g. Groups of 3-4 children seem to work better. The learning intervention also seems to work better if there are max. 16 children in the classroom.
- Students should aim is to fully complete the assigned activities at all of the learning stations, so that by the end of the lesson there no activities/exercises left incomplete
- The learning station with the embodied digital app must be well-structured. Students be provided with worksheets to report their findings / or to complete exercises while working with the embodied digital app
- As far as it concerns the classroom arrangement, it is advised that the learning station with the embodied digital app to be physically separated from the other learning stations in order not to distract the attention of the students working at the other learning stations (e.g. by using a separator fence or a curtain)
- The instructions at the learning stations should be kept simple in order to be easily understandable by the students; in turn, this will enable students to work autonomously without the need for continuous supervision by the teacher
- If students are taught a new concept, it is important for the teacher to design each learning station in a way that is functionally independent on the one hand, and on the other hand all the learning stations are important to be conceptually related to contribute to the same learning objective
- Discussions at the plenary are more crucial at the beginning of such teaching interventions (e.g. to provide the main guidelines) as well as at the end of the intervention in the context of reflection
- The teacher needs to have under his/her supervision the learning station with the embodied digital app
- The teacher has to prepare collaborative scenarios/scripts to promote collaborative learning if the embodied digital app alone does not serve this purpose
- Smooth integration of students with disabilities in groups of mixed skills, in order to promote the collaboration and social interaction between students with and without disabilities. The ultimate goal is for students without disabilities to support their peers in the context of collaborative learning
- Design of attractive learning activities, in order to increase the interest and motivation of ALL the students with and without disabilities
- Addition of scaffolds and motivators (e.g. additional clarifications, simplified instructions) to the various learning stations to provide appropriate support and assistance to ALL the students where needed

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- Students with disabilities should spend more time with the embodied digital apps because this will trigger their interest. Their interest is reduced at the learning stations that follow traditional teaching
- The teacher assistant will need to provide support to students with disabilities, especially at the learning stations lacking technology
- Modeling by all students prior to engaging the students with disability so as to initially see how to act, avoiding disappointment issues

2.1.2 Special education: Sharing of good practices

The INTELed teachers who acted in the context of special education formulated fifteen good practices, focusing on the successful integration of the embodied digital app as well as of the students with disabilities in their learning interventions. All of these good practices are presented below.

- The embodied digital app should be used and perceived by the students as a learning tool and not just as a game
- Systematic use of the embodied digital apps in schools to familiarize students and teachers and create routines
- Affordances to differentiate the levels / available functions of the selected embodied digital app to respond to your students' personalized needs
- The teacher should have practiced and used the selected embodied digital apps, in advance, to know their capabilities and how they work
- There needs to be an alternative if the digital app does not work or presents problems during the learning intervention
- Before the learning intervention, it would be good for the students to get acquainted with similar technologies using various embodied digital apps. This will reduce the novelty effect
- The content of the selected embodied digital app should be fully-aligned to the special education needs of the children as well as to the objectives of the intervention
- The selected embodied digital apps should be collaborative ones in order to promote students' social interactions and support as well as effective forms of collaborative learning
- Daily involvement of students with disabilities with embodied digital apps as this motivates them and keeps them interested
- Freedom of expression during the learning intervention
- Use of the embodied digital apps as a reward. This strategy works best in long-term interventions

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- When organizing the lesson, the teacher should take into consideration the students with disabilities that he/she has to deal with (e.g. the disabilities / difficulties they face)
- During the learning intervention there should be no time pressure for the students. This gives the weakest students / students with disabilities the opportunity to work and try until achieving their goals
- The embodied digital app to be included should contain various reasonable accommodations providing access to the students with various disabilities, for example:
    - Provide a variety of acoustic stimuli for students with visual problems
    - Identify students in a wheelchair
    - Use appropriate colors at the interface
    - Provide bigger letters
- Modeling by the teacher prior to engaging the students with disability so as to initially see how to act, avoiding disappointment issues

3. Best practice cases in Cyprus

3.1. Introduction

As part of the INTELed school pilots in Cyprus, the vast majority of the learning interventions were based on the use of the "Angle Makers" embodied digital app for supporting embodied pedagogy in heterogenous classrooms, where students with different abilities and disabilities co-exist. In this context, beyond its academic and emotional value embodied pedagogy had also a significant social contribution, as it promoted and supported the collaboration and social interaction of students with different abilities and disabilities within the general classroom.

The "Angle-makers" learning interventions in the general education settings were mainly short-term ones (e.g., they usually had a duration of 3-4 teaching hours) as they were aligned with the angles/geometry unit. During the "Angle-makers" learning interventions the classroom was mainly organized in different learning stations. More specifically, there was usually a central learning station where the "Angle-makers" embodied digital app was integrated as well as a set of 3-4 additional learning stations either with or without the use of technology; in its essence in each of the learning station students were engaged with a different learning activity which contributed to the fulfillment of the educational goals that had been set.

In addition, the students were divided in heterogenous groups of 4-5 students; each group was usually composed by both boys and girls of mixed abilities and disabilities. During the learning intervention the students were asked to work collaboratively within their groups, while also rotating and visiting each learning station successively, in order to discover the new knowledge in a playful

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manner. The student roles varied also at each learning station. For example, the students could take the role of an animator, a coach, of an apprentice or a trainer for the other group members in the quest to build new knowledge and skills.

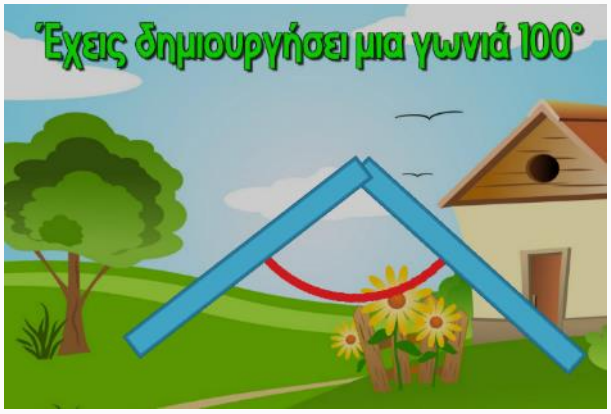
3.2. Overview of the "Angle-makers" learning interventions

The "Angle makers" learning internventions aimed at the teaching of Mathematics (Geometry) and Design and Technology (Systems and Control Technology) subjects to 3rd-6th graders. The purpose of these learning interventions were to exploit innovative educational tools such as the "Angle Makers" embodied digital app, which support the pedagogical approach of embodied learning, in order to create learning opportunities for ALL students, with different abilities and disabilities, in the activities of various embodied learning stations. The implementation of these learning interventions seemed to have multiple benefits to the students' academic, emotional and social development.

3.3. The "Angle Makers" digital app

The "Angle-makers" is an embodied learning app designed for promoting 3rd-6th graders' conceptual understanding about angles in geometry. As part this app students have the opportunity to participate in an embodied digital environment grounded in contemporary kinesthetic and embodied learning approaches. Using interactive and motion-based technologies, the "Angle-makers" (https://www.youtube.com/watch?v=-HcwQKNBoI8&t=11s) aims at supporting young students in enriching their knowledge about the angles and their measurement, the different types of angles and subsequently, the different types of triangles.

In particular, when using the embodied digital app students are invited to take the role of angle-makers for experiencing the world of mathematics and geometry via a playful and educative experience.



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3.4. Description of the "Angle Makers" learning interventions

The activities of these learning interventions were designed to promote the exploitation of new technologies based on the theory of embodied learning for heterogenous classes, where students with and without disabilities co-exist. The learning interventions aimed at the promotion of the teaching of Mathematics (Geometry) and Design and Technology (Systems and Control Technology) subjects to students aged 8-12 years. The intervention's learning objectives were: (a) to promote conceptual understanding of basic concepts of geometry, adapted to the students' developmental level, such as identification and classification of angles (right, obtuse, acute, straight, complementary, supplementary), triangles (right, obtuse, acute, scalene, equilateral, isosceles), polygons (equal, parallel and perpendicular sides; equal, right, obtuse, acute angles), (b) to develop problem-solving by programming robotic models with simple instruction sequences, (c) to engage ALL students, with different abilities and disabilities, in the activities of each learning station, (d) to cultivate multiple 21st century skills such as autonomous learning, digital literacy, critical thinking, collaboration, communication, and creativity.

The learning interventions actively involved ALL students in the learning process through pedagogical activities based on the approach of embodied learning. At the same time, it was based on technologies that meet the needs of ALL students, thus promoting the coexistence and interaction of students with different abilities and disabilities in the context of inclusive education. The students worked in mixed-skill groups in four different learning stations, which they visited successively, in order to discover new knowledge in a playful manner, while at the same time cultivating 21st century skills. The learning interventions aimed at promoting the autonomous learning of students, as well as their active participation in the discovery of new knowledge, the consolidation of existing knowledge and, more generally, the self-regulation of their own learning. In addition, the roles a student had in the various learning stations varied. For example, a student could be an animator, a coach and partner of the other team members, as well as an apprentice or a trainer of the other members in the quest to build knowledge. What follows below is the presentation of two cases of good practice.

What follows below is the documentation of two cases of good practice by our INTELed teachers in Cyprus in relation to the "Angle-makers" learning intervention.

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3.5. Presentation of Best case #1

3.5.1. Interactive multimedia presentation

Figure 4. Interactive poster presented at the Science on Stage Festival 2019

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3.5.2. Overview

School: 1st Primary School of Tseri
Primary education teacher: Mrs. Efi Darreiou
Grade(s): 4th-6th graders
Subject: Mathematics
Context: Inclusive education
Embodied Learning Technology: "The angle makers"

3.5.2 The learning stations

3.5.2.1 The "Angle makers"

Duration: 20'
Materials: Kinect camera, computer, Angle-makers app

Learning goals:
• Identification and classification of the different angle types (right, obtuse, acute, and straight angle)
• Formation of angles (e.g. right, obtuse, acute, and straight) using the body
• Cultivation of 21st century skills

Description: The "Angle makers" is an innovative digital app (Figures 1-2) developed by the Cyprus Interaction Lab (CIL) of the Cyprus University of Technology, within the framework of the European project INTELed. The app is grounded in kinesthetic and embodied learning approaches and utilizes interactive technologies and motion-based tracers to help students understand angles (measurement, formation, classification). During the implementation of the digital app, students took the role of the "angle-makers" and had the opportunity to experience the world of mathematics and geometry via a more playful and entertaining way.

