Design FILS

Designing Future Innovative Learning Spaces

Guidelines for Teacher Trainers on Innovative Classrooms

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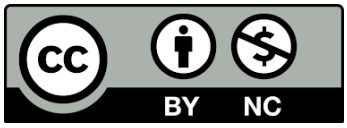

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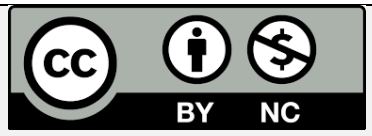

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Abstract

This document aims to contribute to the promotion of innovation and technology-enhanced learning inside schools' classrooms and teachers' practices. For that, a set of key-competences for teachers and teacher trainers are described considering i) the spatial design of innovative learning spaces, ii) the implementation of active learning pedagogies, and iii) the integration of ICT into teaching and learning practices. Real examples of innovative learning spaces from different countries are presented, which aims to work as inspirational good practices in designing flexible learning spaces that supports the development of 21st-century skills on students and that stimulates the adoption of innovative teaching practices.

Keywords: active learning pedagogy, educational technology, learning scenarios, learning space design, teachers' training, teachers' competences

Contents

Guidelines for Teacher Trainers on Innovative Classrooms

The present document aims to provide a set of guidelines to teachers and teacher trainers about the external mechanics and internal skills that need to be activated to promote innovation and technology-enhanced learning inside schools. Additionally, it presents inspirational showcases of innovative classrooms structured around flexible learning zones in order to provide support for training processes both in face-to-face and online settings. It will be prepared according to three dimensions: ICT integration in innovative learning spaces, new design and configuration for learning spaces, and new pedagogical approaches for teaching in the XXI century.

For developing these guidelines, a multi-disciplinary approach was used, and they are built upon the Methodological Framework for Innovative Classroom Trainings created for the Designing Future Innovative Learning Spaces (Design FILS) Project.

Although, these guidelines will address teacher trainers, it will require extensive work as its final target audience will be teachers in schools who need to know how to employ innovative teaching strategies in today's classrooms, how to effectively embed ICT into teaching and learning, and also how to renovate these learning spaces in order to ensure that the learning and teaching practices that take place in them, really present to be innovative and productive in promoting XXI- century skills for the students.

The goal of this document is:

- To contribute to the promotion of innovation and technology-enhanced learning inside schools, classrooms and teachers' practices;
- To help maximize the teaching and learning experiences in flexible learning spaces;
- to provide guidance and some key principles for teacher trainers to base their training sessions on designing flexible and innovative learning environments;
- To provide examples of innovative learning spaces and classroom activities that teachers' trainers as well as teachers can organize in order to take full advantage of new tools, equipment, furniture and subspaces for fostering better classroom management.

Chapter 1 presents a set of key-competences that Teachers as well as Teacher Trainers should be able to develop in order to design, implement and take full advantage of innovative learning spaces. The competences are organized in three different dimensions which

emphasize not only the architectural and technical aspects of learning space design, but also active pedagogical approaches enriched by the use of educational technology.

Chapter 2 presents relevant ideas for organizing Teacher Training activities for using innovative learning spaces. The Design FILS Project adopts the idea of learning scenarios as a methodology that embodies an innovative and creative approach to enhance pedagogy, and meaningful learning educational experiences for teachers.

Chapter 3 describes 5 showcases of innovative learning spaces, where ICT, space design and new pedagogical approaches are optimally articulated to support the development of active learning activities. All the showcases address how the learning space impacts teachers' practices, what type of pedagogical practices are implemented, and also how ICT is integrated in these practices.

Finally, **Chapter 4** presents the main conclusion of this document, highlighting the need to promote more inclusive and responsive design for learning spaces that facilitates the adoption of emerging pedagogies, in a straight articulation with today's digital tools.

Chapter 1 Key Competences for implementing Innovative Learning Spaces for teachers and teachers trainers

The Methodological Framework for Innovative Classroom Trainings developed for this project is structured upon three key pillars for building 21st century-learning environments: Space Design, Pedagogy and Technology:

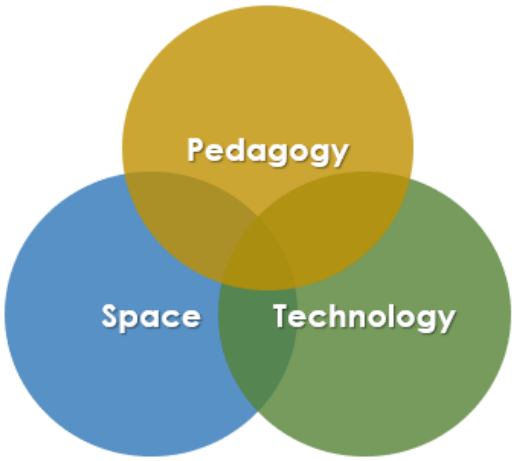

Figure 1. Three Pillars of the framework for Innovative Classroom Trainings (Steelcase, 2014)

In order to create engaging, learner-centered, individualized and collaborative as well as challenging learning environments, teachers and teacher trainers should be able to develop a set of key competences. In this document we conceptualize **competences** as a construct that involves knowledge, skills, attitudes, values and personal characteristics, and that empowers the teacher to act appropriately and professionally (Koster & Dengerink, 2008). Competencies presents the following characteristics (Caena, 2011):

1. A competency consists of one or more skills whose mastery would enable the attainment of the competency;

2. A competency presents a situated nature, it is linked to the context and situation in which is it used, though it can be general and is indeed transferable;

3. Possessing a performance dimension, competencies are observable and demonstrable. Therefore, they are also measurable. It is possible to assess and improve a competency taking in consideration teacher's performance;

5. The development of competency is an inherent element of any effective teacher training process. Competency is essential to any teachers' pursuit of excellence.

Bearing this in mind, a set of key-competences are described considering three different but interconnected dimensions:

1. Understand Spatial Characteristics and Integrate **Space** into Teaching and Learning: This dimension focuses on competences related to the awareness of the role that learning space assume in the practices of its users (teachers and students) and how the spatial design of innovative learning spaces can be used to promote active learning, motivation, engagement, and comfort.

2. Understand and Apply **Active Learning Pedagogy**: This dimension focuses on the knowledge, skills and attitudes involved in adopting student-centred pedagogy, by taking advantage of technology-enhanced learning and learning scenarios approaches.

3. Understand **ICT in Education** and integrate ICT into Teaching and Learning: This last dimension focuses on competences that relate to the understanding of ICT as a catalyst for innovation in teaching and learning practices as well as its role in the development of students and teachers' digital competence.

The key competences related to each of these dimensions are presented in the following pages. These key competences aim to stimulate teachers and teachers' trainer's self-reflection about their level of proficiency in these domains. It can also be used by schools, as well as teachers training centres, for defining their institutional level of maturity regarding these domains and, to therefore, define a baseline for a developmental action plan. A tool for supporting this individual or institutional diagnostic process can be found at its end.

Dimension1. Understand Spatial Characteristics and Integrate Space into Teaching and Learning

A) To understand the concept of an innovative learning space

1.A.1 Understand, analyze and evaluate the complexity of modifying traditional classrooms;

1.A.2 Understand and apply the concepts of six learning zones (to create, to interact, to present, to investigate, to exchange, to develop);

1.A.3 (re)Design and use different learning zones for inclusive education and students with Special Needs.

