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# Skills & Knowledge on Assistive Technology in Early childhood inclusive education

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## SKATE Guidelines: Inclusive classrooms for ECEC teachers

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# SKATE Guidelines: Inclusive classrooms for ECEC teachers

## A. INTRODUCTION

The SKATE Guidelines on Inclusive Classrooms for Early Childhood Education and Care (ECEC) teachers, aims to provide the main theoretical aspects of the content and the focus of the learning programmes developed in the SKATE project. The Guidelines provide an overview of the following components for the appropriate use of digital technologies in inclusive educational settings for young learners (0-6 years of age):

- Overview of the main concepts of disability, digital technology and inclusive education
- Overview of the basic theoretical principles for creativity and learning in ECEC and the notion of inclusive ECEC
- Overview on the role of technology in universally designed learning programmes, as well as how the use of high and low tech technology can empower children with special individual needs or emerging special needs where the educational activities cannot be made fully and permanently inclusive.
- Overview on the implementation of technologies through the use of mainstream tools (e.g., tablets) and emerging (robotics, kinematics, safety wearable devices, simulated environments, smart toys) high-tech technologies as well as low-tech strategies (all often referred to as educational technology in the broader sense (Roblyer and Edwards, 2000) to foster the development of cognitive, intellectual, communication and social competences.
- Overview and indications for the role of low- and high-tech assistive technology in specifically empowering children with communication, motor, sensorial or intellectual disabilities.

The Guidelines have been drafted, validated and consolidated with the involvement of all partners and through the involvement of local ECEC services and stakeholders. Specifically, the SKATE Guidelines have been developed by means of a Delphi procedure involving project partners as well as representative stakeholders. The Delphi method is a robust approach for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to build consensus over a topic. For the Delphi process participants from each partner country were involved, including experts from the project partner organisations as well as external experts representing various disciplines, i.e. academia and research, ECEC services/schools, occupational therapy and rehabilitation, education. The Delphi procedure was structured in four stages, during which the main principles and pillars in defining guidelines were identified, analysed and organised to a table of contents/structure of the Guidelines; then the first draft of the Guidelines was developed,

upon further expansion and elaboration of themes and sub-themes into content supported by literature and evidenced based practice; in the following stage, feedback from stakeholders was obtain towards the finalization of the Guidelines, and the final outcome is presented in the document. The document aims to support the content development of the SKATE learning programmes, and referenced as one of the reading resources containing the main themes of emphasis of the SKATE curriculum and learning materials.

## B. THE GUIDELINES: LEARNING PROGRAMMES MAIN CONCEPTS AND CONTENT

In the following sections the SKATE Guidelines for Inclusive ECEC with the use of digital technology (mainstream (ICT) and (digital) assistive technology (ICT-AT) are elaborated. As mentioned in the introduction these sections aim to provide the main content and issues of emphasis of the SKATE Learning Programmes as well as a relevant reference resource.

### 1. Inclusive Education

This Section of the SKATE Guidelines presents the basics of inclusive education.

#### 1.1. What is Inclusive Education

##### 1.1.1. Definitions, constructions and main models of disability

Discussions about the education of children with disabilities and evolvement of inclusive education throughout the years, are often developing around the ways disability is constructed over different ideologies, theories, philosophical and pedagogical paradigms. Disability constructions and discourses are often related to the disability models which constitute different viewpoints regarding how disability is understood and conceptualised. The main models of disability (but not the only ones) identified are considered to play a catalytic role in the education of learners with disabilities and the struggles for equal opportunities. In brief these models are:

**The Medical Model of disability:** Disability was constructed on the basis of medical explanations and theories of victimisation. According to this model, difficulties of disability are situated within the individual and emerges from the pathology and the physical impairment. The impact of economic and social structures is not considered in the understanding of disability under the medical model (Oliver, 1986), and it reflects the idea that impairment (the actual medical condition) equals disability (the barriers faced by persons with disabilities). The main idea of the medical model is that disability is a problem in the person, and there is need to 'restore... to normality'.

**The charity model of disability:** Resulting from the conceptualisation of disability under the medical model, according to the charity model, people with disabilities are considered incapable of being autonomous and are therefore constructed as helpless victims who require care and protection by non-disabled people (Oliver, 1986). The main idea of the charity model is that people with disabilities depend on sympathy and pity of the others and providing assistance through charity gestures is what is needed.

**The social model of disability:** The criticism of disability activists to the medical and charity models, led to the emergence of the social model of disability. This perspective situates disability in society and the environment. The main idea of this model is that disability is a result of the social barriers and not the individual impairments of the person. Barriers and the way society is structured prevent opportunities for full participation of people with disabilities. The need is to acknowledge, understand and remove barriers in order to empower people with disabilities in all aspects of life. The social model has also become an object of criticism by disability activists as an outdated ideology (Shakespeare & Watson, 2001) and inadequate in terms of acknowledging the person's identity as a whole, formulated by different factors (i.e. gender, age, ethnicity, etc) and personal experiences.

**The human rights model of disability:** Drawing heavily on the principles of the social model, but also as a result of the discussions and critiques of it, attention was brought to the aspect of human rights in disability. The human rights approach to disability is presented through the [UN Convention for the Rights of Persons with Disabilities \(UNCRPD\)](#) and recognises that disability is a part of human diversity that must be respected and supported in all aspects. Impairment is not a reason to deny or restrict human rights, and emphasis is placed on people's with disabilities rights to equal participation in all sectors of life.

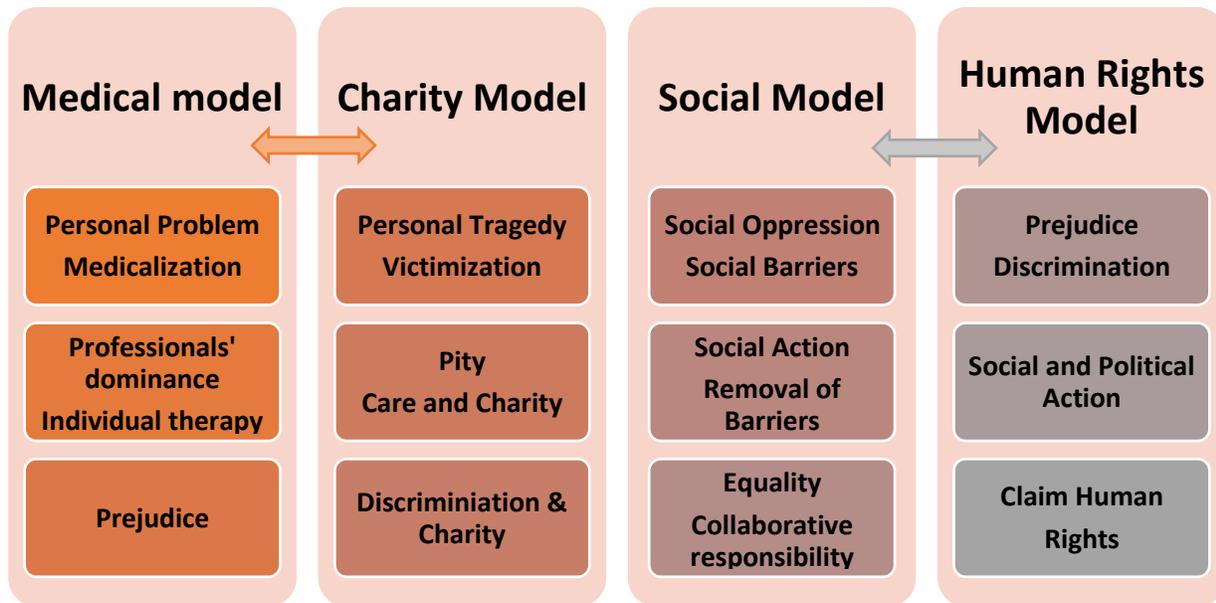


Figure 1: Overview of Disability models: Disability perspective, response and outcomes