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3.5.2.2 Robot mouse bingo

Duration: 20'

Materials: code and go robot mouse set, notebooks, calculator, pencils, erasers, educational tabs, bingo cards, rulers, protractors, tablets

Learning goals:

- Identification and classification of a right, acute, obtuse and straight angle
- Identification of parallel and perpendicular sides in two-dimensional shapes
- Estimation and classification of angles
- Investigation of the sum of the angles of a triangle
- Identification and calculation of complementary and supplementary angles
- Sorting two-dimensional shapes based on their properties
- Recognition, classification and description of different types of triangles according to the measure of the angles and the length of the sides
- Identification of basic elements and properties of a rectangle
- Programming ground robots with simple instruction sequences
- Cultivation of 21st century skills

Description: Students are trained in identifying, naming, assessing and calculating angles, as well as in identifying shape properties and characteristics. They also cultivate problem solving skills and algorithmic thinking by programming the robot mouse to move on a predetermined route. In particular, students roll the dice in turn and then program the robot mouse to move on a predetermined track as many steps as the dice indicates. At the point where the mouse stops, there is a mathematical problem, which all students are asked to collaboratively solve and check if the solution appears on their bingo card. Winner is the student who will first find the correct answers on his/her the BINGO card.

Figure 6: Bingo Card

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3.5.2.3 Riddle me this

Duration: 20’

Materials: Engino robotics, tablet, riddle tabs, improvised mat (tape, scissor, color paper)

Learning goals:

- Problem Solving
- Identification and naming of a right, acute, obtuse and straight angle
- Identification of parallel and perpendicular sides in two-dimensional shapes
- Sorting two-dimensional shapes based on their properties
- Recognition, classification and description of different types of triangles taking in to account the measure of the angles and the length of the sides
- Programming ground robots using programming and control software
- Cultivation of 21st century skills

Description: Different kind of geometric shapes were placed on the ground. The Riddler read riddles, and according to the information provided, group members needed to identify the correct shape and stand on it as soon as possible. Note that there were more than one correct shape for each riddle. At a later stage, the students assembled an Engino vehicle and the game was repeated only this time students needed to program their Engino vehicle, using a tablet, in order to guide it to the right shape.

3.5.2.4 Blue-bot routes

Duration: 20’

Materials: Blue-bots, blue-bot mat, board eraser, boards, markers, pencils, notebooks, tablets, ruler, protractors.

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Learning goals:

- Exploring the concept of coordinates
- Recognition and naming of right and obtuse angles
- Estimation and classification of angles
- Grouping two-dimensional shapes according to their properties
- Recognition, classification and description of different types of triangles by the measure of the angles and the length of the sides
- Identification of basic elements and properties of a rectangle
- Programming ground robots with simple instruction sequences
- Utilization of programming and control software
- Cultivation of 21st century skills

Description: Students were practicing in sort in geometric shapes, based on angle measure, or side size, or the number of sides, or other criteria. They cultivated algorithmic thinking by programming the Blue-bot (initially using buttons and then running Blue-bot companion application on tablet, to follow the path that includes the geometric shapes they have grouped, on the basis of specific criteria).

3.5.3 Assessment of the learning intervention

3.5.3.1. Students' impressions

This learning module has been applied to 150 students (Grades 4-6) in with very positive results. After the implementation the students were asked to express their impressions. They have commented on: (a) positive emotions; (b) desire to continue using such activities; (c) collaboration with their friends and groups; (d) opportunities for developing interpersonal relationships; (e) autonomous learning; (f) developing knowledge and new skills.

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Indicative students' comments

- "…I hope that we will repeat this experience again. I had a great time and I hope that we will have the opportunity to have similar experiences"
- "I collaborated very well with my groupmates…"
- "I had a great time with my classmate. I will remember this experience forever. I had a wonderful time"
- "We collaborated, and this is of a great importance. I cannot express myself in any other words, besides saying that I am thrilled with this experience"
- "These were unforgettable moments… the most important for me was the fact that I worked with my friends"
- "I learnt about shapes and angles in the best possible way…"
- "I really loved it. Each activity contributed in a different learning experience"
- "When I got into the classroom, I said WOW! It was a great experience that I will never forget!"
- "I hope that I will have the opportunity to utilize these learning materials again"

3.5.3.2. Parents' impressions

According to parents' comments, as these were recorded in a relevant survey, their children informed them for the activities of this module, expressing their positive comments as well as the wish to continue engaging in similar activities. In addition, the parents mentioned the positive feelings that the learning module provoked for their children, the teamwork and co-operation required by their children to achieve the goals of the activities, and their active involvement in the activities. Reference was also made to the way of thinking, the processes and the playful character of the activities.

Indicative parents' comments

- "My child had a fantastic time because he discovered a new way of learning of maths"
- "She didn't stop talking to me about this experience while she was doing her homework… She was so enthusiastic about everything! Congratulations to the team that presented the activities"
- "He was so enthusiastic with the technology and programming activities"
- "She told us that it was one of the best activities we had in school"
- "He would love to have the opportunity to be involved in more activities like this".

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3.5.3.3. Teacher's impressions

According to the teacher:

"The learning intervention, besides its educational contribution (making the teaching of mathematical concepts more effective in modern heterogenous classrooms, where students with different abilities and disabilities co-exist), had also a significant social contribution: it had the affordances to promote the social inclusion of students with disabilities by cultivating social skills and also strengthening the competencies of students with disabilities in order to be integrated smoothly into society.

Finally, I strongly believe that this learning intervention had a lot of benefits for student's multi-dimensional development, as it: (a) supported the active participation of ALL STUDENTS, with different abilities and disabilities (thus promoting inclusive education); (b) helped students to develop self-confidence competencies; (c) cultivated students' social skills (e.g., communication, dialogue, collaboration, positive social interactions); (d) fostered students' technological, mathematical and social literacy; (e) promoted autonomous learning; (f) fostered students' responsibility; (g) promoted positive attitudes towards learning; (h) improved the learning outcomes."

3.5.4 Dissemination of the learning intervention

It is worth mentioning that the learning intervention and the best practices adopted were disseminated by the teacher (Mrs. Efi Dariou) via her participation at the Science on Stage Cyprus nationals, on February 24th 2019, at Paphos, Cyprus.

The learning intervention was awarded and will be also presented at the Science on Stage Festival, which will take place at the Cascais, Portugal on October 31st – November 3rd, 2019.

For more information: https://www.science-on-stage.eu/page/display/4/97/0/s

Figures 5-6. Teacher disseminating the INTELed best practice at the Science on Stage Cyprus

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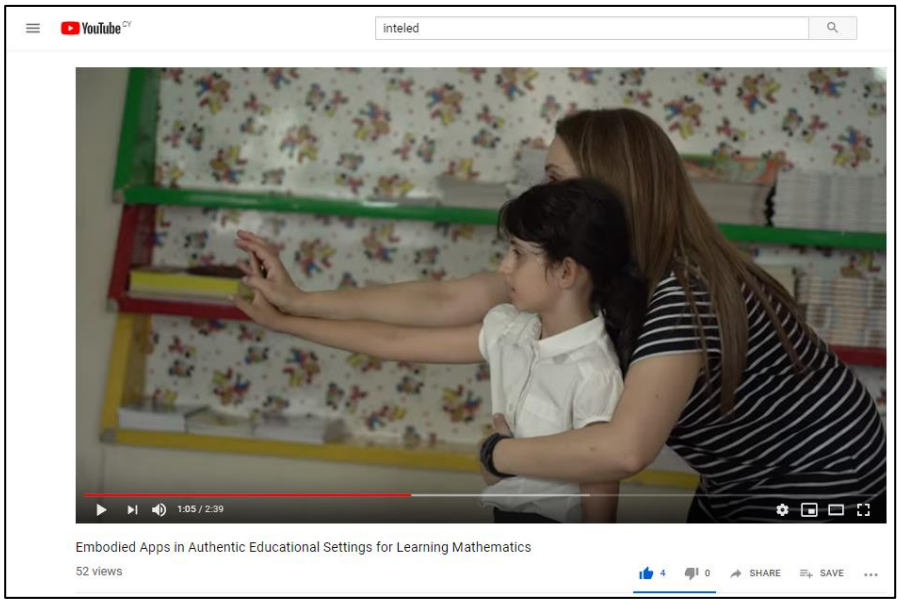
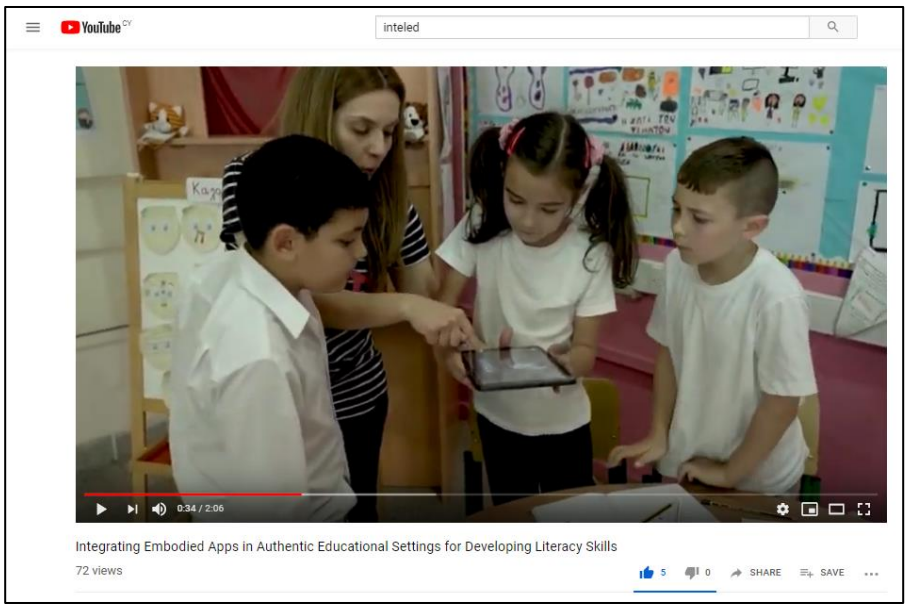
3.6 Presentation of Best case #2

3.6.1 Interactive multimedia presentation



https://youtu.be/iRuTP1giRtU



https://youtu.be/kUJS5Q2w52k

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3.6.2 Overview

School: 1st Primary School of Limassol
Primary education teacher: Mrs. Skevi Sophokleous
Grade(s): 2nd-6th graders
Subject: Mathematics
Context: Inclusive education
Embodied Learning Technology: "The angle makers"

3.6.3 The learning stations

3.6.2.1 The "Angle makers"

Duration: 15'
Materials: Kinect camera, computer, Angle-makers app

Learning goals:

- Identification and classification of the different angle types: right, obtuse, acute, & straight angle
- Formation of angles (e.g. right, obtuse, acute, and straight) using the body
- Cultivation of 21st century skills

Description: First, at this station the students investigated how many angles could use using their bodies. At a second stage they formed the three types of angles individually or in collaboration with their peers using the "Angle-makers" embodied digital app. The "Angle makers" is an innovative digital app developed by the Cyprus Interaction Lab (CIL) of the Cyprus University of Technology, within the framework of the European project INTELed. The app is grounded in kinesthetic and embodied learning approaches and utilizes interactive technologies and motion-based tracers to help students understand angles (measurement, formation, classification).