B) Understand and use spatial characteristics to enhance active learning pedagogy

1.B.1 Apply the concept of six learning zones to support individual, pair or team work;

1.B.2 Design and modify a classroom-level space to foster interaction, collaboration, communication, creativity, self-directed learning, and reflection;

1.B.3 Organize space, furniture arrangements and resources to align with the innovative pedagogies, methodological approaches and learning activities;

1.B.4 Organize and use spaces to facilitate interdisciplinary approaches and team teaching;

1.B.5 Design space to develop organizational capacity building.

C) Evaluate and use space characteristics to develop a sense of belonging, ownership, and comfort

1.C.1 Understand, use and change the spatial features to develop the feeling of ownership and belonging in students: such as personal storages and desks, common areas, individual spaces, extra items enhancing self and social responsibility;

1.C.2 Understand and integrate spatial features to create a comfortable classroom-level space, adjustable to students' needs taking into consideration the anthropometric values and ergonomic criteria;

1.C.3 Understand and apply the concept of flexibility in arranging a learning space.

D) Understand and actively apply the concept of technology-enhanced space

1.D.1 Analyze the complexity of designing a safe technology-enriched space;

1.D.2 Integrate suitable technical devices and ICT tools into space, and create a safe learning environment by providing areas dedicated for technological device usage;

1.D.3 Evaluate the complexity of using virtual space and use the benefits it can offer.

Dimension 2. Understand and Apply Active Learning Pedagogy

A) Understand and apply the main concepts of student-centred pedagogy

2.A.1 Analyse the philosophy of student-centred teaching and learning and create a student-centred learning environment to improve students' performance and motivation;

2.A.2 Assess the dimensions of teacher-student interaction;

2.A.3 Apply active learning strategies to support the development of the '21st century' skills and competences, such as: inquiry, solving problems, applying new knowledge to real life situations, developing independent and collaborative learning, and reflectivity;

2.A.4 Engage students in collaborative project work: organize and scaffold collaborative group work with students taking various roles;

2.A.5 Apply active learning strategies in instruction, and teaching and learning activities to enable differentiation and support inclusive environment;

2.A.6 Identify and apply innovative methods and techniques for interdisciplinary learning and cross-curricular projects;

2.A.7 Engage students in reflective practice to develop students' responsibility for their learning by providing constructive feedback;

2.A.8 Promote inquiry through relevant problems to motivate students in their learning process and encourage students in self-directed learning;

2.A.9 Identify and apply different types and various tools for assessment that can be used in flexible learning spaces;

2.A.10 Design formative assessment tools and methods to gather evidence of learning and use it to adapt teaching to meet students' needs.

B) Understand and apply technology-enhanced learning approaches to support student-centred pedagogy

2.B.1 Assume key principles and elements of technology-enhanced pedagogical approaches;

2.B.2 Analyse the teachers' and students' roles in applying active learning pedagogy in a technology-enhanced classroom;

2.B.3 Value that an Innovative Pedagogy prepares citizens of the society of knowledge in order to be critical thinkers, be lifelong learners, be creative, cope with change, manage and analyze information, work with knowledge and utilize ICT.

2.B.4 Integrate technology-enhanced space into teaching and learning;

2.B.5 Incorporate appropriate ICT activities into lesson plans to support students' acquisition of subject matter knowledge, to develop digital literacy and the 21st century skills;

2.B.6 Apply technology-enhanced pedagogical approaches to support active learning, such as blended learning, digital story-telling, project-based learning and maker-centred project learning;

2.B.7 Apply technology-enhanced pedagogical approaches to foster students' autonomy.

C) Understand and apply the learning scenarios approach to support technology-enhanced teaching and learning

2.C.1 Understand and evaluate the learning scenario approach, its key principles and elements;

2.C.2 Integrate learning scenarios into curriculum;

2.C.3 Adapt or apply existing learning scenarios according to the students' needs;

2.C.4 Develop learning scenarios that enable active and simultaneous use of different learning zones in a flexible learning space;

2.C.5 Develop learning scenarios and activities that connect to current changes in the society and the world of education and develop inquiry, collaboration and reflection in students;

2.C.6 Identify FCL Toolkit for Scenario Development and adapt it to contextual learning requirements and real-life challenges.

Dimension 3. Understand ICT in Education and integrate ICT into Teaching and Learning

A) Understand the innovative role that ICT can have in Education

3.A.1 Analyze the key principles of using ICT in education, and define how they can be put into practice;

3.A.2 Integrate ICT into the curriculum to achieve learning outcomes.

B) Apply ICT in upgraded Teaching and Learning activities

3.B.1 Make the most of ICT to support students' acquisition of subject matter, creativity, making, inquiry, collaboration and reflection;

3.B.2 Use ICT to give feedback to students, assess their performance and define their achievement;

3.B.3 Take advantage of ICT to support students' understanding of their own learning processes and learning strategies;

3.B.4 Develop students' critical stance to evaluate various ICT considering security issues, privacy laws and knowledge of copyright;

3.B.5 Use ICT to promote students digital competence;

3.B.6 Use ICT to participate in professional communities, sharing and discussing practice;

3.B.7 Encourage discussion, collaboration and participation in active learning through ICT to give students an active role, promoting complex cognitive processes, such as analysis and task-solving;

3.B.8 Use open-source software, web apps, and almost ever-present mobile technologies to engage students in active learning pedagogies.

3.B.9 Discover other opportunities for students to be active and use ICT in an interactive and motivational manner;

3.B.10 Use ICT to support distance or blended learning through both synchronous and asynchronous learning activities.

Note: *A self-assessment tool was built to support the reflection of teachers as well as teachers' trainers considering their level of competency in the previous described key-skills. This tool is available here.*

Feel free to use it!

Chapter 2: Teacher Training for designing innovative learning spaces

To design effective training and professional learning opportunities that help teachers use innovative learning spaces, there is a need to consider the factors that have been associated with successful professional development (Darling-Hammond, Hyler & Gardner, 2017): alignment with curricular content, active learning, modelling of effective practices, provision of coaching, experts' support and opportunities for feedback, sustained duration (Mills & Tincher, 2003), using follow-up mechanisms (Martin, Strother, Beglau, Bates, Reitzes & Culp, 2010), and embeddedness in collective practice. Recent OECD report (Minea-Pic, 2020) also highlights that real effective teachers training required a shift from passive to active teachers' role, so the training process needs to provide teachers with the appropriate opportunities to practice and reflect on his/hers practices in a purposeful and structured ways.