### 1.1.2. Inclusive Education: What is it and what not

Understandings and constructions of disability through the various disability models have impacted the education policies and practices of children with disabilities. Often it is easier to understand inclusive education if it is examined against other forms and approaches to the education of children with disabilities. In the following the main approaches including *special education*, *integration* and *inclusive education* are presented.

**Special Education:** Traditionally, children with disabilities have been educated in segregated special education settings, following a special curriculum, with often 'less' content and 'fewer' expected outcomes than their peers without disabilities (Lewis and Norwich 2005). Segregated educational systems and provisions reflect the approach of the medical and charity models of disability according to which 'problems' within the child should be remedied, and hence they are not entitled to equal curriculum and opportunities to all learners. The educational approaches under this perspective are referred to as **special education** and include Special Schools and special settings and provisions in a segregated form.

**Integration:** During the 1980s there was a shift from special education **towards integration** of children with disabilities in the mainstream schools. Integration refers to the modification of schools in order to accommodate learners' with disabilities needs in existing forms of schooling (Sebba & Ainscow, 1996). Existing infrastructures and practices can be modified, when there is a need, but the attention is not

the quality of students' experiences. Integration is often perceived as an opportunity for socialization rather than equal opportunities in education.

**Inclusive education:** The philosophy of inclusive education appeared in the 1990s and has been considered as a social movement against exclusionary practices in education, called by the Salamanca Statement (UNESCO 1994). Inclusive education advocates that equal opportunities in education is not only about some adaptations in mainstream schools. Schools should be restructured at all levels (curriculum, staff culture, school buildings, etc.) and be barrier free (as per the social model) to accommodate all children on equal terms (as per human rights model).

It is noted that these approaches to the education of children with disabilities cannot be considered successive of one another over time, and emergence of one does not mean the elimination of the other. The majority of educational systems around the world are still struggling towards the establishment of inclusive education policies and practices, and both special education and integration approaches co-exist even within the same systems. In addition, by no means inclusive education can be considered as an extension of special or integrated education. Inclusive education is an entirely new educational venture, a totally different paradigm, calling for an educational transformation for social justice, which is also particularly addressed in Article 24 of the UNCRPD.

In an effort to promote inclusive school development, the Centre of Studies in Inclusive Education, in UK developed the *Index for Inclusion* (Booth and Ainscow, 2011), first published in 2000, which includes a set of materials to guide schools towards inclusive education. According to the *Index for Inclusion* (p.11) inclusive education involves:

- Putting inclusive values into action.
- Viewing every life and every death as of equal worth.
- Supporting everyone to feel that they belong.
- Increasing participation for children and adults in learning and teaching activities, relationships and communities of local schools.
- Reducing exclusion, discrimination, barriers to learning and participation.
- Restructuring cultures, policies and practices to respond to diversity in ways that value everyone equally.
- Linking education to local and global realities.
- Learning from the reduction of barriers for some children to benefit children more widely.
- Viewing differences between children and between adults as resources for learning.
- Acknowledging the right of children to an education of high quality in their locality.
- Improving schools for staff and parents/carers as well as children.
- Emphasising the development of school communities and values, as well as achievements.
- Fostering mutually sustaining relationships between schools and surrounding communities.
- Recognising that inclusion in education is one aspect of inclusion in society.

### 1.1.3. Inclusive Early Childhood Education

Access to equal and quality education opportunities is a matter of all ages and all levels of education, starting from the onset of Early Childhood Education and Care (ECEC). The European Commission (European Commission, 2014; OECD, 2015; European Commission 2019) identifies inclusiveness as one of the five quality factors of ECEC. The European Agency of Special and Inclusive Education (2016) has

identified five (5) themes, with twenty-five (25) sub-themes that compose an Ecosystem Model of Inclusive Early Childhood Education. In brief these themes are:

1. Outcomes of Inclusion: Child belongingness, engagement and learning
2. Processes for enabling child's participation including social interaction, involvement in play, child centred approaches, personalised learning assessment and accommodations and adaptations
3. Structural factors within ECE environment that welcome child and family involvement
4. Additional structural factors that operate outside the ECE setting and establish commitments with community, transition between home and ECE setting and staff professional development and training
5. Structural factors at a national level of policy and practice including right-based approaches, regional/national standards, governance and funding, and monitoring and evaluation.

The “vision of inclusion involves improving the quality of education for all children. It consists not only of removing barriers, but also of creating an enabling environment for quality for ECEC” (UNESCO, 2021a, p. 9). As indicated in the following figure themes and subthemes that have been identified through literature review and the analysis of 32 European examples, by the European Agency (2016) are aligned to the vision and directions of inclusive education and the *Index for Inclusion*, highlighting human rights with primary emphasis is the child's participation and holistic development.