Figures 7-8. INTELed teacher with her students during the "Angle makers" intervention

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3.6.2.2 The Pin board

Duration: 20'
Materials: 4-5 pinboards, rulers, pencils, rubber bands

Learning goals:
• Identification and classification of a right, acute, obtuse and straight angle
• Estimation and classification of angles
• Investigation of the sum of the angles of a triangle
• Recognition, classification and description of different types of triangles according to the measure of the angles and the length of the sides
• Identification of basic elements and properties of a rectangle

Description: The students are asked to develop different shapes using a pin board. Subsequently the students are asked to transfer these shapes on a diagram with dots in their guidebooks, using their rulers. These shapes should have (a) right angles, (b) acute angles, (c) obtuse angles or (d) all three types of angles.


Figures 9-10. Students participating at the pin board activity

3.6.2.3 Ozo bots

Duration: 20'
Materials: Ozo-bots, Ozo-bots mats, color codings, rulers, pencils, notebooks,

Learning goals:

- Identification and classification of a right, acute, obtuse and straight angle
- Estimation and classification of angles
- Design of Ozo-bots' routes with different angles

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Description: Students are asked to design as many routes as possible to move the OZO bot robot. These routes should have a shape (a) that has only right angles and (b) that has acute, obtuse and right angles. They also need to use the color codes they want (these codes regulate the speed and movement of the robots-attached) by incorporating them in their paths, while also describing the robot's movement on these routes. This activity integrates the element of differentiation, since each child will form the path that can be based on its level.

Figures 11-12. Students participating at the Ozo bots activity

3.6.2.4 Blue-bots routes

Duration: 15'

Materials: Blue-bots, blue-bot mat, board eraser, boards, markers, pencils, notebooks, tablets, ruler.

Learning goals:

- Exploring the concept of coordinates.
- Recognition and naming of right and obtuse angles
- Estimation and classification of angles
- Grouping two-dimensional shapes according to their properties
- Recognition, classification and description of different types of shapes by the measure of the angles and the length of the sides
- Programming ground robots with simple instruction sequences
- Utilization of programming and control software
- Cultivation of 21st century skills

Description: Students were asked to identify schemas on the blue-bot mat and instruct the robot (blue bot) on how to reach them. In particular, students were asked to find: (a) a shape that has no

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angles; (b) a shape that has only right angles and all its sides are equal; (c) a shape having only right angles and its opposite sides are equal, (d) a shape having three equal sides and a right angle, (e) a shape having right angles and five sides, (f) a shape having only acute angles, (g) a shape having 2 acute and 4 obtuse angles, and (h) a shape having two right angles, an obtuse angle and an acute angle. The shapes that students were to find are of gradated difficulty (starting with quadrilaterals which were already familiar with and ending up with looking for shapes with more than four sides and a combination of three type of angles).

Figures 13-14. Students participating at the Blue bots activity

3.6.4 Assessment of the learning intervention

3.6.3.1. Students' impressions

This learning module has been applied to 90 students (Grades 2-6) at the 1st Primary School at Limassol (Cyprus) with very positive results. After the implementation the students were asked to express their impressions. As in the previous best case, the participating students have commented on: (a) positive emotions; (b) desire to continue using such activities; (c) collaboration with their friends and groups; (d) opportunities for developing interpersonal relationships; (e) autonomous learning; (f) developing knowledge and new skills.

Indicative students' comments

- "I liked it when I played with the Kinect camera. I also liked it when I played with the pinboards."
- "When our teacher showed us the Kinect camera I liked it very much because we started playing and identifying the different types of angles (acute, obtuse). […] I will always remember this lesson because it was a really joyful one."

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- "I liked it because we played very exciting games. I always remember this lesson, because it was something different. I would like to participate again in a lesson like this."
- "I really liked the lesson because we took part in various playful activities and we had the opportunity to collaborate with the rest of the children. I hope that we will have the opportunity to make similar lessons. I will remember this one for the rest of my life as it was an impressive one".
- "I liked the lesson with the Kinect camera as it gave me the opportunity to learn more about the angles and it was very amusing".
- "The lesson was interesting and creative. We had a very nice time."

3.6.3.2. Teacher's impressions

As the teacher stated:

"I would like to thank you for providing my students the opportunity to participate in this learning process. They really had an amazing time and you can rarely find such opportunities which motivate all the students. It was also an honor for me to take part in a such a qualitative professional development programme. I do hope that I will have the opportunity to attend some of your future training workshops!"

3.6.5 Dissemination of the best practices

It is worth mentioning that the best practices adopted were disseminated by the teacher (Mrs. Skevi Sophokleous) via the organization of two sample learning interventions which were also video captured and shared on the INTELed Community of Practice (https://www.facebook.com/groups/178585362871649/).

- The first sample learning intervention was the one presented, for learning in mathematics, above and can be found here: https://www.youtube.com/watch?v=iRuTP1giRtU&t=26s
- The second sample learning intervention transferred the best practices adopted in the context of a Kinems-based implementation for developing literacy skills and can be found here: https://www.youtube.com/watch?v=kUJS5Q2w52k&t=28s

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4. Best practice cases in Greece

4.1 Presentation of Best case #1

4.1.1. General information

School: 46th Primary School of Piraeus
SEN Teacher: Ioanna Sotiropoulou
Student: StudX
Grade: 2nd
Special Education Need: Expressive language disorder
Subject: Math
Learning Goal: To learn how to add and subtract up to 100
Embodied Learning Technology: Kinems Learning Games
Kinems Learning Game: Fairy Bells
Academic Goal: Represent and solve problems involving addition and subtraction- up to 100>
OA.A.1 Addition and subtraction word problems within 100

4.1.2 Overview

Within 46th Primary School of Piraeus operates a Special Education Unit, in which the SEN teacher provides support to students with Special Education Needs (SEN). In the present case study, the SEN teacher has designed a lesson plan for her StudX, setting a specific learning goal; to learn how to add and subtract up to 100 (Appendix A1). She worked with her student (in the rest of the text we will address him as StudX), on this learning goal from the 5th of February 2019 to the 17th of May 2019, using the *Fairy Bells*[1] game. During this period StudX, was attending his classes in the Special Education Unit twice per week for 60 minutes, in a group of 6 SEN students (fig.15).

Figure 15. SEN students working in small groups in the Special Education Unit

[1] Fairy Bells: https://academy.kinems.com/games/fairy-bells, Kinems Learning Games 2019

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SEN students were filling in worksheets in a small group, on their desks. When it was time for the learning session with Kinems, StudX was standing in front of the interactive whiteboard to practice with Fairy Bells (fig. 16). Sometimes, the SEN teacher was encouraging the rest of the SEN students to participate as well in the session, by reading the math problem and thinking of the correct answer,without revealing the correct answer to StudX. The SEN teacher was partially next to StudX encouraging him and providing him with support when needed especially during the first sessions, while monitoring the rest SEN students in the group.

Figure 16. StudX practicing with Fairy Bells in Kinems Learning Games Platform

After each session, the SEN teacher was accessing the analytics of the Kinems Learning Games platform in order to assess her student and prepare the next session (fig. 17).

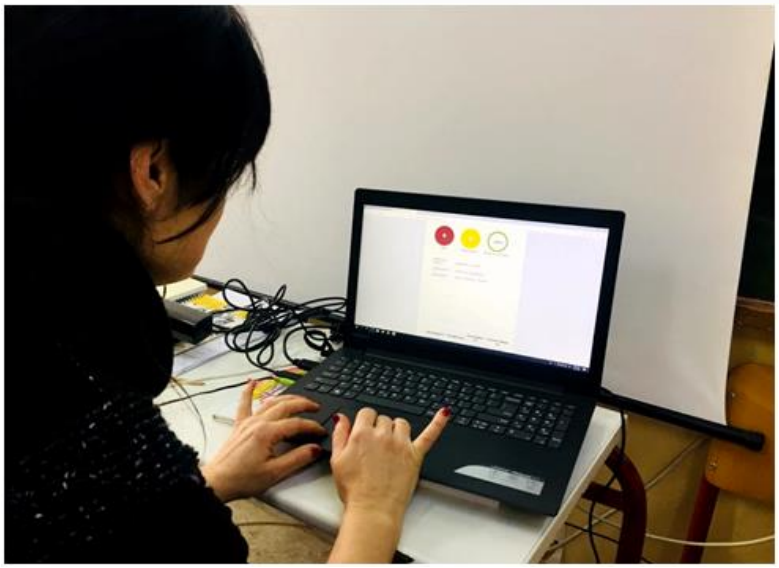

Figure 17. SEN teacher accessing the analytics of Kinems Learning Games platform

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According to the SEN Teachers' overall assessment, StudX managed to achieve the learning goal to a great extend, since he was able to add and subtract up to 20 with 100% success and has shown improvement with addition and subtraction up to 100. Taking into account the detailed student diary that teacher was keeping all that period (Appendix A2), after 19 sessions, StudX in the last session with Fairy Bells, managed to answer all questions, noting 100% success in 4 minutes and 30 seconds. Followingly, the SEN teacher provides us with a detailed report of the progress of her student.

4.1.3 SEN Teachers' report

"In the 2nd grade, the learning objective for StudX, was the cultivation of logical and mathematical thinking. We worked with Fairy Bells (fig.18). However, it was a challenging step, because StudX was facing reading comprehension difficulties as well. Difficulties have been also noticed with concentration, since StudX was easily distracted by external factors.

In the beginning, StudX was standing in front of the interactive whiteboard with obvious shyness and embarrassment. However, from the very first sessions with Fairy Bells, an immediate focus of attention was observed. StudX needed constant boost; he couldn't act all by himself. He was hesitant and he used to whisper the question, rather than reading it aloud. In the first session the time of completion was 7 minutes and 17 seconds with 12% success, 1 correct effort and 2 wrong.

StudX was not discouraged. He wasn't showing signs of fatigue during the sessions. To the contrary, he started participating to the sessions with less hesitance and restless attitude. The flow of the speech gradually improved due to repetition and constant practice. StudX was able to answer simple math problems, since he could understand the context of the question. In the last session StudX completed the session within 4 minutes and 30 seconds, noting 100% success, which means 3/3 correct answers without help.

During the last sessions, StudX was in excellent mood. He was more concentrated and he noted excellent performance. Reading comprehension has greatly improved. Now, in problem-solving questions/exercises, StudX can undestand better the mathematical relationship of "add- subtract"".