Teacher professional learning is here defined as formal and informal activities that aim to update, develop and broaden the skills, knowledge, expertise and other relevant characteristics of teachers (Boeskens, Nusche & Yurita, 2020) in both pre-service and in-service situation. For teacher training and professional development, designing and implementing **Learning Scenarios** can be an effective strategy to enhance reflection while planning teaching activities in technology-enhanced learning spaces (Pedro et al., 2019). The Design FILS Project adopts the idea of learning scenarios as key to planning teaching activities in technology-enhanced learning spaces. The purpose underlying the learning scenarios approach in the Design FILS Project is to develop a generative and flexible learning methodology that embodies an innovative and creative approach to enhance pedagogy, and meaningful learning educational experiences for teachers. *[More information on this can be found on Design FILS Project Output 3.]*

The Design FILS Project looks at teacher training from several complementary and compatible (not exclusive) points of view. Therefore, face-to-face, online and in-house teacher training activities are proposed focusing on the different fundamental aspects related to the transformation of educational spaces and the methodological changes inevitably associated with this transformation.

Face-to-face training activities will count on flexible and innovative learning spaces that are designed as reconfigurable spaces, but the most remarkable issue is the division of activities into learning zones.

The face-to-face training activities could be organized on the following sequence of phases, which are presented in suggestive sequence. These are grounded on the principles of 'Learning Zones' within the **Future Classroom Lab** model and learning scenarios model. Next, we focus on the process of the training drawing on the key aspects of teaching and learning and incorporated into the six learning zones of the FCL.

Phase 1. Presentation: Brief presentation of contents and theoretical bases and proposal of the scenario to start developing teaching-learning activities. This phase would take place in the "Present" area, applying a more expository methodology ending with an "Inquiry-based learning" methodology.

In this phase trainees work in large groups, and they can take advantage of the flexibility of the place to experiment with different configurations of the space according to the activity to be developed, so if the presentation is more interactive, they can use a U configuration while the placement of the chairs can be more linear if the presentation is more expositive. The furniture used in this space allows changing this configuration easily and quickly.

Phase 2. Investigate: Searching for information and sharing of the information gathered to be able to give an answer to the problem in question. The trainees would move to the "Develop" area where they would have access to different resources.

This phase requires a process of concentration and reflection, so it is intended that this area has a quiet and solitary environment.

Phase 3. Develop: Trainees meet as a group in the "Exchange" zone to give a consensual response to the challenge posed in the first phase.

Phase 4. Prototyping: Trainees working in groups develop skills to find the solution to the problem posed. In the "Investigate" area they will find the appropriate tools to carry this out. This area would work as a Makerspace where trainees would have access to technology as well as hands-on material (Basye, Grant, Hausman, & Johnston, 2015). The development of the project should be checked regularly, and the problems encountered along the process should be solved in a collaborative and independent way. In the final part of this phase, they should carry out an evaluation of the whole process.

Phase 5: Dissemination. To finish the process, the group of trainees should carry out a plan of dissemination of their project, thus developing their communicative and creative skills. In the "Create" area, students will be able to use the audiovisual media available and finally, in the "Interact" area, students will have the opportunity to experience their communication skills, using different ICT resources such as the interactive whiteboard and different software for this purpose.

One of the major pillars of teacher training in FILS is in-house training, as schools is the real element to impulse an effective training taking into account teacher demands and adapting them to the real needs of schools. It is of major interest that schools themselves design their own professional training plans after a thorough previous identification of their needs.

Educational centers with *state-of-the-art* technology and learning spaces, are the ideal places to receive training truly integrated in the environment, which allows greater involvement and participation of teachers and which reinforces teamwork. This type of training is part of a fundamental process for schools and should be integrated into their educational and curricular projects.

Regarding the use and transformation of learning spaces, it is evident that on-site training is clearly suitable since it deals with real problems and the needs of each center, stimulates joint research by the actors that play a part in the process of change, allows methodological innovation, and transformation of the real learning spaces of the center and its implementation by consensus.

In short, it is a very effective training to achieve real and visible transformations adapted to each educational community.

It is important to offer a variety of topics related to the learning spaces themselves, continuous training in ICT and active methodologies, both in face-to-face continuous training and in-house training for teachers of all levels, just as it is fundamental in the design of these activities taking into account the opinion and contributions of the teachers themselves.

Chapter 3: Showcases

This chapter presents five showcases of innovative learning spaces. They aim to be inspirational examples, working as good practices in designing flexible learning spaces. In these, ICT, space design and new pedagogical approaches are used to support the development of teaching and learning activities that promote the development of 21st-century skills on students, as well as development of the key-competences for teachers and teacher trainers listed in chapter 1. These showcases come from different countries: Portugal, Spain, Turkey and the Czech Republic, as marked in Figure 2. They involve different educational settings and school levels, from K-12 to Higher Education.