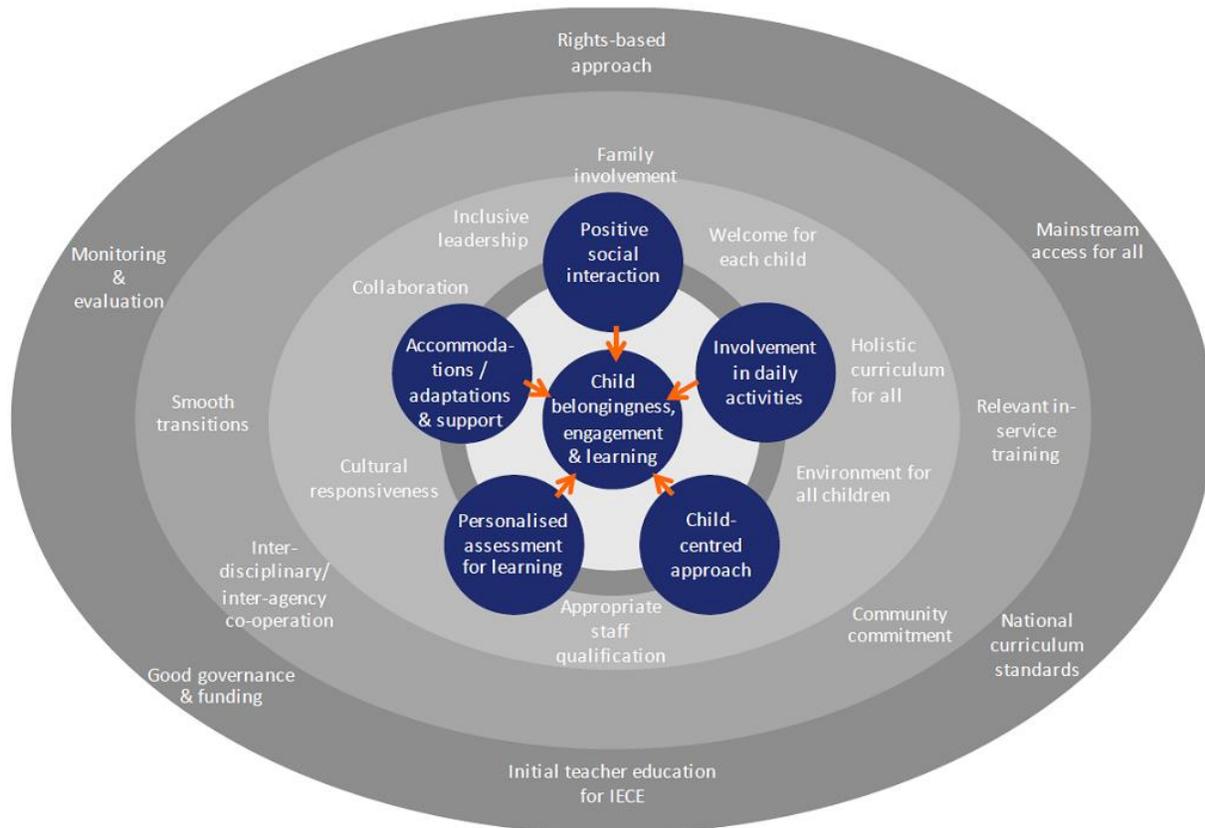


Figure 2: The Ecosystem Model of Inclusive Early Childhood Education  
 Source: European Agency of Special and Inclusive Education (2016, p. 15)

## 1.2. Applying inclusive pedagogies in the classroom

### 1.2.1. What is Inclusive Pedagogy

As identified in the previous section Inclusive Education is a process to increase participation of all learners in every aspect of education, i.e. school culture and community and the educational curricula. To achieve the aims of inclusive education, educators are making an effort to become more inclusive in their practices in order to respond to classroom diversity. If not designed to provide rich learning opportunities available for *all learners*, these practices often lie in the framework of integration or even special education, by only implementing approaches “that work for *most* learners, alongside something ‘*additional*’ or ‘*different*’ for those (*some*) who experience difficulties” (Florian & Black-Hawkins, 2011, p. 814). Without denying individual differences between learners, **inclusive pedagogy** is a pedagogical approach that aims to enhance learning for *everyone* in order to reduce educational inequality and refers specifically to pedagogy and approaches to teaching. Diversity and individual differences are considered part of the human condition (Florian, 2015). The key to inclusive pedagogy is the provision of options, by considering every possible diverse learner in the classroom. Choices are available to everyone, and individual support is provided in ways that do not stigmatise, while it can be available to anyone at any time.

Consequently, inclusive pedagogy calls for teaching and learning approaches founded on the principles of flexibility, adaptability, reasonable accommodations for all, respect to everyone’s individuality and provisions of options for equal opportunities in participation and engagement. In terms of learning design, these qualities are particularly reflected in Universal Design for Learning, a framework that has gained increased attention in connection to the use of technology in education and mostly assistive technology.

### 1.2.2. Universal Design for Learning and Differentiation

Universal Design for Learning (UDL) has its roots in the broader concept of Universal Design (UD) or Design for All, which is based on an architecture and engineering framework introduced by Mace (Mace, Hardie & Place, 1990) for the design and development of physical environments, and then the design of products (Michael & Trezek, 2006).

Similarly, to inclusive pedagogy, UDL considers every learner instead of focussing on how to adapt particular differences and needs. In addition, as per the vision of inclusive education, UDL aims at designing inclusive learning experiences right from the beginning and not simply making adjustments to existing processes and infrastructures. The framework focuses mainly on responding to *all learners’* diverse needs and opportunities to participate through designing instructional goals, assessments, methods, and materials that can be customized and adjusted to meet individual needs, but be available to *everyone*. It was introduced by [CAST](#) (originally Center for Applied Special Technology, but now simply CAST) with the aim to “make learning inclusive and transformative for everyone”. Technology holds a critical role in UDL for providing the possibilities for flexibility in applying the framework’s principles for technology enhance learning experiences and in the digital era (Meyer, Rose & Gordon, 2014) .

UDL is based on three basic principles ([CAST, 2022](#)):

- **Engagement:** (the ‘why’ of learning), which refers to providing options for motivating and maintaining learners’ interest and effort in the learning process;

- **Representation:** (the ‘what’ of learning), which refers to providing options of different means of presenting content and information;
- **Action and expression:** (the ‘how’ of learning), which refers to providing options for various means of participation and learners’ interaction in the learning process.

For each principle [a set of guidelines](#) is available, as a tool used for the implementation of UDL and they offer concrete suggestions that can be applied to any discipline or domain to ensure that all learners can access and participate in meaningful, challenging learning opportunities. In order to facilitate teachers and other professionals that wish to implement UDL in designing learning experiences, CAST has also developed a set of checkpoints which provide examples and ideas of choices and strategies to be implement for addressing the UDL principles.