Figure 18. Fairy Bells – Kinems Learning Games

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4.2 Presentation of Best case #2

4.2.1 General information

School: Special education needs school of Egaleo for students in the autistic spectrum
SEN Teacher: Martha Christoudi
Student: StudX
Grade: -
Special Education Need: Autistic spectrum disorder
Subject: Math
Learning Goals:

- To add within 5, counting the quantities
- To add within 10, counting the quantities
- To add within 5, without using quantities
- To add within 10, without using quantities

Embodied Learning Technology: Kinems Learning Games
Kinems Learning Game: MathLoons
Academic Goals:

- Add two numbers- sums up to 5> **OA.A.5** Fluently add and subtract within 5
- Add two numbers up to 10// Add two numbers up to 10- using ten frames> **OA.A.2** Addition up to 10

4.2.2 Overview

Context

The class consisted of 4 students. A teacher assistant was present in the class for some hours during the school day, in order to support the teaching process. Moreover, some hours per week the students were attending other therapies outside the classroom. The ratings of the students referred to severe autism level; the students had no productive speech, sound loud, face difficulties in social interaction and accepted social behaviors.

The student

StudX is a 11 years old boy (fig.19), low in the autism spectrum (Appendix A3). It has a rudimentary speech, but mostly sounds, and very rarely addresses his speech to interact. He is very anxious in changes and in what happens suddenly (for example, if the lights of the class are closed suddenly). He also reacts to anything new with intense anxiety, intense sound and withdrawal. Of course, the second time he faces it, he has more gentle reactions, until he becomes familiar, so he shows comfort and willingness. StudX has been working with his teacher for 3 years, so a relationship of

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cesie
Universidad de Valladolid

trust and communication has been established between them and now he is more receptive to doing new things.

Figure 19. StudX during a session with Kinems

Class organization during the session

During the sessions, the rest of the students were in the classroom, working individually on their desks, and there was always the teaching assistant to support them. After each session, the SEN teacher was gaining access to the analytics of the Kinems Learning Games platform in order to assess her student and prepare the next session.

According to the SEN Teachers' overall assessment, StudX managed to achieve the 3 out of 4 learning goals to a great extent. The third goal was not completed, due to time being considered emerging. We did not reach the 4th goal, as it was a precondition to achieve the third goal.

4.2.3 SEN Teachers' report

"We started practicing with addition last year. StudX stereotypically can count up to very big numbers, or continue counting from any given number and generally shows a preference in numbers and Math. In the beginning, we were practicing with addition up to 5 by using objects. Then we proceeded with addition by using objects, within 10. Finally, we managed to use the notebooks to familiarize with the addition symbols, but we continued to use aids and after this phase we started using the Kinems platform.The sessions began on January 18th and completed on April 4th, 2019.

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Finally, although in many sessions StudX appears to understand 100% of the questions (Appendix A4), that was because I provided him with a lot of support, which he was looking for until the moment he started being sure about his answers . So, in the first session that he notes 100% success StudX had my support. However the support wasn't that intense in the rest sessions and it was slowly eliminated.

At the first sessions we strongly faced the student's refusal to participate. It was something completely new and it caused him an intense anxiety. StudX could not manage closed lights during the session and this made it harder to accept it. He was leaving and asking to shut down the computer and open the lights. Gradually and seeing the other students to play, he started getting more familiar and finally he started playing with pleasure.

When he started playing the games, his progress was impressive. StudX quickly began to understand the moves, which he had to do with his hands, which hand he had to use, how and how long he had to wait. Moreover, he began to perceive the space in which he could move so that the game could continue without interruption. Finally, he began to have better body awareness and spatial orientation. In addition, he began to understand the rules of the game better, so he didn't my need support.

During other Kinems' sessions in the class, he used to observe his friends playing. So, even indirectly, he noted strong signs of interaction with classmates, something that I have not noticed in other school activities. Moreover, StudX achieved the academic goal of addition without generalizing. However, the development of other skills that were not directly targeted at sessions using Kinems was observed. The student could read the text and understand what the exercise was about. While reading texts, it was not that easy for me to understand if he could comprehended the concept. I understood that he could understand the context, because he was doing what the exercise was asking for.

Figure 20. StudX during a session with Kinems

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In the beginning we were facing some difficulties during the sessions due to the tensions of the rest students, who were distracting him. Sometimes other students were also interfering with the game. Sometimes, his movements were not recognized by the camera, something that used to get him angry. Fortunately, he was calming down quickly, returning back to the game play. Students couldn't also wait for their turn during the first sessions. However, we started working on that, and gradually all students started waiting more and more time for their turn.

Sessions with Kinems were very effective for the particular student. They helped him a lot to develop skills in more areas than I expected in general. Furthermore, it is very important to note that Kinems games helped the student to develop skills that were emerging. More specifically, although we were already working on the addition, Kinems games provided an alternative way to the student to understand it better. He had already acquired reading skills and with the Kinems games, he practiced more his reading comprehension in order to answer the questions."

Figure 21. Mathloons – Kinems Learning Games

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Appendix A

A.1 Student Profile

Student Profile		
Student: StudX	**Grade:** 2nd	**Subject:** Math
Number of students in each session: 6		
Organization of the classroom: Students are sitting in a small group. StudX stands in front of the interactive white board ready to start his training session.		
Activities before and after Kinems: Students are working on writing worksheets.		
Stand-by Activities for the rest class: Students are filling in worksheets.		
Learning Goals	Duration	
1. To add and subtract up to 100	5/2/2019-17/5/2019	
Comments: He improved his concentration, his reading comprehension and his memory. He managed to answer the problems correctly in a shorter period of time. He managed to achieve the learning goal; to add and subtract up to 100.		

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A.2 StudX: Kinems Diary

Kinems Diary				
Learning Goal: To add and subtract up to 100				
Training Session	**Date**	**Settings**	**Success Rate**	**Duration of the session**
1st	5/02/2019	3 questions	12%	7 min & 12 sec
2nd	11/02/2019	3 questions	100%	4 min & 40 sec
3rd	12/02/2019	3 questions	75%	6 min & 5 sec
4th	13/02/2019	3 questions	60%	7 min & 57 sec
5th	18/02/2019	3 questions	33%	8 min & 17 sec
6th	18/02/2019	3 questions	60%	10 min & 44 sec
7th	06/03/2019	3 questions	75%	4 min & 39 sec
8th	06/03/2019	3 questions	90%	4 min & 10 sec
9th	26/03/2019	4 questions	66%	11 min & 3 sec
10th	27/03/2019	4 questions	80%	10 min & 6 sec
11th	27/03/2019	4 questions	80%	8 min & 44 sec
12th	30/04/2019	4 questions	100%	9 min & 57 sec
13th	30/04/2019	4 questions	80%	3 min & 52 sec
14th	30/04/2019	4 questions	100%	6 min & 9 sec
15th	15/04/2019	4 questions	80%	4 min & 17 sec
16th	15/04/2019	4 questions	80%	2 min & 17 sec
17th	07/05/2019	4 questions	70%	5 min & 7 sec
18th	07/05/2019	4 questions	80%	5 min & 40 sec
19th	17/05/2019	3 questions	100%	4 min & 30 sec

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A.3 Student Profile

Student Profile		
Student: StudX	**Grade:** Special education needs school	**Subject:** Math: Addition
Number of students in each session: 4		
Organization of the classroom: The students sit on their desks. They work alone. In the classroom there is a teacher assistant to supervise and support the students, when it is necessary, while they work alone. Each student, with the help of his teacher, stands in front of the interactive board in order to participate in the Kinems session.		
Activities before and after Kinems: The activities before and after the Kinems session are group activities. The students form a group, they interact with each other and they perform psychomotor activities like "waiting my turn". The reason that we choose group activities at these particular timings is because we want to provide a variety of approaches by switching from group to individual and back to group way of work within the class with the students.		
Stand-by Activities for the rest class: The students work individually on their desks. The activities are envelopes based on TEACCH method and other matching and sorting activities.		

Learning Goals	Duration
1. To add within 5, counting the quantities	18/01/2019- 28/02/2019
2. To add within 10, counting the quantities	04/03/2019- 20/03/2019
3. To add within 5, without using quantities	28/03/2019- 04/04/2019
4. To add within 10, without using quantities	04/04/2019-

Comments:

Beyond the initial goals, the student has also made progress in other areas except from learning. Developments in space organization and body awareness, development in social skills, and interaction with peers have been observed. Finally, incentives to participate in the educational process were developed, since the game environment was much more attractive than the traditional way of learning.

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A.4 Kinems Diary

Kinems Diary 1				
Learning Goal: To add within 5 counting the quantities				
Training Session	**Date**	**Settings**	**Success Rate**	**Duration of the session**
1st	18/01/2019	5 questions	100%	2 min & 38 sec
2nd	04/02/2019	5 questions+ 5 questions	80%+ 100%	2min & 29 sec + 2 min & 17 sec
3rd	08/02/2019	5 questions+ 5 questions	80%+ 100%	1min & 45 sec + 2 min & 03 sec
4th	13/02/2019	5 questions+ 5 questions	100% + 100%	2min & 29 sec + 2 min & 17 sec
5th	28/02/2019	10 questions+ 10 questions	100% + 100%	4min & 45 sec + 3 min & 47 sec

Kinems Diary 2				
Learning Goal: To add within 10 counting the quantities				
Training Session	**Date**	**Settings**	**Success Rate**	**Duration of the session**
1th	04/03/2019	5 questions	100%	2 min & 07 sec
2th	13/03/2019	10 questions	100%	4 min & 54 sec
3th	20/03/2019	15 questions	100%	7 min & 05 sec

Kinems Diary 3				
Learning Goal: To add within 5 with no quantities to count				
Training Session	**Date**	**Settings**	**Success Rate**	**Duration of the session**
1th	27/03/2019	15 questions	66%	7 min & 43 sec
2th	28/03/2019	15 questions	73%	10 min & 01 sec
3th	04/04/2019	15 questions	73%	10 min & 27 sec

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5. Best practice cases in Italy

5.1 Presentation of Best case #1

School: Scelsa
Grade: primary school
Special Education Need: learning difficulties
Subject: Math
Learning Goal: Allow the student to acquire a greater knowledge of the angles and be able to recognize them adequately, without the use of the goniometer.
Embodied Learning Technology: Kinems Learning Games
Kinems Learning Game: Kinect Angles

Overview

Students have been divided in pairs (2 students) so as to help each other during the game. Starting from the assumption that an angle of 90 ° can be expressed by rotating the arms by 1/4, the students can therefore understand how swinging the arms slightly can define amplitudes of the angle greater or less than 90 °. Each pair of students should include at least 1 SEN student, so as to foster cooperation and mutual help as well as inclusion among students with different levels of learning.

Subsequently, the pairs can be calibrated according to the difficulty level of the game. In this case, students can answer slightly more specific questions, thus solving mathematical problems of greater difficulty and using Kinect motion sensors.

Class organization during the session

Teachers must divide students into pairs and explain to the students the purpose of the game, as well as its modalities. The concentration of the student is required as every slight movement of the arms determines a more or less visible change of the angle width. Kinect sensors are also sensitive to minimal arm movements. It is also advisable to maintain a correct posture and a fixed position. Before to start the pilot, we suggest teachers to test the Kinect sensor/camera to verify its operation. Be sure that the camera detects the player before to start the game. The game is strongly recommended for students 8-14 years old.