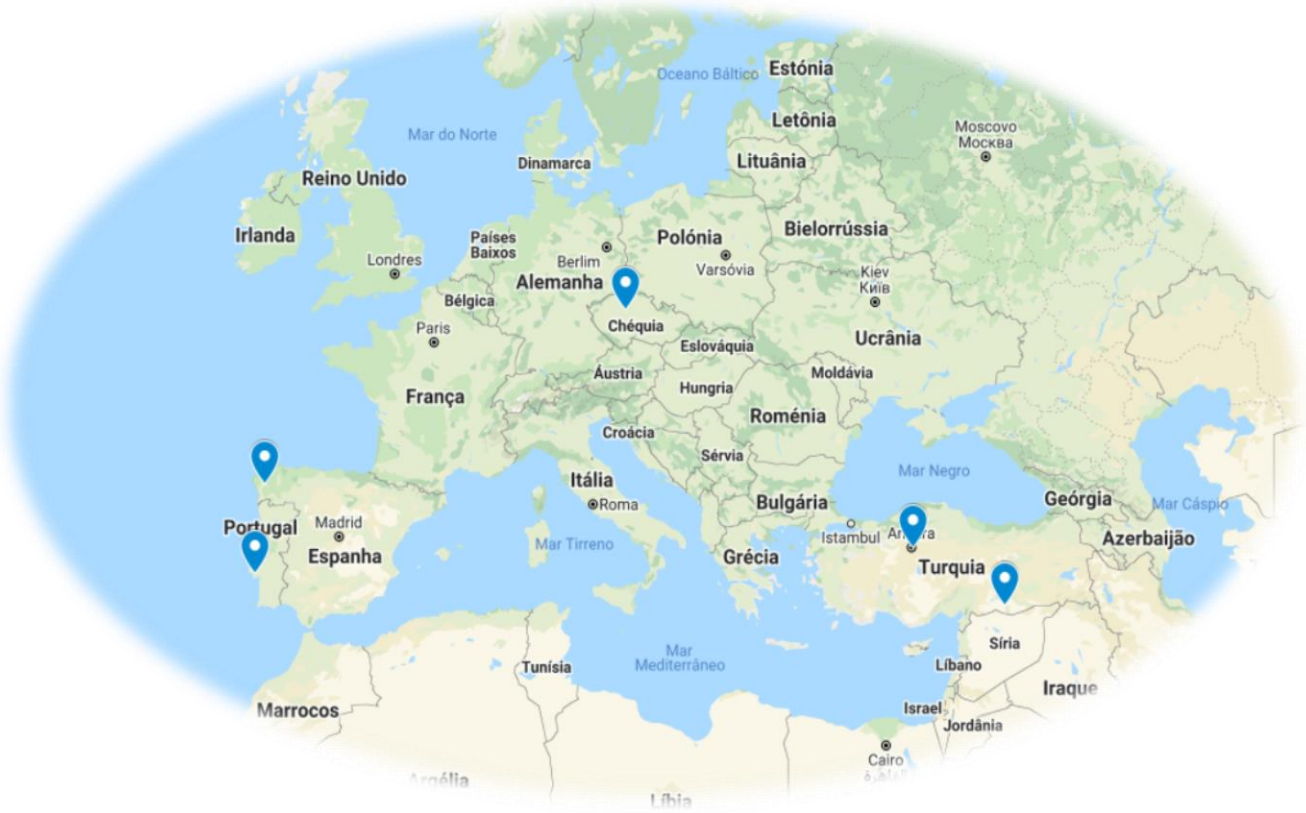

Figure 2. Location of the 5 showcases

Showcase 1: From 30 Desks to the Future Classroom Lab

Institution: ZS Dr. Edvarda Benese (ZSDREB), Prague

Country: The Czech Republic

Educational Level: Elementary education

Website: https://zscakovice.cz/ict

Rows of desks dominate classrooms all over the Czech Republic. The classic alignment of learning spaces is by far the most preferred. Besides color in the photos, little changes can be seen from those black and white days. However, one classroom at a time, ZS Dr. Edvarda Benese school has been improving their learning spaces. It is possible to see that it is hard to convert classrooms in the Czech public school system, or even just to use a new alignment of desks: classroom alignment is directly connected to the habits that teachers have in the classroom.

In 2016, ZS Dr. Edvarda Benese school became part of the Future Classroom Lab (FCL) project and we began with the conversion of one classroom into a modern example of what a learning space should be, fully utilizing the capabilities of space design and technology. Even today ZS Dr. Edvarda Benese school is still adding components to our FCL. When the FCL first opened, it was used by two teachers now its time schedule is full every single day. In 2019, our school opened a new section of our building, where all the classrooms are capable of modern practices. In 2020, ZS Dr. Edvarda Benese school opened a project-based learning program for first-grade students, where the learning space is designed to meet the needs of today's learners.

Figure 3. ZS Dr. Edvarda Benese Future Classroom Lab

ZS Dr. Edvarda Benese school is working very hard to open more classrooms which have a redesigned space. However, their teachers are not totally trapped even if they have the standard '30 desks and 30 chairs' classrooms. What has made a difference is the help provided to teachers for promoting new learning habits and how to reconfigure their classrooms so that learning is optimized.

Learning spaces and teacher practices

The goal of the learning space should be to promote learning for all learners. When the space is specifically designed with multiple learning zones, such as the FCL, it can improve the learning process because there are more possibilities for the individuals who are learning there. The critical challenge to overcome is how to change teacher's habits so that they can best utilize a learning space like the FCL. With so many learning zones, it can be very similar to jumping into 'frozen waters' for a teacher who has only taught in the classic setup. ZS Dr. Edvarda Benese school designed it space to be as flexible as possible. The school learning space can be aligned in many different ways for many different activities, but for teachers who are just starting to try new alignments, the institution likes to warm them up to it.

Even in the school normal classrooms the teacher can implement various configurations to achieve a similar effect. Besides the desks and chairs, most of the FCL components can be taken out of the FCL and used in any classroom. Several kits are available, from iPADs to Ozobots, to a green screen, which teachers can bring to their classroom and use in their lessons. This allows teachers to try a new classroom configuration and learn some new teaching practices with relatively low pressure. As they explore the use of new kits and new components in their classrooms, they start booking the FCL and start using the total package available.

Pedagogical practices

The biggest hurdle to overcome for many teachers is essentially giving control of the learning to the students. The classical setup of rows is very much orientated towards teacher control of the learning, but in spaces like FCL the goal is to have the students controlling their own learning process, thus making it student centered. The benefit is that, by establishing choices as critical components in the curriculum, students have to take responsibility for their learning, and they usually do so happily.

First, the expectations need to be clear. The students need to know and be trained on how exactly they should behave when they are working at certain zones/stations. Which is why, in ZS Dr. Edvarda Benese school, teachers begin to work with certain kits and components individually. The class can work on one station or one kit at a time in their own classroom before coming to the FCL, so that, as time goes by, they know all the components. It is hard to establish clear expectations for six different learning zones in one lesson, which is why mobility is important. ZS Dr. Edvarda Benese school strives to make every component of our FCL able to be taken out of the FCL and used in a normal classroom.

The second big step for the teachers, who are using the FCL and all its capabilities, is to train them how to move around the room, assess our students, and provide feedback. As different groups diverge into different paths of learning, the teacher still needs to provide instruction. This usually occurs in a couple different ways: the teacher can be one of the stations that students visit, or the teacher can be mobile constantly checking in with teams of students as they go. The second option is for the teacher to constantly move around in the room checking in with groups and providing guidance.

Preparation in a learning space like the FCL is very different from a teacher directed lesson. Instead of preparing a single lesson, the teacher must prepare an entire unit beforehand and prepare the space to aid in that unit's learning objectives. It is up to the teacher to prepare the environment so that it can act as a 'third teacher' or at least so that students can begin work without the teacher's direct help. The teacher needs to be aware of which stations the

class will need to accomplish certain units and acquire the materials needed for that. In most classes, the teacher may not need a green screen, but maybe a certain unit of learning requires it. Maybe the unit needs temperature sensors… The teacher needs to be able to compile a list of 'stations' or 'kits' they need in advance.

One example is ZS Dr. Edvarda Benese school APE classrooms, a new project where our teachers are trying to maximize the effectiveness of lessons by modifying the classroom set up to meet the needs of learning. In one, the teacher may opt for groups set up; in another, he/she may use the theater set up. APE classrooms focus on learning for first graders, aged 6-7, the modular and adaptable way the environment is used is similar to the FCL without the intense focus on technology. The emphasis is on flexibility and using the environment to meet the needs of the learners. Maybe in one week, three or four different room configurations can be expected. For 6-7 years old children sometimes choosing is stressful, they need to know where to go more than their older counterparts. Considering that one of the teachers uses tokens with numbers which correspond to stations in the classroom, and as students come into the class, they take a specific number.

ICT integration to teaching and learning

The goal is to enhance the learning which occurs in ZS Dr. Edvarda Benese school, the environment is certainly able to do that and so is technology. Technology is utilized best as a tool for students and teachers. Early on, the institution noticed teachers who are starting to incorporate technology into their classes as a one-time event, the result is that the technology acts more as a gimmick, sometimes it can be distracting, instead of a tool. ZS Dr. Edvarda Benese school want technology to be one of the ingrained habits in the learning process; for that it is critical that teachers establish clear expectations about ICT usage within their classes.

ZS Dr. Edvarda Benese school is fortunate to have a wide variety of technology available to its teachers, it is there for them to use, but in order to use it effectively they need to be comfortable with it. Several training activities are offered throughout the year on all the available components. These trainings can introduce teachers to different use possibilities, but the next step is demonstrating the specific uses of technology in the course of a unit. Typically, the institution tries to find a 'lead' teacher who is willing to work certain technology into their units and be a live example to others, and eventually help the others enlist the aid of technology in the classroom. One example is the use of OZOBOTS. When it was added to the school repertoire of technology, they were primarily used by teachers of older students. Then, the school found an elementary teacher who was really interested in them. Her work with OZOBOTS and demonstrated to the other teachers how to use them regularly through teaching math. Now OZOBOTS are used by many of our elementary teachers. By establishing routines with technology, teachers can truly enlist it as an aid in teaching and learning activities. First, ZS Dr. Edvarda Benese school offers trainings then we use the help of a teacher

leader who can go deeper with certain technological components to stimulate other teachers' learning.