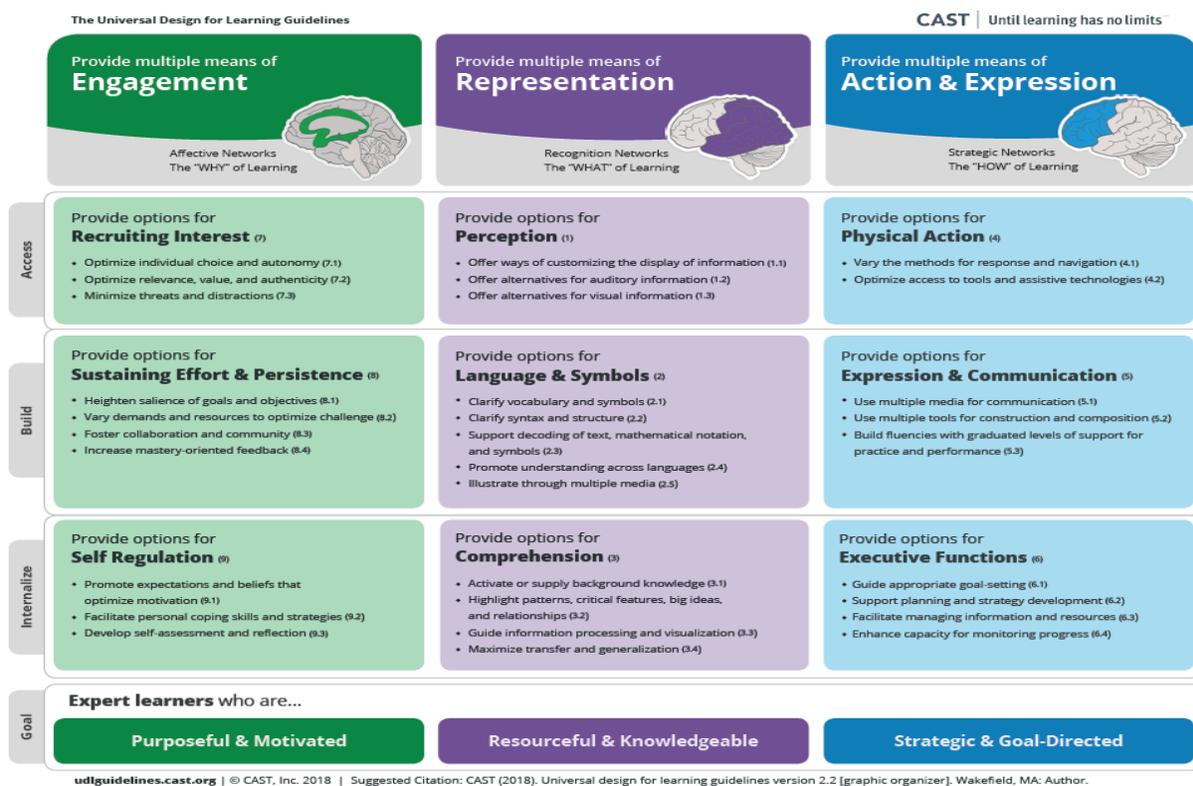


Figure 3: UDL Guidelines  
Source: <https://udlguidelines.cast.org/>

One of the main tools of UDL is **differentiated instruction or differentiation**. According to Tomlinson (2000), differentiation is defined as a philosophy towards curriculum and instruction that systematically takes learners’ differences into account in designing learning opportunities for each student. More specifically, it provides a framework for responding to learners’ differences in relation to their readiness, learning profiles and interests, and adjust the learning content, process and environment accordingly. In inclusive practices many times differentiation is misinterpreted in the sense of making special adjustments for particular learners, which is not within the philosophy of inclusive education or the UDL. However, in the framework of inclusive education, differentiation is actually a tool for understanding each learner’s diverse needs and competences and provide a variety

of options for flexibility in learning and instruction. This flexibility is for everyone that can be benefited by designing learning on the basis of various possible levels of readiness, various learning profiles and diverse interests and motivation of engagement in learning. In line with UDL principles, in differentiation flexibility and adjustments may occur in the content to be studied, in the activities used to learn the content, or in the product completed to indicate mastery of the content.

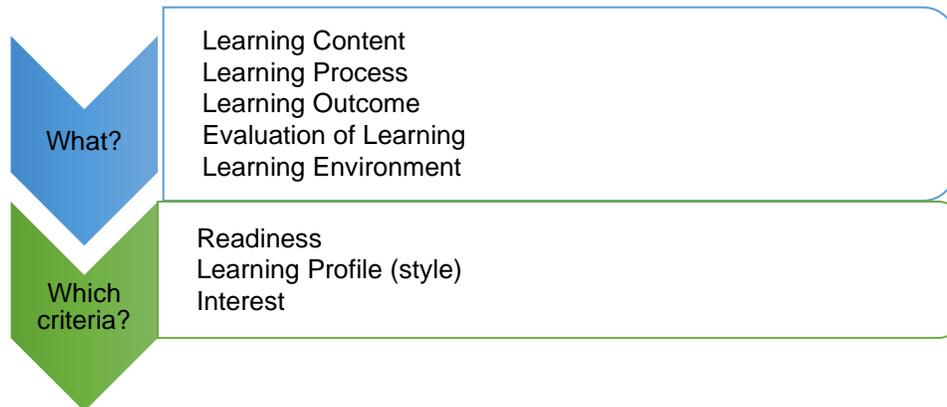


Figure 4: Differentiation: What and for What?

There are a number of strategies that can be employed by teachers in order to implement differentiation for the purposes of UDL and inclusive education. Such approaches may include: levelling of activities, collaborative learning approaches (e.g. jigsaw method) and allocation of team roles/tasks, use of mnemonics, visualization and the use of symbols etc. Some examples are mentioned in other sections of this document with specific focus on the use of mainstream technology and assistive technology.

### 1.3. Challenges and Opportunities in inclusive education: Research evidence on teachers’ knowledge, practices & attitudes

There has been a quite large corpus of literature and research (e.g. Ewing et al, 2018; Symeonidou, 2017; Symeonidou & Phtiaka, 2012; Avramidis & Norwich, 2002) during the last 20 years that provides evidence about teachers’ practices, knowledge, beliefs and attitudes for inclusive education. This evidence describes both challenges and opportunities in relation to what teachers know, believe and do for inclusive education, which may serve as indicators for the design of relevant teachers training and professional development. In the table below the main aspects of these challenges and opportunities are outlined.

Table 2: Challenges and Opportunities in Inclusive Education

	Challenges	Opportunities
<b>Teachers’ knowledge</b>	<ul style="list-style-type: none"> <li>● Limited knowledge about inclusive education</li> <li>● Absence of inclusive education issues in the basic teacher education curricula</li> </ul>	<ul style="list-style-type: none"> <li>● Revised teacher education curricula in Higher Education on issues of diversity and social justice increase teachers’ knowledge on inclusive education</li> <li>● Trainings, seminars and other open access opportunities for</li> </ul>

	<ul style="list-style-type: none"> <li>● In-service training usually focused on specific disabilities and address special educators rather than classroom teachers</li> </ul>	<p>professional development and lifelong learning</p>
<b>Teachers' practices</b>	<ul style="list-style-type: none"> <li>● Inclusive practices that are based on <b>special education and integration</b> paradigms</li> <li>● Limited collaboration with family and parental involvement</li> <li>● Difficulties in classroom management and attention to all learners</li> <li>● Lack of professional development on practical strategies for implementing inclusive education</li> </ul>	<ul style="list-style-type: none"> <li>● Teachers' collaborations with other professionals (e.g. special educators, occupational therapists, speech and language therapists)</li> <li>● Available technology resources</li> <li>● Teachers with active experiences in inclusive education that have already applied inclusive pedagogies</li> <li>● Promotion of UDL and differentiation in the last few years through UNCRPD and its impact to national legislation.</li> </ul>
<b>Teachers' attitudes and beliefs</b>	<ul style="list-style-type: none"> <li>● Prevalence of the medical and charity models of disability in teachers' attitudes</li> <li>● Education of children with disabilities is a responsibility of the special educator</li> <li>● Children with disabilities receive better education in special schools</li> <li>● Concerns about learners' with disabilities attention, behaviour, communication and social skills</li> <li>● Policies, decisions and academic positions on inclusive education are out of touch with classroom reality</li> <li>● Low self-confidence in implementing inclusive education</li> </ul>	<ul style="list-style-type: none"> <li>● Some teachers' dissatisfaction with special education and segregative systems and practices</li> <li>● Teachers' personal interests in inclusive education</li> <li>● Teachers' need and urge to solve practical issues of addressing the needs of children with disabilities in the mainstream classroom</li> <li>● Increase number of teachers looking into the human rights approach</li> </ul>