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Figure 22. Students from primary school testing the Kinect Angle Game

Figure 23. Students from secondary school testing the Kinect Angle game

5.2 Presentation of Best case #2

School: Scelsa
Grade: primary school
Special Education Need: learning difficulties
Subject: English
Learning Goal: Allow the student to acquire a greater knowledge of English grammar.
Embodied Learning Technology: Kinems Learning Games
Kinems Learning Game: Word Mage

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Overview

This game helps students in learning the key concepts of the English language (adjectives, names and verbs) using the body and movement as a tool for learning. It allows the student to acquire a minimum knowledge of English, in a fun way and through the game.

Students must be divided into pairs so as to help each other during the game. Each pair of students should include at least 1 SEN student or having minimum learning goals, so as to foster cooperation and mutual help as well as inclusion among students with different levels of learning.

Subsequently, the pairs can be calibrated according to the difficulty level of the game. In this case, students can recognize more difficult and less common adjectives, names and verbs. It is advisable to include the activity within the school program and during the teaching hours of the English language.

Class organization during the session

Teachers must divide students into pairs and explain to the students the purpose of the game, as well as its modalities. The concentration of the student is required as every slight movement of the arms determines a more or less visible change of the angle width. Kinect sensors are also sensitive to minimal arm movements. It is also advisable to maintain a correct posture and a fixed position. Before to start the pilot, we suggest teachers to test the Kinect sensor/camera to verify its operation. Be sure that the camera detects the player before to start the game. The game is strongly recommended for students 10-14 years old.

Figure 24. Student from primary school testing Kinect Angle game

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5.3 Assessment of the learning intervention

From February 2019, a total of 12 in-service teachers, who previously took part in the TPD training sessions, implemented the embodied learning activities in schools. In Italy, the INTELed school pilots involved 2 primary schools and 2 secondary schools (middle and lower high school), for a total of 6 general classrooms working with 110 students.

CESIE met periodically 8 teachers, in order to monitor their progress on pilot and evaluate feedback on the practical phase. In addition, 2 focus group (animated by and for teachers) were organized in one school so that 4 teachers met two times to discuss their progress and exchange their best practices.

5.3.1 Teachers impressions

In Italy, both teachers and parents agreed on the usefulness of Kinect embodied games to deal better with attention deficit, especially for students with attention deficit hyperactivity disorder.

As the teacher stated:
Before the INTELed pilot, the pupil (boy, 14 years old) was unlikely to be involved in the class activities. The lesson plans and activities were considered too difficult for him. On the contrary, Kinect motion games gave him the opportunity to join the activities together with the whole class, relate better with his peers and measuring himself on the same learning bases as his classmates.
Mrs. C. Gagliano, SEN teacher in secondary school (pupils aged 13-16)

Table 1. Results from the teacher evaluation on the pilots

	Focus group	Interviews
Strengths	A. Greater interaction of the BES pupils with the whole class group B. Motor coordination improved (although there still need more pilot sessions) C. Greater understanding of school subject through gaming, as a learning by doing/playing model	A. using Kinect apps, SEN pupils received didactic information in an easiest and fastest way. B. improved cohesion among the students in the same class group as many of them helped their SEN classmates while implementing activities through Kinect Apps.
Weakness	Sharing of the Kinect with other schools	Sharing of the Kinect with other schools

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Opportunities	A. Availability of interactive educational tools (Kinect) that had never been available to the school before B. Possibility of using a unique teaching tool (Kinect) for different disciplines in school, as math and English, thus meeting the needs of SEN teachers in choosing a common methodology to deal with learning disorders and disabilities.	Dealing better with attention deficit and counteract this kind of disorder. Kinect apps can be used to foster the concentration of those pupils, who don't have medical and certified attention disorders but still show some attention troubles as well. Kinect sensor games could make all students to be more collaborative and interested in school contents.
Best practices shared between teachers while integrating embodied learning	A. Using Kinect apps, teachers progressively increased the difficulty in the level of embodied games and according to the student's improvements in their curricula. B. Teachers propose to integrate the embodied learning techniques in the "I CARE" Italian national plan for the integration of SEN pupils in school.	Solving arithmetic problems by the embodied game: Math Mage. Teachers as "designers" because they selected specific arithmetic problems that could be easily solved using Kinect sensors. In addition, Kinect math mage sounds like a more common all-age game, having "lives" for each player-character and losing "lives" in case of wrong answer. That's make the embodied games more interesting for children who feel as they are playing a match. Kinect motion games helped 2 students affected by autism to get a better control on their emotions while focusing on the comprehension of the mechanism of some apps and stimulating concentration through the eye-contact.

5.3.2 Students' impressions

Referring to the specific lesson plan proposed by the teachers and the use of embodied games in it, students were really satisfied as they learnt through experience and game, having fun together. That's why the qualitative feedback from students about the type of activity proposed, the lesson plan, the classroom instructions and orchestration was mainly positive. All students would like to

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repeat the activity, by integrating a general theoretical explanation of the subject (first) and the practical implementation of it (then), though the Kinect games.

As the student stated:
"It's really funny to learn math and the multiplication tables in that way! I find it less tiring than traditional lessons, let's do it again!"
Boy (10 years old), primary school

However, the utility and desire to take advantage of Kinect games is more when at school than at home (50% of students wouldn't like to use Kinect games at home as they just tested didactical games).

In addition, we evaluated the level of satisfaction, fun and overall personal well-being (feel comfortable or not with the teachers and the other students) expressed by students though discussing with them.

Sometimes, students though that they had less time than other pupils, as the game was too short. However, the time for playing, the duration of the activity and the level of difficulty were expressly calibrated and managed by the teachers accordingly to the needs and learning abilities by each student.

5.3.3 Parents' impressions

Parents expressed their opinions that will carefully take into consideration by teachers, when conducting again the embodied learning activities in the classrooms.

As the parents stated:
My son was very happy to be able to get up and move during class hours, combining fun and learning. I think it could be a great idea to introduce dynamism, based on the embodied learning, in our school…
(Parent of a boy aged 11, secondary school)

My son loves games and movement very much, that's why he really appreciated Kinect "team and cooperative" games…
(Parent of a boy aged 11, secondary school)

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5.3.4 Dissemination of the learning intervention

The learning intervention and the best practices adopted were disseminated by CESIE during the multiplier events (10th and 11th September 2019), where new teachers have been informed about the INTELed method and the use of multisensory games in education.

See relevant video here: https://youtu.be/-tTsWI9Bizw

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6. Best practice cases in Spain

6.1. Presentation of Best case #1 - Kindergarten CEIP García Quintana

6.1.1. Interactive multimedia presentation

CEIP García Quintana (clases infantil) https://www.youtube.com/watch?v=qDMeDm3mGkw

6.1.2 Overview

School: CEIP Antonio García Quintana (Valladolid, Spain).
Teachers: Pilar Moreno, Ana González, María Luisa López, with the help of three collaborators.
Grade: Kindergarten grades 1-3 (3-5 years old).
Subject: Living beings. Animals and Plants.
Context: Inclusive education.
Embodied Learning Technology: Kinems Learning Games.

This case has been carried out at three kindergarten classrooms at the "CEIP Antonio García Quintana", a Kindergarten and Primary Education Public School located in the city of Valladolid. It is a preference school for students with motor disabilities. These students go to class together with students without disabilities. The typical ratio is of up to 2 students with disabilities in each class.

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Three teacher-tutors from the first, second and third levels of kindergarten (3-5 years old) participated in this case. The characteristics of these three groups are briefly described below:

- 1st level classroom (3 years old): 20 pupils without SEN students, although some of them had early support problems.
- 2nd level classroom (4 years old): 14 pupils, with one SEN student with physical disabilities.
- 3rd level classroom (5 years old): 21 students with one girl with motor disability.

Three sessions took place according to the following phases:

1. Presentation of the activity to all the children. The teachers provide the main guidelines to all the class.
2. The children rotate between different stations.
    a. Station 1. Kinems. Tika Bubble.
    b. Station 2. Handicrafts – Butterfly, Bee, or Flowers.
    c. Station 3. Mural – All the children cooperate to paint a mural.

Figure 25. Overview of the stations in one of the classrooms

3. After the experience, all the children assess the session with a collaborator.
4. In one of the classes. The teacher asked the students to paint a drawing about the experience.

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Learning goals

The activities were focused in the curricular area of "Knowledge of the environment. First approach to nature". The contents and specific goals selected by the teachers were:

Content: Living beings: Animals and plants

Goals:

- To identify living beings (animals and plants).

- To get initiated in the classification of animals and plants according to one of their characteristics.

Table 1 illustrates the objectives of the curricular design according to the cognitive, physical and emotional areas.

Table 2. Curricular objectives worked on the pilots in relation to the cognitive, physical and emotional areas.

AREAS	CURRICULAR OBJECTIVES
1. Cognitive	1.1. To identify the different animals of the natural environment, analyzing their characteristics. 1.2. To identify some animals and classify them.
2. Corporal	2.1. To perform movements that require coordination, balance, control and guidance and execute with certain precision tasks that require manipulative skills.
3. Emotional and Interactional	3.1. To participate in group activities valuing the own and foreign contributions and respecting the basic principles of democratic functioning. 3.2. To show interest in different activities and act with attention and responsibility, experiencing satisfaction with well done tasks.

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6.1.3. Description of the sessions and of the learning stations

Presentation of the activity to all the children

In each of the classrooms, the sessions lasted one hour in which the children had to complete the three stations. In the three cases, the students were divided into three groups to rotate through the stations. Before starting with the activities, each teacher explained to the students what was going to be done throughout the session. Table 2 shows a brief description of the main aims of the activities performed in each class regarding the stations.

Table 3. Classrooms activities

Classroom	***Station 1. Kinems. Tika Bubble***	***Station 2. Handicrafts***	***Station 3. Mural***
Kindergarten 1	Matching fruits and colors	Butterflies	*All the children cooperate to paint a mural.*
Kindergarten 2	Matching animals with number of legs	Bees	*All the children cooperate to paint a mural.*
Kindergarten 3	Matching animals with your home	Ladybugs, flowers and frogs	*All the children cooperate to paint a mural.*

Station 1. Kinems. "Tika Bubble" Game.

The game employed in the three classrooms was *Tikka Bubble*. This game consists of matching elements that are related to each other. The categories of the selected elements were those related to fruits and their colors; animals and some of their characteristics, e.g. number of legs of each animal. The objective of this activity was to improve bilateral coordination skills by working the upper body and using both hands simultaneously to match the related objects.

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Figures 26a-c. Tikka Bubble station in the three kindergarten classrooms

Station 2. Handicrafts – Butterfly, Bee, or Flowers

As shown in Table X2, in each kindergarten class the children had to create different crafts with clay (see Figure 27).

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Figure 27. Handicrafts made with clay by children

Station 3. Mural – All the children cooperate to paint a mural.