Showcase 2: FCL Göbeklitepe - Smart space design for technology-enhanced, active learning

Institution: Kırkmağara Ortaokulu, Şanlıurfa

Country: Turkey

Educational Level: Lower secondary education

FCL Göbeklitepe has been created as an innovative learning space in a public secondary school, involving six different learning zones (Interact, Exchange, Investigate, Create, Present and Develop). Teachers give importance to innovative pedagogical approaches, ICT integration into learning and teaching process, flexible learning space design even though their 9-13-year-old students are from disadvantaged socio-economic backgrounds.

Learning spaces and teacher practices

As the classroom is small, all the six learning zones are not available at the same time. Therefore, the teachers adjust the space according to the course, subject and the situation of the student, specified in the plan before the lesson. They organize space in order to allow students to create small groups for collaboration, communication and brainstorming; in other words, to support peer learning. They also give importance to well-organization of furniture to make space larger. So flexible desks and mobile Raspberry Pi computers are preferred to design space appropriately. In addition, the teachers believe that furniture must be functional and useful to support learning. The materials and furnishing do not need to be so expensive and new, so they prefer economical and hand-made furniture.

Figure 4. FCL Göbeklitepe

Pedagogical practices

The space has been built on active learning. While teachers are the "Learning Designers", students are active in the learning process. The teacher promotes the idea that students should take responsibility for their own learning (autonomy). In addition, they should feel free in how to make their products. The lesson plans are designed within the framework of Technopedagogical Content Knowledge (Mishra & Koehler, 2006). For example, digital storytelling is common in English lessons with the use of animation software Powtoon. However, students do not have the chance to experience blended learning and project-based learning because they do not have internet connection and computers at home.

Figure 5. FCL Göbeklitepe

ICT integration to teaching and learning

Canva, Powtoon, Bubbl.us, Raspberry Pi, Stopmotion are some of the programs and applications used as ICT tools. As integrating ICT into Teaching and Learning, teachers encourage students to use these technological devices because it provides learning faster and more permanently. Students use ICT tools especially in research, development, production, and presentation of the products but they do not have access to technology outside of the classroom. So, teachers sometimes prefer non-technological tools like poems, sketches, songs, and pictures in their classes. Besides, teachers use Slack applications actively for their professional development.

Showcase 3: MOSAIC - Efficient use of innovative pedagogies enriched with various ICT tools

Institution: Pursaklar Feride Bekçioğlu Ortaokulu, Ankara

Country: Turkey

Educational Level: Lower secondary education

MOSAIC is a flexible learning environment inspired by the Future Classroom Lab model. It has been established in a lower secondary school in an urban area of Turkey, for students aged between 9 and 13.

Learning spaces and teacher practices

Reflecting the concept of six learning zones in the FCL model, MOSAIC is a learning space that enables easy reconfiguration in design with modular furnishings and flexible repositioning of learners and teachers for various activities. As integrating space into teaching and learning, the school staff take technical support for the construction of the FCL from the National FCL Lead Ambassador and two university architecture students. The space, furniture and resources are organized in alignment with the innovative pedagogies and learning activities. As their objective is to create a flexible learning environment including both technological and non-technological tools, there is also a drama stage near the technological devices. In the space design, they take all teachers from different subjects into consideration, the teachers are free to change the furniture design in accordance with the requirements and needs in their lessons. They are also encouraged to create collaborative workspaces.

Figure 6. MOSAIC Space

Pedagogical practices

The teachers using MOSAIC believe that well-designed projects motivate students to engage in a deeper level of learning and thinking, and the students have a higher level of "buy-in" when deciding what form their learning will take. Therefore, they promote project-based learning, by enabling the development of 21st century skills. In their lessons, students have a chance to make small projects in a peer-learning environment, which sometimes lead to creating better projects than the teachers. The teacher starts his lessons introducing a real-life problem, then allows students to work on it as a team actively, plan their work, research the problem, take responsibility for their learning, work collaboratively, design and produce imaginatively in a relaxed, non-monitored environment. When they present and deliver their works, the teacher and rest of the classroom give them feedback to encourage them to discover more. Through local teacher training sessions for teachers about new approaches in education, teachers have more opportunity to explore different pedagogies. Teachers create scenario-based learning activities together and guide the students with different techniques. For Future Classroom Scenarios, they always address the educational trends and consider how their school should respond to these trends. Accordingly, they combine these trends with the curriculum topics. They also try to test and evaluate the existing scenarios, and they share their experiences within their school community of practice, give feedback and reflect on the challenges they experience while using learning scenarios.

ICT integration to teaching and learning

MOSAIC has many kinds of equipment including 30 tablets, 5 laptops, chroma key, robotics and a 3D printer as well as animation, logo, poster, cartoon and video editing software. In this learning space, the students are free to choose and employ the ICT tools that suit their purposes and needs in their projects and assignments. In History lessons, for instance, they can use technology to "become" a character in an appropriate location. They can use their imagination and the 3D printer to create many different things. They can also express themselves and be creative on the drama stage or by using robotics and sensors. For robotics, they do not have robotics kits; instead, students and teachers make all the parts of the robots, some using the 3D printer and some using other materials, e.g., wood. Some teachers are already integrating imaginative technology-supported elements into their practice. For instance, with a detailed photograph of a cell and with the chromakey, the Science teacher was able to seem to be inside the cell indicating and describing all the parts of it to her students via the green box/green screen technology. Moreover, teachers use ICT tools to assess learning and collect evidence to keep track of their students' continuous development and growth, and to give timely, relevant, and effective feedback to students. In short, the students and the teachers can actively benefit from the MOSAIC classroom by integrating technology into a lot of different pedagogical practices.

Showcase 4: Future Teacher Education Lab - An innovative learning space to support initial teacher education

Institution: Institute of Education, University of Lisbon

Country: Portugal

Educational Level: Higher education

Website: http://ftelab.ie.ulisboa.pt

Video: https://www.youtube.com/watch?v=nV15CsDkgnU

The Future Teacher Education Lab (FTELab) is an initiative of the Institute of Education at the University of Lisbon, presenting itself as a pioneer in the context of European higher education learning spaces dedicated to teacher initial education, though it also promotes activities for teachers continuous training. FTELab consists of a multifunctional space where different strategies are put in place in favor of the modernization of professional teacher training processes.

In particular, FTELab Project (i) allows the exploration of new learning scenarios with digital technologies in the initial training of teachers, and (ii) develops regular workshops on the innovative use of digital technologies and online environments for in-service teachers, analyzing their transformative power with regard to teaching and learning practices in secondary schools as well as in higher education.