In general, teachers' attitudes towards inclusive education vary greatly, as they seem to be affected by a number of factors. These factors are related to: teachers' knowledge and education/training on the education of children with disabilities as part of their basic education training or in-service professional development, the support that they receive from school and educational authorities, their own experiences with disability (in personal level) as well as with special and inclusive education (in professional level), the educational policy and practice established in their educational settings/systems, the available resources. Investigating and analysing teachers' attitudes, knowledge, practices and experiences in inclusive education has been a main tool for researchers' and academics toward the design and implementation of effective teacher training and professional development on inclusive education pedagogies.

## 2. Early Childhood Education

Early Childhood Education is important in children's lives because it is when they first learn how to interact with others (peers, teachers, and parents) and also begin to develop interests that will stay with them throughout their lives. In this section the basic concepts and theoretical backgrounds of learning in Early Childhood Education and Care (ECEC) are presented. In addition, the basic pedagogical principles for inclusive ECEC are presented including: Learning through play (learning, play and participation), with a brief connection to theories and approaches such as constructionism and the lifelong kindergarten approach; and promoting children's development of social relations, with a brief connection to theories and relevant pedagogical approaches and examples.

UNESCO (2021) (United Nations Educational, Scientific and Cultural Organization) defines that Early Childhood, is the period from birth to eight years old, is a time of remarkable growth with brain development at its peak. During this stage, children are highly influenced by the environment and the people that surround them. Here is what the organization says about the importance of early childhood education:

*“Early childhood care and education (ECCE) is more than preparation for primary school. It aims at the holistic development of a child's social, emotional, cognitive, and physical needs in order to build a solid and broad foundation for lifelong learning and wellbeing. ECCE has the possibility to nurture caring, capable and responsible future citizens.”*

### 2.1. What is early childhood education

#### 2.1.1. Definitions and Setting

Early childhood education describes the period of learning that takes place from birth to compulsory primary school age, that falls within a national regulatory framework, i.e., which must comply with a set of rules, minimum standards and/or undergo accreditation procedures. It includes:

- public, private, and voluntary sectors
- centre-based as well as home-based provision (in the provider's home)

Many European countries, structure ECEC services according to the age of the children. Usually, the transition from the first phase to the second takes place when children are around 3 years old. In order to reflect the different regulations, a distinction between provision for children 'under 3 years' and for

those aged '3 years and over' is often made. However, it is important to keep in mind that in some countries the transition can be as early as 2-and-a-half years or as late as 4 years of age.

In Europe, there are significant differences in the age at which children have a guaranteed place in ECEC. Only seven EU Member States (Denmark, Germany, Estonia, Latvia, Slovenia, Finland, and Sweden) as well as Norway guarantee a place in ECEC for each child from an early age (6-18 months), often immediately after the end of childcare leave. A place in publicly subsidised ECEC is guaranteed from the age of 3 or a little earlier in the three Communities of Belgium, as well as in Czechia, Spain, France, Luxembourg, Hungary, Poland, and the United Kingdom (England, Wales and Scotland). Around a quarter of European education systems provide guaranteed places from age 4, 5 or 6 for the last 1-2 years of ECEC. Often, this provision is explicitly directed at preparation for primary education and is compulsory.

Early childhood education and care – provision for children before the start of compulsory primary education – has two aspects:

- i. care (or childcare): service mainly intended to enable parents to work while the child's safety and care is ensured,
- ii. early childhood education: services with an intentional educational component to support child development and prepare for primary education.

#### 1.1.2. Guidelines and Curricula for ECEC

In all European countries, the top-level authorities have issued official guidelines to ensure that settings have an intentional educational component. The content of these guidelines varies but they generally include developmental or learning goals and age-appropriate activities, sometimes in the form of a standard curriculum. The curriculum that educators follow is based on the pedagogical principles of early childhood education (European Education and Culture Executive Agency, Eurydice, 2019):

1. It is based on socio-culturally aspects through active negotiation of social relations within contexts such as time, place, culture, gender, class and others.
2. Each child is unique, with individual learning styles and pace. They have their own voice, and they should participate in a democratic dialogue for the decisions that relates them.
3. Children learn through play, exploration and discussion and are actively involved in the process of constructing their knowledge.
4. Educational guidelines, where they exist, establish a set of areas for children's learning and development. The learning areas highlighted in (almost) all countries which apply to the entire phase of ECEC are: emotional, personal and social development; physical development; artistic skills; language and communication skills; understanding of the world; cooperation skills; and health education. Other learning areas are less frequently mentioned and are more often targeted at older children
5. The learning process should begin with what children can do, considering that every child is capable and has the potential to develop and learn.

6. Relationships between adults and children are a milestone in the development of children. In this context the relationship between family and school is vital, thus parents are considered school's collaborators.
7. The children have the right to play. Play is the main core of learning procedure, framework, and organization of learning. It is a social practice that helps children in expressing and empowering their feelings, needs, motivations, knowledge, and skills.

As mentioned above, with an emphasis on the development areas, it ensures that every child will be actively involved in the processes related to the development of skills, attitudes, experiences, and knowledge that will strengthen them, so that they become creative and active citizens. The learning areas highlighted in (almost) all countries which apply to the entire phase of ECEC are: emotional, personal and social development, cognitive development and physical/motor development (European Education and Culture Executive Agency, Eurydice, 2019; MOECYS, 2020)

#### **i. Emotional, Personal and Social Development**

It includes the child's personal and social experience, expression, and management of emotions and the ability to establish positive and rewarding relationships with others (Cohen, Onunaku, Clothier, & Poppe, 2005). It encompasses both intrapersonal and interpersonal processes such as social interaction, cooperation, self-confidence, and community roles. It is the process through which children learn to build relationships. It involves learning the values, knowledge, and skills necessary to understand how to get along with others.

#### **ii. Cognitive Development**

Cognitive development involves how children think, explore, and figure things out. This domain includes a range of elements related to thinking (creative, reflective, lateral, deductive) and making sense of the world (children understand what's happening around them), i.e., risk taking, problem solving, investigating, planning, predicting, reasoning, and questioning. Furthermore, it refers to the experiences and processes, either structured or not, that lead to the strengthening/empowerment of the child's skills and abilities and consequently to his/her development into a critical and independent person.

#### **iii. Physical/motor Development**

This domain involves the senses (taste, touch, sight, smell, hearing, and proprioception — or bodily awareness of one's orientation in space), gross motor skills (major movements involving large muscles), and fine motor skills (involving small muscles, particularly of the fingers and hands). It is the growth and development of both brain and body and involves developing control of muscles and physical coordination.