Children made different animals and plants using finger paint. Later on, they shared their creations in a mural paper. The mural was exhibited in a hallway of the school. Figure 28 illustrates a picture of the "Spring mural".

Figure 28. Mural painted by the children

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6.1.4. Assessment of the learning intervention

Students' impressions

After the experience, all the children assessed the session with a collaborator. A simple questionnaire with three questions was employed. Children were asked to rate into "a bit, regular and a lot" to the following questions: "I have liked to play"; "I have talk to others during the game"; and "I have got bored playing". Besides, as it is shown in Figure 5, a facilitator helped each child to place one sticker in the pages that matched their opinion about the activity. Due to the early age of these children, one facilitator had to read aloud the questions to enable the students' understanding of the questions (Figure 29).

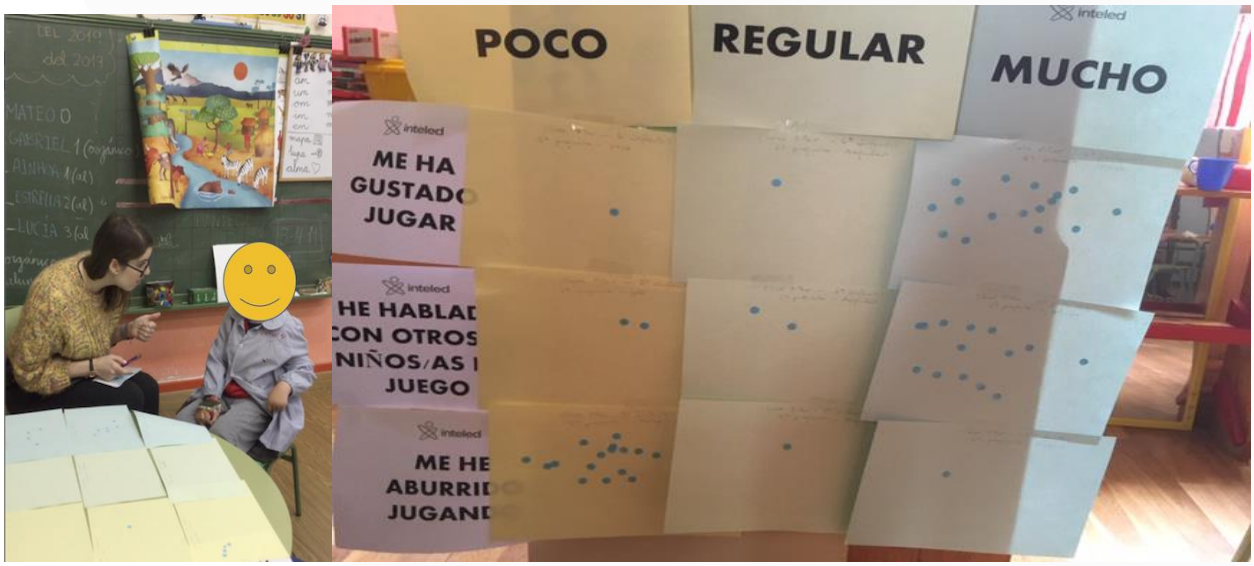

Figure 29. Students' engagement assessment in the kindergarten pilots. The questions are shown in the vertical column and the answers appear in the horizontal layout.

The results of this assessment showed that the majority of them liked playing and did not get bored during the sessions. Moreover, teachers' comments according to what they had seen in the development of the session also stressed that students enjoyed the activity and were actively engaged:

- "When she completes all the exercises correctly, the student dances and laugh"
- "Once the student completes all the exercises in Kinems she does not want to leave the Kinems corner. She wants to continue with the game".
- "All the students are clapping when the child who is playing complete with success the tasks".

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Also, in one of the classes, the teacher asked the students to paint a drawing about the experience and they were very happy to do it (see Figure 30).

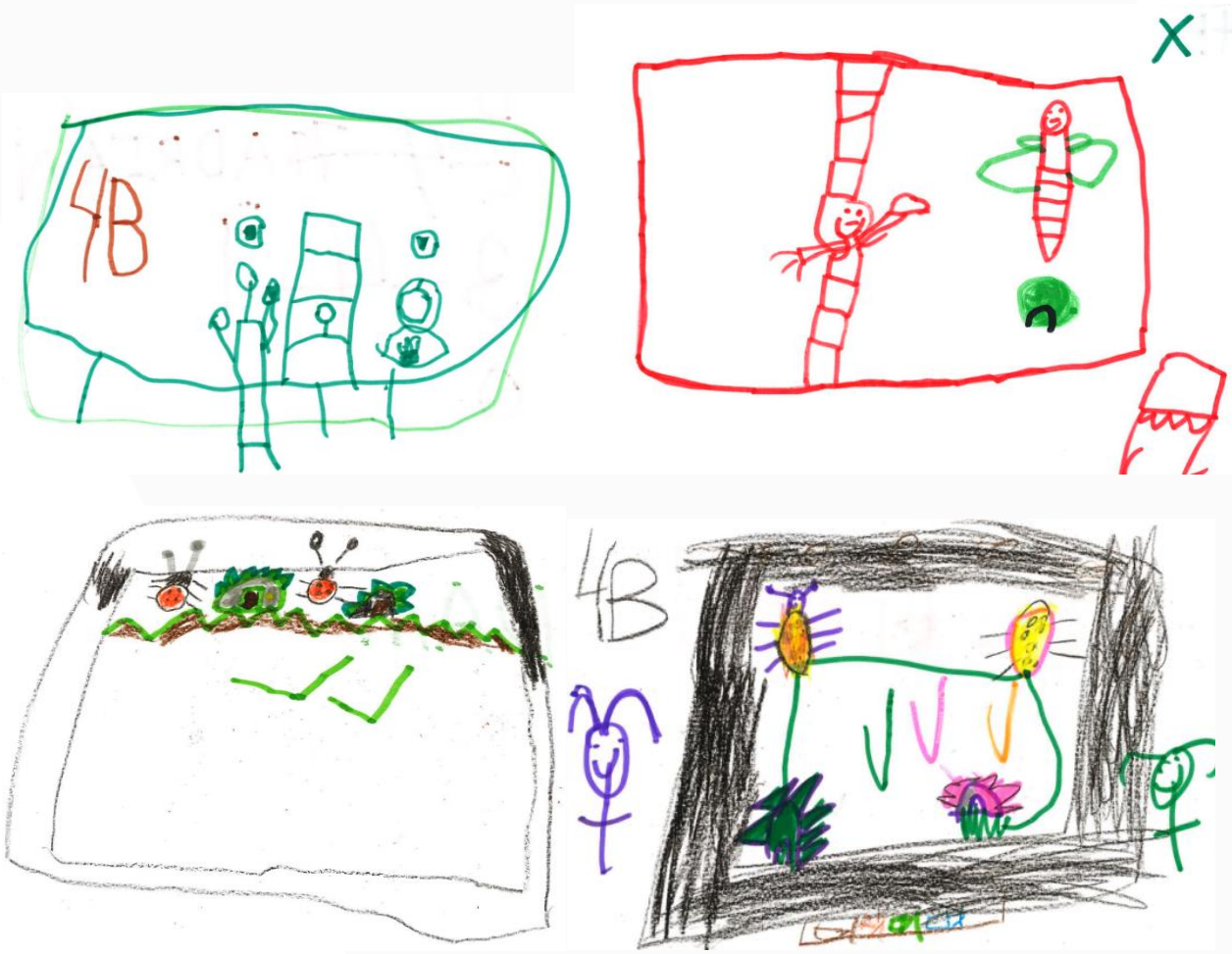

Figure 30. Drawings made by the students about the activity

Teachers' impressions

After the implementation, all the teachers involved in the sessions shared positive impressions regarding the developed activities. They highlighted aspects such as:

- The students have received the INTELed sessions well.
- The games employed promoted children's motivation to learn through playing.
- Obtaining immediate feedback of the successes achieved, and this encourages them to continue with the challenge.
- The students desired to continue playing with the game once the session was finished.

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Also, the teachers considered that this kind of educational practice favors educational inclusion since it allows all students to be actively engaged in the classroom as well as adapt the game conditions according to the students' skills and competencies.

> "Everybody enjoyed the experience. It does not matter if children have special needs or not. They enjoyed playing. The games were also attractive for all of them".

Parents' impressions

Parents' impressions were collected by means of a survey. These impressions have been discussed already in deliverable IO-T4. As we point out in this report, parents were positive overall about this kind of innovation in the class. some of them referring to the fact that children like games and computers and therefore they promote engagement and learning, and some others because they were positive about innovation in general.

However, some of the parents pointed out that they did not have enough information about the innovation to express their opinion, and a third group of parents expressed worries about using too much technology at these early ages. Also, when asked about what the children had said about the activity, many families said that the children had not said anything about it until they were explicitly asked about it. These impressions point out to the need of the families of very young children to have fluid communication with the teachers, to be aware of what are the children doing in the classroom and explore better the feelings of their children about them.

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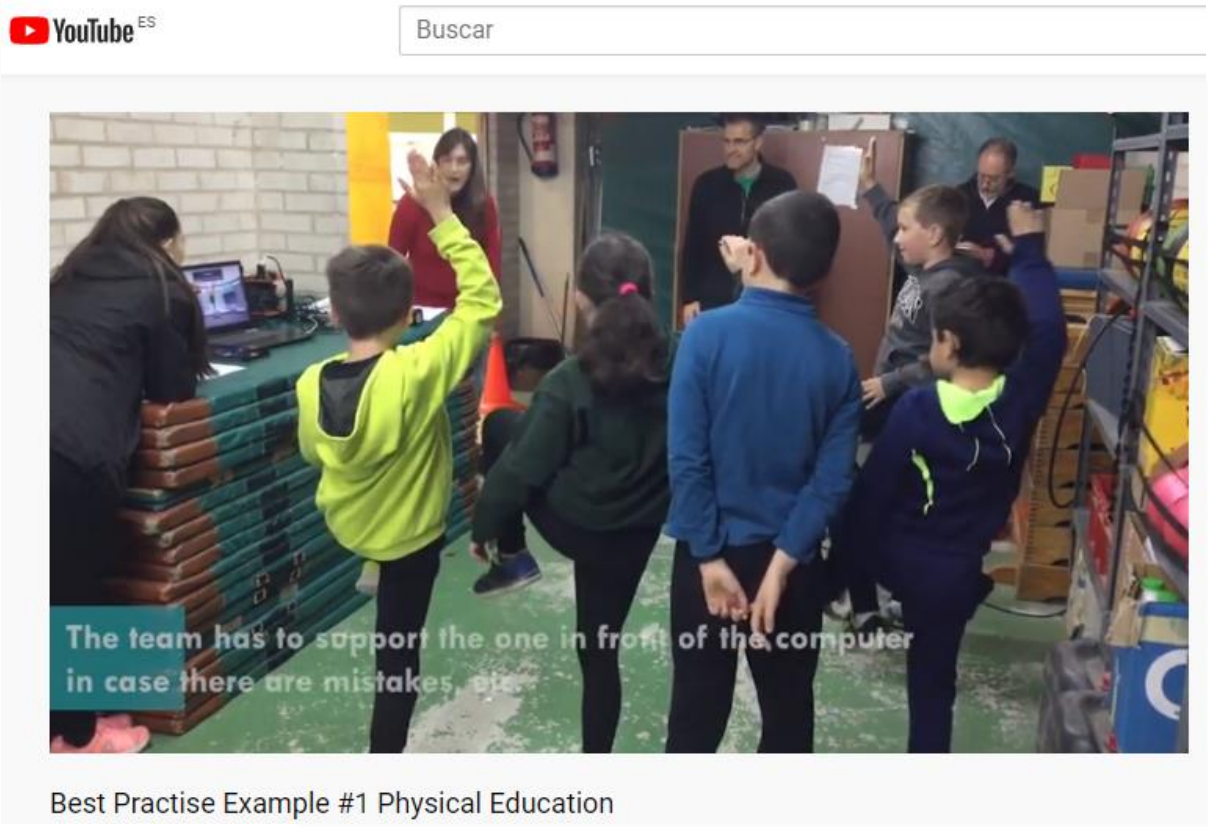
6.2. Presentation of Best case #2 - Physical Education