The FTELab Project targets (future) middle and secondary school teachers who take their Masters Degree in Teaching (e.g., Mathematics, Physics, Informatics, Arts, Economy) at the Institute of Education. In some areas, FTELab also functions as an incubator of ideas where it is possible to identify future needs for technological solutions for education and simultaneously develop tangible educational resources.

Additionally, FTELb serves as a modeling example and context for training for higher education professors, especially in what regards their preparation for the implementation of e-learning and blended learning courses.

Learning spaces and teacher practices

Following a modular structure, FTELab aims to promote favorable conditions for teacher training and professional qualification, with articulation between the dimensions identified for the competences of the 21st century teacher [following the areas described in The UNESCO ICT Competency Framework for Teachers (UNESCO, 2018) and DigiCompEdu

(Redecker & Punie, 2017)], in a multidisciplinary perspective of teachers' work, and in alignment with the new Portuguese regulation for qualification for teaching.

The learning space is organized around powerful ideas that embody the pedagogies that should be induced on future teachers: (i) the idea that technology enhanced initial teacher education programs create conditions to improve the quality of teachers' practice, (ii) the notion that immersive use of digital technologies is associated to changes in the way teachers relate to knowledge and pedagogy, and (iii) the emphasis on the need that future teachers act according to the profiles of new generations of children and youngsters.

The FTELab space has spatial organization that promotes multiple activity dynamics based on a variety of technological tools and movable furniture taking into account the quality of the environment, in particular with temperature, light and acoustics.

Figure 7: Future teacher Education Lab

FTELab is inspired by FCL 6-areas design although it keeps a permanent dialogue between these different areas of work: islands of movable tables and chairs are easily transformed into a small auditorium or keep away opening space for demonstration of robots and drones based learning scenarios, digital displays can be moved around in the room and easily serve group work as well as support for plenary sessions, a videoconferencing space is also available mainly to support the development of hybrid classes (where part of students are at different locations), a chill-out zone is also available to stimulate student-teachers to see than relaxed and informal activities can be productively used to stimulate cognitive processes and promote learning, etc.

Figure 8: Future teacher Education Lab activities with future-teachers

Pedagogical practices

The very concept of 'learning scenario' constitutes the general bases for the design of the activities taking place at FTELab. Planning learning scenarios includes a reflection and discussion process putting together the student-teacher and the teachers' trainer(s). This is done in seminars that take place at FTELab taking advantage of the space and technological resources available.

Adopting a pedagogical approach that values the student-teachers' role involves a participatory design strategy, holding student-teachers responsible for their contribution in all stages of the learning activities since its planning. For group work, student-teachers usually use either the FTELab zone dedicated to 'chill-out' or organize islands of tables. Identifying the situation, idea or problem to be solved should then be acknowledged by all participants involved and analyzed as a group task using brainstorm methods and taking advantage of the entire space at FTELab.

At this stage, constructing a conceptual map is usually relevant as it provides a clear association of curricular concepts and techniques to the tasks designed by student-teachers for the pupils' activity, as well as the representation forms that will be put to practice (e.g. data registry, producing short activity reports). The conceptual map, associated with the set of tasks of the scenario, constitute a crucial element for a successful implementation, as it will serve as the activity's script within the scenario. Student-teachers either use their own devices to take notes or represent ideas on the analogic writing tablets available.

In the production phase of the learning scenario, the student-teachers' group uses all the needed resources available at FTELab, in particular those associated with the specific learning scenario. In some cases, the learning scenarios make use of tangible programming devices (e.g., robots, drones, Arduino), digital tablets available at FTELab, as well as 3D scanners and printers.

Student-teachers are encouraged to experiment active learning methodologies such as project-based learning, problem-based learning, inquiry-based learning, flipped classroom or a combination of those adopting the basic principle of "fitting to purpose"–they should adopt the pedagogies that best serve the goals of the learning scenario.

A draft version of the learning scenario is then presented at the sharing space at FTELab using the digital interactive panels for the whole group of colleagues and professor(s) for discussion and improvement.

ICT integration to teaching and learning

FTELab addresses the use of ICT in teachers' pedagogical practices as an evolving and dynamic issue. Student-teachers are encouraged to take action and seek for innovative forms of using digital technologies while designing learning scenarios for their pupils. The teacher' trainer at FTELab adopts a role that takes seriously the principle of isomorphism–adopting the same type of actions that he/she wants his/her student-teachers to develop–thus assuming that student-teachers will both learn the content and the form of teaching.

Digital technologies are available at FTELab and are used according to the objectives of the activity keeping the notion that they are always movable together with the furniture thus providing a high degree of flexibility.

The multiplicity and diversity of technologies available include digital tablets, large screen displays, a variety of robots and drones, video recording and telepoint adds, videoconferencing table, cameras and audio, 3D scanner, 3D printers and analogic white tablets and board. All the technologies available are put in place to mediate and sustain communication and collaboration between student-teachers and teachers' trainer(s).

FTELab creates the right context for the development of an open culture that inspires future teachers to be active, audacious and innovative when embracing their professional practice with a mindset that looks at digital technologies as part of the ecosystem where todays' education takes place.

Showcase 5: AulaNova - An innovative, high-tech learning space focused on teacher training

Institution: Centro Autonómico de Formación e Innovación (CAFI). Santiago de Compostela

Country: Spain

Educational Level: teachers at all levels and curricular subjects of non-university education.

Website: https://eventos-edu.xunta.gal/en/aulanova

Blog: https://blogs.xunta.gal/aulanova/

Video: https://www.youtube.com/watch?v=1tkLJ8F1e-A

The Regional Ministry of Culture, Education and University of Galicia (Spain) has created Aula Nova, a teacher learning space managed by the CAFI (Regional Centre for Training and Innovation) opened in July 2018 and located in Santiago de Compostela (Galicia, Spain).

Aula Nova is born as an innovative teacher learning space with the intention of being a model to inspire schools in order to encourage them to transform learning spaces. It offers a large number of training activities in several areas (emerging methodologies, makerspaces, ICT tools, STEAM projects, Innovative Learning Space, etc.).

In its first stage, Aula Nova promotes the training of Galician teachers by guiding and advising them through thematic courses based on pedagogical transformation and learning spaces (3D print, biomaking, maker spaces and maker corners, etc.) and participating in the organization of technology-promoting events such as Maker Faire Galicia, which transfers and opens up some of these activities to the public and families.

Nowadays, due to the coronavirus pandemic context, a new model of teacher training has emerged, taking into account the manipulative and inquiring character of the training that is intended to be offered to teachers.

It is developed through video conference sessions where attendees can interact with each other via chat or in the virtual classroom forums. Teachers are provided in advance with an appropriate kit to follow the training program and, during a short period of time, attend project-based training and develop a project with the support of a guiding teacher.

We have decided to convert the difficulties caused by the new pandemic context to promote a flexible space able to expand to the teachers' homes. For this purpose, we have designed an adapted training plan comprising five strategic lines: STEM / STEAM learning, teachers' needs, short times, direct transfer to the classroom and approach to Aula Nova. In this plan

five thematic lines are contemplated: from Galicia to space (ESERO and ESA spatial program), Programming and robotics (Microbit, Phyton, robotic simulators), Research (Science method), Scientific dissemination (Ed Talks) and Creation of projects (Design Thinking, SCRUM). The plan/program includes several training courses of different levels.