## **2.2. Basic Pedagogical principles of Early Childhood Education**

### **2.2.1. Creativity and Play: Theories and approaches to children's social relations in education**

The countries that have high-level educational guidelines usually recommend certain pedagogical approaches such as High Scope and Reggio Emilia. Both approaches are focused on the child, its active role and the development of all domains. These approaches consider the complexity of teaching and learning, as it appears on the complexity theory. Based on the complexity theory, learning processes

should not be linear since it should take into account the powerful ideas and experiences of the children that live in the 21<sup>st</sup> century. As Resnick & Robinson (2017) states, while designing learning programs for young children you have to not only give P's a chance (project, peers, passion, play) but also have in mind the skills that are needed in order to succeed in today's world which are called the C's of the 21<sup>st</sup> century and they are: choice (free will-responsibility), collaboration, critical thinking, creativity, communication, citizenship.

Play, in any form, is the most important activity of preschool children that contributes to their overall development. Exceptional educators of the history of pedagogy (e.g. Socrates and Plato) highlighted the importance of play and the theories that point out the importance of it go far back in time. The ancient philosopher, Plato, supported that you can find out more about a person if you play with them for an hour than having a conversation with them for an hour. Following Plato's argument, Piaget played a central role in the importance of play in early childhood, specifically in children's cognitive development. Piaget's theories about learning emphasised the need for children to explore and experiment for themselves. For Piaget, play was a means by which children could develop and refine concepts before they had the ability to think in the abstract (Piaget, 1976, Katz & Chard, 2000).

However, Piaget was accused of "reducing" the role of the adult in children's play because he believed that children could discover things on their own and that by having adults interacting with them while playing, they were interfering their creativity and ingenuity. On the contrary, Vygotsky, emphasised the social and cultural aspects of play rather than the "lonely explorer" of Piaget. He argued that during play children were able to think in more complex ways than in their everyday lives, and could make up rules, use symbols and create narratives (Katz & Chard, 2000).

Additionally, Papert (1993), states that children learn best when they are actively engaged in constructing something, that has personal meaning to them. This is based on the theory of constructionism and the fundamental principle that children need to be actively involved in constructing their knowledge in order to perceive it. As mentioned above Resnick (2017) emphasizes, a successful learning process should deal with an in-depth study of things that have meaning for children (PROJECTS), with passion (PASSION), interacting and exchanging ideas with peers (PEERS). This process in its natural form is play. It is a process of experimentation, trial and error of new ideas and materials. This type of process is repeated and is characterised by a spiral process in which children *imagine* what they want to do, *create* a project based on their ideas, *play* with their creations, *share* their ideas and creations with others, *reflect* on their experiences – all of which leads them to imagine new ideas and new projects (Resnick, 2007).

While stating the importance of play, we couldn't ignore Albert Einstein's declaration that 'play is the highest form of the research' which includes three significant pedagogical frameworks: the pedagogy of documentation, listening and democracy. These pillars are derived from Reggio Emilia's educational approach recognising children as designers/architects of their own learning (Edwards, Gandini, and Forman, 2012). All these pedagogical frameworks are founded on the ground of making learning visible and on the notion of openness to meaning making, joint decision making, encouraging active listening and active learning, leading a totally child-centred approach. Explicitly, through documentation teachers can more easily study and ask questions about their practices, but teachers must first be capable of the art of becoming surprised and amazed by children and their potentialities (Dahlberg, 2012). Learning should feel like diving into unknown (Ackermann, 2007)

Conclusively, Resnick quote best describes the importance of play in early childhood: “All I really need to know (about creative thinking) I learned (by studying how children learn) in kindergarten”, who defines the kindergarten approach to learning a **creative thinking**.

### 2.2.2. Creativity and Play: Practical Strategies and Approaches

As Moyles (1989) pointed out, both free play and structured (guided) play are really important. These two forms of play are interconnected and have different goals based on the time that the children will use it. When the children engage in free play, they experiment and find out new ways to use different materials. It allows them to “lead into” the play, explore it themselves, design/create their own play without teacher’s help. On the other hand, when they engage in structured play, the teacher or the materials directs children’s play and explorations. It shows them “how to” use it.

Both forms of play are organized in learning centres, and it offers children a variety of opportunities for problem solving, exploration, development of creativity and imagination, development of social skills, support learning through meaningful activities, active participation, direct contact with materials, other children and adults.

During free play, the teacher offers opportunities for children to engage in socio-dramatic play, imaginative symbolic play, constructive play, creative play, kinetic play, exploratory-experimental play and play with pedagogical material. More information about each type of play below:

*Table 2: Examples of Creativity and Play for Learning in ECEC*

Type of play	Example	
<p><b>Socio-dramatic play:</b> Children are engaged in role play with different themes that referred to real life situations (personal, social and family)</p>	<p>Doctor's office/ Hospital: A child pretends to be a doctor and takes care of a friend that is sick. They use patient’s folder, pretend x-rays, clipboards for taking notes, visual schedule for booking appointments, medication.</p>	 <p><i>Image source:</i> <a href="https://valueofdramaticplay.wordpress.com/">https://valueofdramaticplay.wordpress.com/</a></p>
<p><b>Imaginative symbolic play:</b> Children are engaged in role play with themes that referred to fantasy situations (non-real)</p>	<p>A child pretends to be a pirate trying to find a treasure. They use maps, hats, compass, telescope.</p>	 <p><i>Image source:</i> <a href="https://www.alamy.com/">https://www.alamy.com/</a></p>

<p><b>Constructive play:</b> Children are engaged in building constructions, combining materials within the framework of real and fantasy situations</p>	<p>A child is playing with wooden blocks, legos, dublo blocks etc and they are building a farm for the farm animals.</p>	 <p>Image source: <a href="https://www.communityplaythings.co.uk/learning-library/articles/constructive-play">https://www.communityplaythings.co.uk/learning-library/articles/constructive-play</a></p>
<p><b>Creative play:</b> Children use familiar materials in a new or unusual way, make new connections of their experiences, express ideas and feelings</p>	<p>A child plays in the music centre and makes its own melody while playing the musical instruments. He/she can share his/her music with his/her friends.</p>	 <p>Image source: <a href="https://www.pinterest.com">https://www.pinterest.com</a></p>
<p><b>Kinetic play:</b> Children are engaged in movement activities either indoor or outdoor.</p>	<p>By using a dice, the children need to perform the movement that each number represents.</p>	<p><b>Πίζε το ζάρι!</b></p> <p>Τελίμο επίσημο για ένα λεπτό! Στάσου στο 1 πόδι σαν τον πελαγό! Πιάσε τα δάκτυλα των ποδιών σου! 10 Αλματάκια σαν το Βατραχάκι! Χοροπήδα με το ένα σου πόδι για ένα λεπτό! Χόρευε το τραγούδι!</p> <p><small>Learningcornerandcrafts.com</small></p>
<p><b>Exploratory-experimental play:</b> Children are engaged in play while exploring, experimenting, discovering ideas - concepts – information and developing skills.</p>	<p>A child experiments in the science centre with different kinds of leaves. During his/her play, he/she groups the leaves in different categories based on certain criteria (size, shape, colour), discovers the different parts of the leaves, labelling and drawing the parts of the leaves.</p>	<p><b>Label EVERYthing</b> with photos or clip art labels</p>  <p>Image source: <a href="https://www.pinterest.com">https://www.pinterest.com</a></p>

**Play with pedagogical material:**

Children are playing with pedagogical materials that have certain rules and structure are directly related to concepts and skills.