6.2.1. Interactive multimedia presentation

CEIP Gómez Bosque (Igor) https://www.youtube.com/watch?v=9B2g6oAJa9k



6.2.2 Overview

School: CEIP Gómez Bosque (Valladolid, Spain)

Grade: 1st and 4th of Primary Education (6-7 and 9-10 years old).

- 1st course: 21 children and 3 SEN students.
- 4th course: 16 children and 1 SEN students.

Subject: Physical Education – Areas: Body awareness / Motor skills / Games and sport activities.

Teacher: Igor Calvo

Pre-service teachers: Sara García Martín, Diego Martín Ruiz.

Learning goals and overall approach to the design

1. To promote the inclusion of all the students.
2. To develop motor skills with non-conventional resources.
3. To reinforce respect to peers.
4. To achieve a more complete body development through the use of different body segments.

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One of the issues the teachers face when solving how to integrate the embodied games from the Kinems suite in the classrooms was the fact these games are designed as individual games. They decided to design a set of stations and include the activity so that the use of the embodied games was not perceived as something apart. From this idea, they decided that all the children rotated through all the stations. Therefore, the classroom was divided into groups of 4 or 5 people to complete all the tasks proposed in the different stations. They chose "Do Like" as the game.

6.2.3. The learning stations

1. Presentation of the activity to all the students. The teacher and the pre-service teacher provide the guidelines to all the children

Firstly, teachers devoted time to explain the whole class the learning goals of each of the stations (see Figures 31a-b). The groups remained 6 minutes in each station. At the end of the circuit, teachers asked students to complete a self-assessment sheet regarding the activities in groups. Moreover, a short questionnaire about the activities performed in the Kinect station was also shared with the students.

Figure 31a-b. Presentation of the activity to all the students

2. The children rotate between different stations

A series of cooperative activities were proposed to facilitate the participation of all students and give greater dynamism. All of them were adapted so that the students with motor disabilities could participate in them. For example, in some of them, balls were substituted by balloons, to facilitate that all the students could bounce them (Figure 32a-d).

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Figure 32a-d. Images of some of the cooperative stations and their instructions.

3. Kinems station: "Do Like"

In this station, the students participated in groups of 4 or 5 children to exercise gross motor skills, body control, laterality and balancing through the "Do like" game.

One by one the students made the different proposed body positions. At the same time the rest of the classmates had to check if his/her partner was performing the movement correctly. Thus, students gave advice to their classmates to help them when they saw that someone had difficulties in doing the movements (See Figures 33a-b).

In the case of SEN students, we used an avatar and the help of a partner so that he could perform the postures by imitation (visual aids). In the 1st grade classroom (6 years old), two handkerchiefs of different colors were used to help the children distinguish between right and left, since it is a very difficult content to acquire in most cases.

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Figures 33a-b. Kinems station. All the children are asked to do the same that the one in front of the computer.

To work on the objective of peer cooperation for the social inclusion of all students, one instruction was introduced: all students should perform the movements at the same time his/her partner is doing the same with the Kinems game.

4. Final evaluation

At the end of the session the children were given two self-assessment sheets. The first one was a self-assessment sheet to collect the children vision of all the activities they had done. It included a five-item assessment table (the first two related to the motor competence of the session and the last 3 in relation to cooperation) and four levels of achievement (never, rarely, several times, many times) (see Figures 34a-b). The second sheet was devoted to evaluating their experience with the Kinems station. This sheet was composed of 5 items that had to be assessed with a four-level scale illustrated with smiling faces. It was filled out individually by the students (see Figures 35a-b).

Figures 34a-b. Self-assessment in groups of all the activities.

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Figures 35a-b. The evaluation sheet of the Kinect station was filled individually

6.2.4. Assessment of the learning intervention

Students' impressions

The assessment of the Kinems station by the students, collected through the individual evaluation sheet mentioned in the previous section showed that they had been very interested and motivated in the use of the games. After two trials with the Kinems games, the children reported their interest to continue the use of the tool (as discussed in the O3 T4 report).

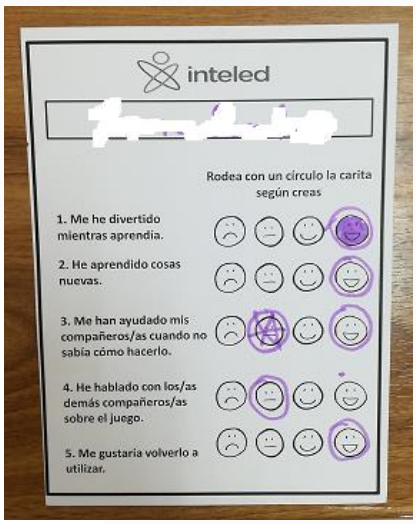

Figure 36. An example of an assessment sheet filled out by a student

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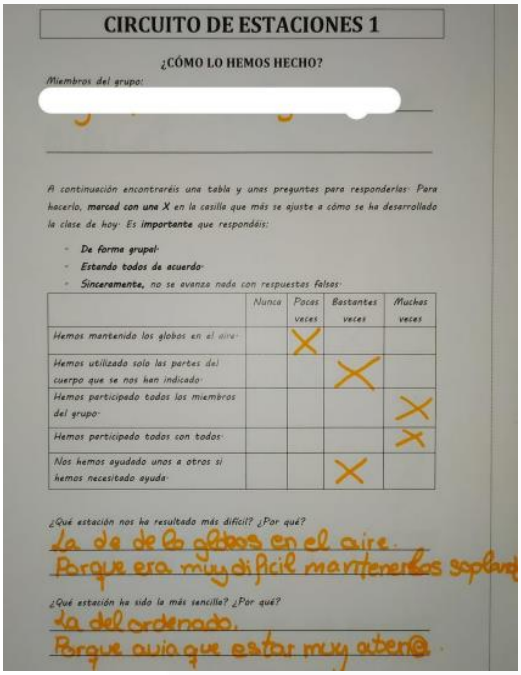


CIRCUITO DE ESTACIONES 1

¿CÓMO LO HEMOS HECHO?

Miembros del grupo:

A continuación encontraréis una tabla y unas preguntas para responderlas. Para hacerlo, **marcad con una X** en la casilla que más se ajuste a cómo se ha desarrollado la clase de hoy. Es **importante** que respondáis:

- **De forma grupal**
- **Estando todos de acuerdo**
- **Sinceramente**, no se avanza nada con respuestas falsas

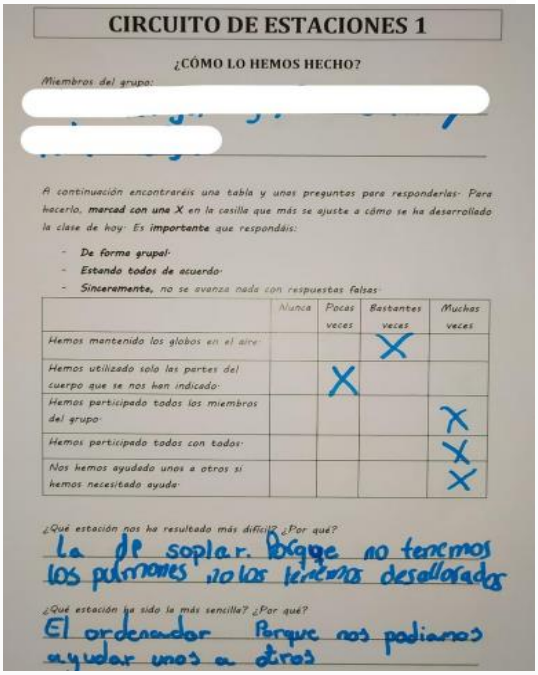
	Nunca	Pocas veces	Bastantes veces	Muchas veces
Hemos mantenido los globos en el aire		X		
Hemos utilizado solo las partes del cuerpo que se nos han indicado			X	
Hemos participado todos los miembros del grupo				X
Hemos participado todos con todos				X
Nos hemos ayudado unos a otros si hemos necesitado ayuda			X	

¿Qué estación nos ha resultado más difícil? ¿Por qué?

La de de los globos en el aire. Porque era muy difícil mantenerlos soplan

¿Qué estación ha sido la más sencilla? ¿Por qué?

la del ordenador. Porque avia que estar muy atent@



CIRCUITO DE ESTACIONES 1

¿CÓMO LO HEMOS HECHO?

Miembros del grupo:

A continuación encontraréis una tabla y unas preguntas para responderlas. Para hacerlo, **marcad con una X** en la casilla que más se ajuste a cómo se ha desarrollado la clase de hoy. Es **importante** que respondáis:

- **De forma grupal**
- **Estando todos de acuerdo**
- **Sinceramente**, no se avanza nada con respuestas falsas

	Nunca	Pocas veces	Bastantes veces	Muchas veces
Hemos mantenido los globos en el aire			X	
Hemos utilizado solo las partes del cuerpo que se nos han indicado		X		
Hemos participado todos los miembros del grupo				X
Hemos participado todos con todos				X
Nos hemos ayudado unos a otros si hemos necesitado ayuda				X

¿Qué estación nos ha resultado más difícil? ¿Por qué?

La de soplar. Porque no tenemos los pulmones ni los tenemos desarrollados

¿Qué estación ha sido la más sencilla? ¿Por qué?

El ordenador. Porque nos podíamos ayudar unos a otros

CIRCUITO DE ESTACIONES 1

¿CÓMO LO HEMOS HECHO?