Learning spaces and teacher practices

We can define Aula Nova as a hybrid idea where maker spaces, digital labs and innovative classrooms converge. Its creation was inspired by FabLab, makerspaces and FCL concepts and, in fact, it belongs to the FCL ambassadors Spanish Network as well as to the EUN Network.

Aula Nova is divided into five different working spaces inspired in the FCL model: Communicate (express, present, show work), Collaborate (complete challenges, interact), Create (implement your ideas, learn), Prototype (explore, develop) and Design (invent, discover).

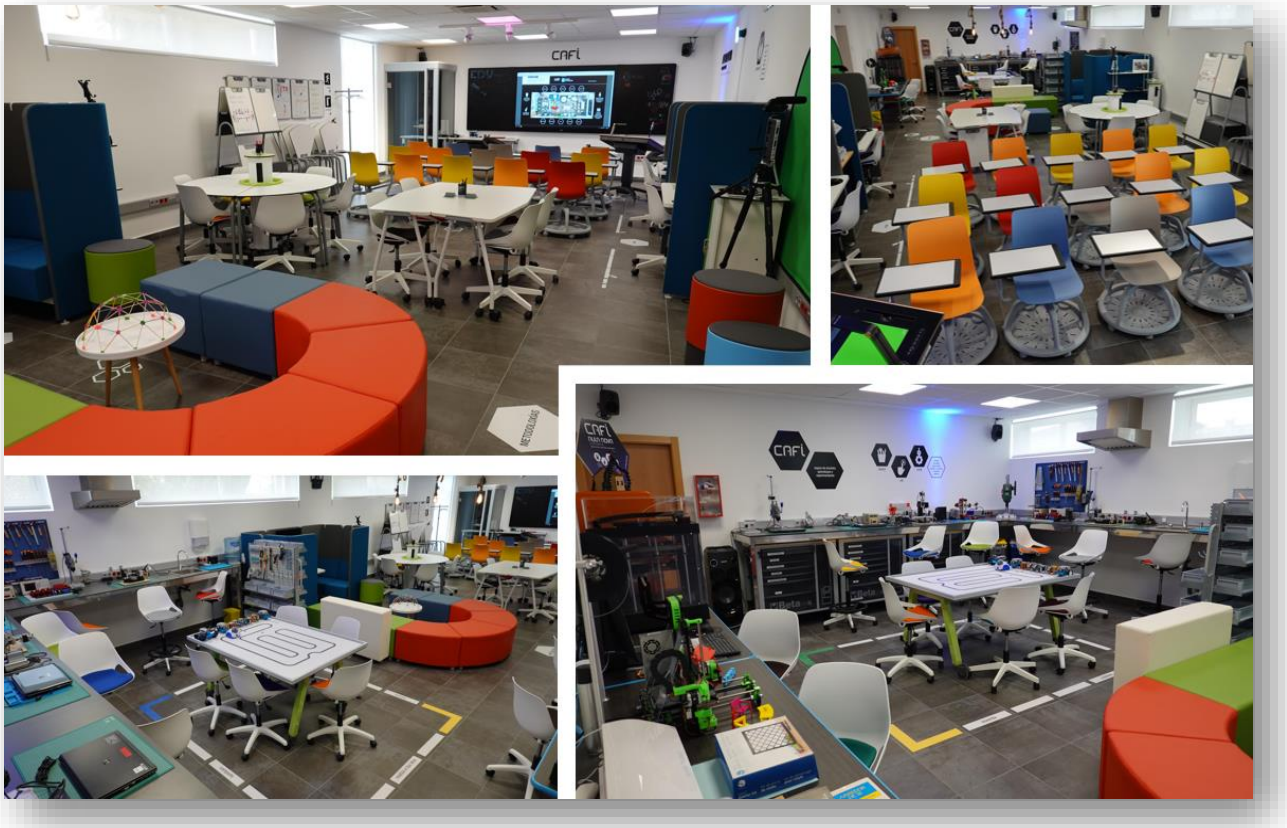

Figure 9: AulaNova

Each of these learning zones is highly technologically equipped to carry out a great number of training activities, while its flexible distribution can be easily modified depending on the type and contents of the activity.

There are four main lines of pedagogical innovation that are being developed in AulaNova: Maker Line, Lab Line, STEAM Line and Methodology Line.

In order to provide experiences in innovative learning spaces, project-based training activities are developed, and these learning zones are used in the different stages of the process. Some examples of the developed activities are: design of projects based on 3D printing, working with Arduino and Raspberry Pi in scientific projects, using makerspaces to carry out STEM projects, etc.

Pedagogical practices

Aula Nova has been conceived as a welcoming, flexible place to work in groups to provide training to teachers on technology-enhanced active learning pedagogies in innovative spaces.

The methodology is directed towards enhancing learning, developing creativity and innovation, and fostering student autonomy.

Teachers can come to this space to experiment or create research groups, allowing them to learn about new resources and pedagogies that do not yet exist in their schools. In this way, teachers are encouraged to use them in their classrooms.

After their usage at school, teachers are committed to provide evidence of their experience creating a material that is added to other resources in Aula Nova and that can serve as a future inspiration for other teachers.

Also, Aula Nova provides training related to emerging pedagogies such as Design Thinking, SCRUM; Visual thinking, blended and flipped learning, etc.

The Teacher Training Service (to which CAFI belongs) promotes and encourages many innovative projects to be implemented in schools, related to the transformation of the different areas of the school and the use of active pedagogies.

In 2018 the Regional Ministry of Culture, Education and University of Galicia, created the program "Maker Spaces" to provide funds for schools to set up new makerspaces. Since then, Aula Nova is carrying out an important pedagogical practice as it has become the training place and an inspiration for teachers who want to create their learning spaces through this programme.

Thanks to this initiative an important number of schools, both primary and secondary, have created and developed a Makerspace and have had in-house teacher training in new spaces and methodologies. As a result, new flexible areas are being created in the Galician educational centres, making possible an integrated work in STEAM areas, through active methodological strategies. These spaces include motivating resources for students, close to their own experience, and promotes investigation, experimentation and innovation.

ICT integration to teaching and learning

Aula Nova combines a technological and methodological vision with a high maker component and collaborates with other initiatives focused on transforming educational spaces and introducing new inspiring experiences in schools.

This space is committed to support teachers to reach their aims in order to facilitate their teaching work. To achieve this goal, Aula Nova makes technological resources -such as radio equipment, robots or science experiments kits- available to teachers, and it also provides advice and support them.

It includes a wide range of technological equipment to be used for teacher training, such as Laser Cut, 3D Printer, 3D Scanner, CNC Lathe, Recording booth, Chroma Key Green Screen, Cutting Plotter, different types of robots and other kits related with electronics, Arduino, etc.

Regarding ICT integration in teaching and learning, Aula Nova carries out training activities on different levels about programming, coding, creating applications for mobile devices, applications of VR and AR in education, creation of didactic audiovisuals resources, electronics, robotics, artificial intelligence, 3D software, etc.