Domino games, puzzles, matching games, etc



*Image source:*

<https://sme.goiania.go.gov.br/>

### 3. Technology

Infants, toddlers and preschoolers nowadays grow up in an environment where technology is everywhere. Children with and without disabilities use technology on a daily basis. Embedding this technology in teaching to complement and improve traditional instruction and learning methods can help develop certain skills.

By technology we mean both Information and Communication Technology (ICT) and Assistive Technology based on ICT (ICT-AT). In the first part of this section we will look at the use of ICT with Early Learners and in part two we will talk about the use of ICT-AT with Early Learners.

To make the use of technology in early years effective a number of ethical issues should also be taken into consideration, and they are summarized in Annex 1.

#### 3.1. Using ICT with Early Learners

##### 3.1.1 Technology-enhanced learning

When technology is used as a mediating device supporting learning, it is called E-learning or technology-enhanced learning (TEL). E-learning or TEL includes all kinds of educational technology that electronically support the educational process. (UNESCO International Bureau of Education, 2016)

In ECEC, children still need guidance and support from teachers who think critically about the possibilities and limitations of integrating digital technology, teachers who think with the children about when, how and why to use digital technology (Undheim, 2021).

##### 3.1.2 Benefits of ICT

In some countries, ICT has become integral to the teaching-learning interaction. ICT offers myriad opportunities for communicating, accessing and distributing knowledge, creating content and collaborative learning. When ICT is appropriately used by digitally literate and ICT-trained teachers and embedded into curriculum design (learning goal based), it is expected to support the development of innovative teaching practices, improve teaching instruction and enhance and enrich learning experiences. The use of ICT in teaching and learning approaches can lead to

1. higher child's order thinking skills (e.g. metacognitive and reflective skills).
2. higher child's engagement and motivation.
3. higher cooperation between children and more social play.
4. improved children's quality of life.
5. creative, interactive, exploratory and individualised learning environments for learners to take in information, process information and express their understandings.<sup>1</sup>
6. better prepared learners to deal with ongoing technological change in society.<sup>2</sup>

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<sup>1</sup> For example, over 87% of learners learn best through visual and tactile modalities and ICT can help these learners to (interactive) 'experience' the information instead of just hearing it. ICT can also give the opportunity to adapt learning to different children's needs. In addition, ICT can offer apps that provide extra support to learners with special needs (e.g. features for simplified instruction, ability to set pace and level of difficulty, ...) so they can more easily participate in the general education curriculum.

<sup>2</sup> Digital literacy - the acquisition of knowledge and skills, and the development of attitudes or values for effectively choosing and using ICT - has become an important consideration for curriculum frameworks.

(Hatzigianni, Gregoriadis, Karagiorgou, & Chatzigeorgiadou, 2018; Mavrou, & Meletiou-Mavrotheris, 2016; More & Travers, 2013; UNESCO International Bureau of Education, 2016; UNESCO's International Institute for Educational Planning, 2021).

### 3.1.3 Types of ICT

ICT for ECEC can be divided in five main categories:

1. Screen-based technology, e.g. computers, laptops, tablets, smartphones, interactive white boards or smart boards
2. Not screen-based technology, e.g. projectors, cameras
3. Exploratory technology, e.g. digital microscopes
4. Internet of Toys (IoT<sup>3</sup>), e.g. programmable toys such as Bee-Bots, virtual pets, social robot, programmable lego
5. Apps, software and online resources.

(Undheim, 2021)

Some common educational applications of ICT into ECEC include: computers, laptops, tablets, smartphones, audio and video devices, (smart) TV, interactive white boards or smart boards and programmable toys (e.g. Bee-Bots) (internal report SKATE).

### 3.1.4 Technology as supporting creative thinking and play

“Digital technology works in synergy with play and is not a threat.”

(Hatzigianni, Gregoriadis, Karagiorgou, & Chatzigeorgiadou, 2018, p. 929)

A growing body of evidence highlights the potential of digital technology to enrich play. Adding digital technologies to play makes children's (social) play more complex, facilitates transactions between play and learning, allows children to reflect on their actions and positive influences collaboration and co-operation. (Hatzigianni, Gregoriadis, Karagiorgou, & Chatzigeorgiadou, 2018; Undheim, 2021). When IoT<sup>3</sup> are involved in children's play, mutual interactions occur on different levels between the teachers, the children and the IoT<sup>3</sup>; new experiences emerge and children's creative, communicative and problem-solving abilities are stimulated (Undheim, 2021).

Digital play framework (DPF) is “a new assessment tool aimed at helping educators to understand how children learn to use technologies through play” (Edwards & Bird, 2015, p. 2) and plan, observe and integrate technologies with a play-based approach. (Hatzigianni, Gregoriadis, Karagiorgou, & Chatzigeorgiadou, 2018)

### 3.1.5 Selecting and evaluating ICT

When ICT is used for educational purposes in ECEC, it is important to choose suitable educational computer software, apps or technologies. Existing evaluation tools can be helpful for evaluating educational computer software, apps or technologies.

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<sup>3</sup> Internet of Toys (IoT<sup>3</sup>) is an umbrella term for connected and smart toys. Connected toys can connect to the internet and communicate with remote systems or with each other. Smart toys have sensors to interact and adapt to the behaviour, needs and preferences of the user. (Allana, S., & Chawla, S., 2021)

### **3.1.5.1 Educational computer software**

Educational software can play an important role in improving education. However, not all educational software is suitable and effective for teaching and learning. (Lê & Lê, 2007)

In the past decades, various evaluation tools have been developed for evaluating educational computer software to support teachers' selection of quality software. You can find a non-exhaustive list of existing tools in Annex 5.

### **3.1.5.2 Educational apps**

There is a growing prevalence of education technology, in particular self-proclaimed educational apps for Early Learners to be used on touchscreen devices such as tablets and smartphones. Research has shown that only a few of the app developers have taken into account the development and learning process of young children when creating the app. When developing apps, developers often do not follow a specific curriculum and/or seek little or no input from educators and development specialists. The majority of educational apps in popular stores have no guarantee of educational value. That is why it is important to evaluate apps so that you can choose appropriate, high quality educational apps to use. For this evaluation you can use existing evaluation tools targeting Early Learners. You can find a non-exhaustive list of existing evaluation tools published up to 10 years ago in Annex 6.