Miembros del gru

Muy bien, intentándolo y esforzándonos

A continuación encontraréis una tabla y unas preguntas para responderlas. Para hacerlo, **marcad con una X** en la casilla que más se ajuste a cómo se ha desarrollado la clase de hoy. Es **importante** que respondáis:

- **De forma grupal**
- **Estando todos de acuerdo**
- **Sinceramente**, no se avanza nada con respuestas falsas

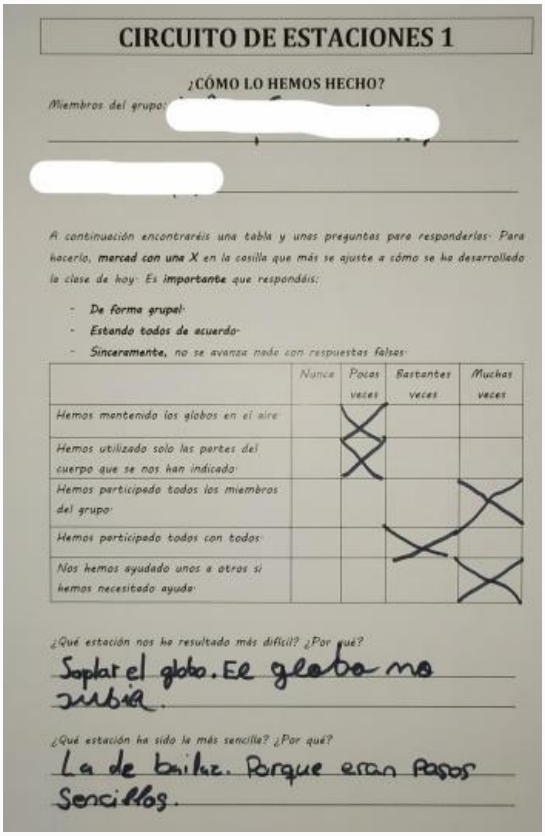
	Nunca	Pocas veces	Bastantes veces	Muchas veces
Hemos mantenido los globos en el aire		X		
Hemos utilizado solo las partes del cuerpo que se nos han indicado				X
Hemos participado todos los miembros del grupo				X
Hemos participado todos con todos				X
Nos hemos ayudado unos a otros si hemos necesitado ayuda				X

¿Qué estación nos ha resultado más difícil? ¿Por qué?

la de soplar el globo. Porque casi siempre se nos caia.

¿Qué estación ha sido la más sencilla? ¿Por qué?

La de la camara. Porque solo nos teniamos que mover.



CIRCUITO DE ESTACIONES 1

¿CÓMO LO HEMOS HECHO?

Miembros del grupo:

A continuación encontraréis una tabla y unas preguntas para responderlas. Para hacerlo, **marcad con una X** en la casilla que más se ajuste a cómo se ha desarrollado la clase de hoy. Es **importante** que respondáis:

- **De forma grupal**
- **Estando todos de acuerdo**
- **Sinceramente**, no se avanza nada con respuestas falsas

	Nunca	Pocas veces	Bastantes veces	Muchas veces
Hemos mantenido los globos en el aire		X		
Hemos utilizado solo las partes del cuerpo que se nos han indicado		X		
Hemos participado todos los miembros del grupo			X	
Hemos participado todos con todos			X	
Nos hemos ayudado unos a otros si hemos necesitado ayuda				X

¿Qué estación nos ha resultado más difícil? ¿Por qué?

Soplar el globo. El globo no subia.

¿Qué estación ha sido la más sencilla? ¿Por qué?

La de bailar. Porque eran pasos sencillos.

Figures 37a-d. Examples of assessment sheets filled out by the teams

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Cyprus University of Technology

Social Computing Research Center

University of Piraeus Research Center

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Universidad de Valladolid

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As regards the experience as a whole, Figure 36 displays examples of some of the evaluation sheets filled out by the groups. The results obtained in terms of the "cooperation" dimension pointed out that all groups positively valued this aspect, giving the answer "many times" or "several times" in most groups as can be seen in Figure 37a-d.

Parents' impressions

Families impressions were collected by means of the parents' survey described in IO3-T4. Some of the answers of the families from this case are collected below:

- "S/he have discussed that they have carried out balance games through imitation of the movement of an avatar in a game. What s/he has liked most is to obtain equilibrium and the fun with his/her mates. What s/he has liked less is that they are too many to see the computer screen correctly"

Families stated that their children had expressed their will of playing again these games in the class because they had found it enjoyable:

- "She says she would like to repeat it, that she has enjoyed it a lot"
- "Yes, she wants to use it at home and at school"
- "She says it is funny, like a game. She has not said anything negative"

Overall, parents were satisfied that their children had enjoyed using new tools for their learning, and the possibility these tools open to transfer the contents and the activities to their own houses.

Teachers' impressions

Figure 38. Interview with the teachers after one of the sessions.

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Teachers' impressions were collected through interviews after the experiences (Figure 38) and in the reports written by the pre-service teachers about their work with these courses during their practicum (Martín Ruiz, 2019; García Martín, 2019). In their comments, teachers point out that this tool is useful to work Physical Education and test the learning achievements:

> "This activity (Do like) has been useful for students to foster the identification of left and right and to improve laterality. It was a surprise to me that many students had trouble to follow the indications to perform the movements. In the first course, it is normal that they have more problems with laterality, but I saw similar mistakes in children from the fourth grade, and these contents are part of the curricula since kindergarten education".

> "The students had problems in understanding some of the instructions given by the game Do like. For example, "*to keep the left foot and raise the right hand*" means the student should lift the right foot and raise the right hand".

Teachers highlighted that students were able to improve cognitive abilities such as attention and concentration, as well as several executive functions. It is worth noticing that, according to teachers, the use of multisensory games might be especially helpful for SEN children to remain focused on solving the tasks. Also, they stated that this kind of experiences can contribute to foster children's willingness to learn:

- "Students enjoyed an activity that was different in the Physical Education class"
- "The work done related to making differences in the body segments, equilibrium and coordination, was positive thanks to the "Do Like" game"

With respect to the inclusion of SEN students, the teachers point out that all the children could participate in the activity with no difference:

> "I think this is the first time that we have done it [put all of them together] and they have been all together, all cheerful when they had to do it, and it was not distinguishable who needed it more or less"

They also point out that, in spite of initial doubts, they finally found a way of working with this tool their inclusive Physical Education sessions and that they are satisfied with the result, with some aspects that could be improved, like:

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- "The games are mostly individual activities, because, up to now, they only have the option of playing individually. Even if we have implied the rest of the teammates in the game, at the end of the day it is an activity in which only one person is truly playing."
- "The activity required one teacher assistant. While the rest of the students are carrying out the rest of the activities, the teacher does not have time to prepare the game for each individual student and observe its performance. "

In their final reflections, teachers pointed out interesting insights (Martín Ruiz, 2019). They stressed that these resources (embodied games) offer a new possibility to work contents related to other areas in an innovative way, to benefit from some of the personalization capabilities offered by the tools, propose the idea of involving teachers in communities of practice to enrich these proposals, and envision a future where these technologies are more accessible:

> "[...] it would be useful and convenient to use it in the breaks, or like a "motor break" in the classroom. This way, the students that complete a task could have it as a reward, or simply, a way of releasing the need of movement that children have.
>
> "Within the area of Physical Education, it could be possible to establish it as a rotative activity in which in each classroom two students of each group could go through it to work different movements and transversal contents. Moreover, as the tool offers the possibility of creating individual profiles, each student would have their own profile in which their progress could be stored."
>
> "It would be very positive to train teachers in this tool, and to create a community in which its members would contribute their feedback and proposals for the use of Kinems, with the goal of improving it."
>
> "At this moment, these games require the use of a Kinect camera, but in the future, I foresee that more accessible technology, like computers or tablets would integrate the technology to use embodied games."

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Diego Martín Ruiz, Educación Física inclusiva: Análisis e Intervención a través de metodología cooperativa en un caso de 4º de Educación Primaria. Trabajo Fin de Grado, Universidad de Valladolid. 2019.

Sara García Martín. Educación Física inclusiva: Análisis e Intervención a través de metodología cooperativa en un caso de primero de Educación Primaria. Trabajo Fin de Grado, Universidad de Valladolid. 2019.

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7. Summary and conclusions

The INTELed project aimed at providing teachers with knowledge and skills about the use of interactive and embodied learning technologies to address the needs of ALL learners (students with and without disabilities) in inclusive and special education contexts.

The project involved also school pilots in the 4 participating countries of the partnership (Cyprus, Greece, Italy and Spain) led by the INTELed trained teachers. This report focused on the presentation of the INTELed best practices, collected during the school pilots as well as of the cases of good practice in the four consortium partner countries.

Best cases of good practice were captured in each partner-country. Cases of good practice from each partner-country were subsequently fully documented as "Best Practices" to be shared between the partners and became available in the project's website for open access. A YouTube channel has been created, linked to the project's website, to allow and all interested stakeholders to enjoy videos of these "best practices"

The INTELed YouTube channel is accessible at:
https://www.youtube.com/channel/UCCulQiJv9pRF3PyQo7XL0rg/videos?view_as=subscriber

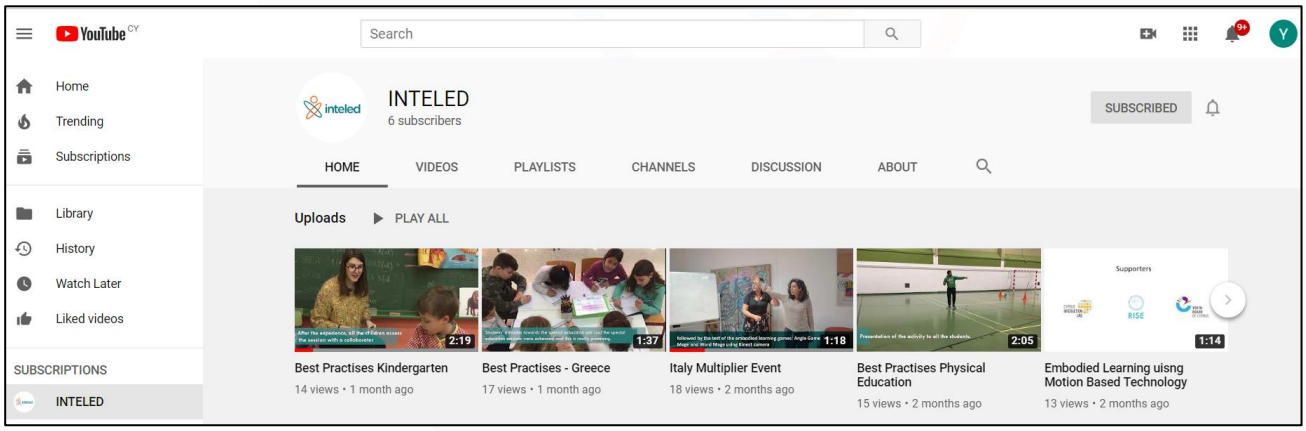

Figure 39. Screenshot from the INTELed YouTube channel

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