Considering the 5 showcases previously described and having in mind the key-competences for implementing innovative learning spaces presented on Chapter 1, the following table organizes the competences most often promoted in each of the showcases.

Key Competences for implementing Innovative Learning Spaces	Showcase 1	Showcase 2	Showcase 3	Showcase 4	Showcase 5
Dimension1. Understand Spatial Characteristics and Integrate Space into Teaching and Learning					
A) To understand the concept of an innovative learning space					
1.A.1 Understand, analyze and evaluate the complexity of modifying traditional classrooms;	x	x	x	x	x
1.A.2 Understand and apply the concepts of six learning zones (to create, to interact, to present, to	x				
1.A.3 (re)Design and use different learning zones for inclusive education and students with Special					
B) Understand and use spatial characteristics to enhance active learning pedagogy					
1.B.1 Apply the concept of six learning zones to support individual, pair or team work;	x	x	x		x
1.B.2 Design and modify a classroom-level space to foster interaction, collaboration, communication,	x	x	x	x	x
1.B.3 Organize space, furniture arrangements and resources to align with the innovative pedagogies,	x	x	x		
1.B.4 Organize and use spaces to facilitate interdisciplinary approaches and team teaching;	x		x	x	x
1.B.5 Design space to develop organizational capacity building.	x		x		
C) Evaluate and use space characteristics to develop a sense of belonging, ownership, and comfort					
1.C.1 Understand, use and change the spatial features to develop the feeling of ownership and				x	
1.C.2 Understand and integrate spatial features to create a comfortable classroom-level space,	x		x		
1.C.3 Understand and apply the concept of flexibility in arranging a learning space.	x	x	x	x	x
D) Understand and actively apply the concept of technology-enhanced space					
1.D.1 Analyze the complexity of designing a safe technology-enriched space;	x			x	x
1.D.2 Integrate suitable technical devices and ICT tools into space, and create a safe learning	x	x	x		
1.D.3 Evaluate the complexity of using virtual space and use the benefits it can offer.					
Dimension 2. Understand and Apply Active Learning Pedagogy					
A) Understand and apply the main concepts of student-centred pedagogy					
2.A.1 Analyse the philosophy of student-centred teaching and learning and create a student-centred	x	x	x	x	
2.A.2 Assess the dimensions of teacher-student interaction;	x		x		
2.A.3 Apply active learning strategies to support the development of the '21st century' skills and competences, such as inquiry, solving problems, applying new knowledge to real life situations,	x	x	x	x	x
2.A.4 Engage students in the collaborative construction of ideas and artifacts, in collaborative project	x		x	x	
2.A.5 Apply active learning strategies in instruction, and teaching and learning activities to enable	x				x
2.A.6 Identify and apply innovative methods and techniques for interdisciplinary learning and cross-curricular projects;	x			x	
2.A.7 Engage students in reflective practice to develop students' responsibility for their learning by	x		x	x	
2.A.8 Promote inquiry through relevant problems to motivate students in their learning process and	x		x		
2.A.9 Identify and apply different types and various tools for assessment that can be used in flexible	x		x		
2.A.10 Design formative assessment tools and methods to gather evidence of learning and use it to			x		
B) Understand and apply technology-enhanced learning approaches to support student-centred					
2.B.1 Assume key principles and elements of technology-enhanced pedagogical approaches;	x	x	x	x	x
2.B.2 Analyse the teachers' and students' roles in applying active learning pedagogy in a technology-	x	x	x	x	
2.B.3 Value that an Innovative Pedagogy prepares citizens of the society of knowledge in order to be					x
2.B.4 Integrate technology-enhanced space into teaching and learning;	x	x		x	x
2.B.5 Incorporate appropriate ICT activities into lesson plans to support students' acquisition of subject	x	x	x	x	x
2.B.6 Apply technology-enhanced pedagogical approaches to support active learning, such as blended	x	x	x	x	x
2.B.7 Apply technology-enhanced pedagogical approaches to foster students' autonomy.	x	x	x	x	x
C) Understand and apply the learning scenarios approach to support technology-enhanced					
2.C.1 Understand and evaluate the learning scenario approach, its key principles and elements;	x		x	x	x
2.C.2 Integrate learning scenarios into curriculum;	x		x	x	
2.C.3 Adapt or apply existing learning scenarios according to the students' needs;	x		x	x	
2.C.4 Develop learning scenarios that enable active and simultaneous use of different learning zones in	x			x	
2.C.5 Develop learning scenarios and activities that connect to current changes in the society and the	x		x		
2.C.6 Identify FCL Toolkit for Scenario Development and adapt it to contextual learning requirements	x				
Dimension 3. Understand ICT in Education and integrate ICT into Teaching and Learning					
A) Understand the innovative role that ICT can have in Education					
3.A.1 Analyze the key principles of using ICT in education, and define how they can be put into practice;	x	x	x	x	
3.A.2 Integrate ICT into the curriculum to achieve learning outcomes.	x	x	x	x	
B) Apply ICT in upgraded Teaching and Learning activities					
3.B.1 Make the most of ICT to support students' acquisition of subject matter, creativity, making, inquiry,	x	x	x	x	x
3.B.2 Use ICT to give feedback to students, assess their performance and define their achievement;	x		x		
3.B.3 Take advantage of ICT to support students' understanding of their own learning processes and		x			
3.B.4 Develop students' critical stance to evaluate various ICT considering security issues, privacy laws				x	
3.B.5 Use ICT to promote students digital competence;	x	x	x	x	x
3.B.6 Use ICT to participate in professional communities, sharing and discussing practice;	x	x			x
3.B.7 Encourage discussion, collaboration and participation in active learning through ICT to give	x		x	x	
3.B.8 Use open-source software, web apps, and almost ever-present mobile technologies to engage	x		x	x	
3.B.9 Discover other opportunities for students to be active and use ICT in an interactive and	x		x		
3.B.10 Use ICT to support distance or blended learning through both synchronous and asynchronous	x			x	

Chapter 4: Conclusion

The intention of the present document was to highlight the need for considering teacher training, both in pre-service and in-service contexts, in a multidimensional approach where scientific and pedagogical knowledge is aligned with technology and spatial related competences. For that, a set of key-competences were presented for teachers and teacher trainers to support: i) their incremental knowledge regarding spatial characteristics impact on teaching and learning; ii) the application of active learning pedagogy, and iii) ICT integration in Education. Also, a set of showcases were organized as exemplifying stories of good practices regarding the design, implementation and use of innovative learning spaces.

This document supports the idea that today's learning spaces can no longer stay rigid, static, and hierarchical places. They must adopt a design that, in addition to spatial qualities, articulates the use of technology with active learning pedagogies, in order to enable the development of innovative teaching practices and promote students' performance and well-being. In today's schools the interaction between technology, space and pedagogical practices needs to be carefully considered. The learning spaces layout as well as the technology available need to be sufficiently flexible to allow continuous adaptation and flow between the various pedagogical approaches: e.g., flipped learning, project-based learning, gamification, just to name a few. More inclusive and responsive designs (CABE, 2008; Lippman, 2016) are needed, as it allows the creation of adaptable layout that accommodate emerging pedagogies, in a straight articulation with today's digital tools.

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