(Israelson, 2015; Kolak, Norgate, Monaghan, & Taylor, 2020; Lubniewski, McArthur, & Harriott, 2018; More & Travers, 2013; Papadakis, 2021; Papadakis, Kalogiannakis, & Zaranis, 2017; Papadakis, Kalogiannakis, & Zaranis, 2018; Papadakis, Vaiopoulou, Kalogiannakis, & Stamovlasis, 2020; UNESCO's International Institute for Educational Planning, 2021)

### **3.1.5.3 IoT Toys**

IoT Toys have become popular due to their assumed educational value.

More than educational computer software and apps, IoT Toys track various personal data of the child through the presence of various sensors (microphone, camera, physical movement, location, etc.) in the toy (Allana, S., & Chawla, S., 2021). Therefore, it is important to evaluate the privacy and security of IoT Toys (Allana, S., & Chawla, S., 2021). For this evaluation you can use existing evaluation tools. You can find a non-exhaustive list of existing evaluation tools in Annex 7.

## **3.1.6 Integrating ICT in Early Childhood Education and Care**

When integrating ICT in ECEC it is important that the requisite infrastructure is supplied and maintained, and that it is ensured that these ICT investments are matched with teacher support on knowledge and competences and other policies aimed at effective ICT use. (UNESCO's International Institute for Educational Planning, 2021)

### **3.1.6.1 ICT infrastructure**

"School policies need to provide schools with the minimum acceptable infrastructure for ICT, including stable and affordable internet connectivity and security measures such as filters and site blockers." When bringing ICT into classrooms, policies should use an incremental pathway, establishing infrastructure and bringing in sustainable and easily upgradable ICT with equitable access to these ICT devices for learning for all learners. Therefore, policies need to intentionally bridge the digital divide to bring ICT and digital literacy to all learners, not just those who are easiest to reach. (UNESCO's International Institute for Educational Planning, 2021)

### 3.1.6.2 Teacher ICT competences

According to UNESCO's International Institute for Educational Planning (2021):

- “Teacher policies need to target basic ICT literacy skills, ICT use in pedagogical settings, and discipline-specific uses. Successful implementation of ICT requires integration of ICT in the curriculum. Finally, digital content needs to be developed in local languages and reflect local culture.”
- “Teachers need specific professional development opportunities on ICT for formative learning assessments, individualized instruction, accessing online resources, and for fostering learners’ interaction and collaboration. Such training in ICT should positively impact teachers’ general attitudes towards ICT in the classroom and should also provide specific guidance on ICT teaching and learning within each discipline. Without this support, teachers tend to use ICT for skill-based applications.”

Training in ICT gives teachers adequate digital competence. For teachers, adequate digital competence means knowing when, how, why and when not digital tools should be used. Examining their understanding and experiences of digital tools, but also why they are not always able to use digital tools, is an important first step (Lindeman, Svensson, & Enochsson, 2021). The European Framework for the Digital Competence of Educators (DigCompEdu) is a scientifically sound framework describing what it means for teachers to be digitally competent (<https://joint-research-centre.ec.europa.eu/digcompedu/en>).

### 3.1.6.3 Service delivery system

Many countries have integrated technology-enhanced learning in the educational system, but how they integrated it (f.e. nationally, locally, school based, ...) depends on each country's or region's policies. Therefore, it is best to check the information from your local government(s). For the countries of the SKATE project, some interesting websites are listed in Annex 8.

## 3.2. Using ICT-AT with Early Learners

“Assistive technology enables and promotes inclusion and participation, especially of persons with disability, aging populations, and people with non-communicable diseases. The primary purpose of assistive products is to maintain or improve an individual's functioning and independence, thereby promoting their well-being. They enable people to live healthy, productive, independent and dignified lives, and to participate in education, the labour market and civic life.” (World Health Organization, 2019)

In this guideline we focus on ICT-AT which is AT based on ICT.

### 3.2.1. Benefits of ICT-AT

ICT-AT has great potential in providing both routine and customized access to the general early learning curriculum for all learners. With effective integration of ICT-AT into the general classroom, learners can have the provision of multiple means to communicate their questions and ideas, to complete their work with greater independence in performing tasks that they could not accomplish or only could accomplish with great difficulty, and to express what they have learned. Assistive technology has a major role in augmenting abilities and removing barriers, as well as ensuring effective evaluation/assessment of all learners. Current ICT-AT applications support a diversity of flexible, learner-centred assessment strategies that are adapted and tailored to individual needs, thus meeting

the diverse needs of all learners and leading to greater equity and validity of assessments. Properly integrating ICT-AT into inclusive education can help to remove functional and societal barriers for learners with disabilities, provide them with learning opportunities and create a level playing field to realise their varying abilities by giving everyone the necessary support and an equally accessible learning environment. ICT-AT can help children with disabilities to meet the same outcomes as their typically developing peers.

(Ahmad, 2015; Lohmann, Hovey, Gauvreau, & Higgins, 2019; Mavrou, & Meletiou-Mavrotheris, 2016)

Some other benefits for early learners of ICT-AT integration in ECEC are:

- Creating effective inclusive, supportive learning environments and experiences for young children with disabilities and increase the overall effectiveness of inclusive programs (Hunt, 2021; Judge, Floyd, & Jeffs, 2008)
- Providing tools of access and enhancement for inter- and intrapersonal development (Judge, Floyd, & Jeffs, 2008)
- ICT-AT for communication, mobility and independence can enhance learning through equal play with peers and interactions with peers for early learners with disabilities (Hunt, 2021; Lohmann, Hovey, Gauvreau, & Higgins, 2019)
- Promoting personalized learning: customized instruction, curricula and evaluation (Mavrou, & Meletiou-Mavrotheris, 2016; Traina & Hoogerwerf, 2018)
- Educational software can offer multisensory experiences, positive reinforcement, individualized instruction, and repetition (Ahmad, 2015)
- Increasing interactivity, active learning, motivation and engagement (Hunt, 2021; Floyd, Canter, Jeffs & Judge, 2008; Judge, Floyd, & Jeffs, 2008)
- Immediate increase of children’s attending behaviour (Hunt, 2021; Parette & Stoner, 2008)
- Developing both expressive and receptive communication skills and language for young children at risk or with disabilities (Floyd, Canter, Jeffs & Judge, 2008; Hunt, 2021; Parette & Stoner, 2008; Lohmann, Hovey, Gauvreau, & Higgins, 2019)
- Increased opportunities for socialization, communication attempts and interaction (Floyd, Canter, Jeffs & Judge, 2008)
- Promote reading and literacy development through Accessible Digital Textbooks (Hunt, 2021)
- Increase independence (Hunt, 2021; Traina & Hoogerwerf, 2018)
- Increased self-esteem and confidence (Floyd, Canter, Jeffs & Judge, 2008)
- Increase quality of life (Botelho, 2021)
- Child behaviour benefits e.g. children adhering to classroom rules, following sequences in tasks, and demonstrating appropriate social behaviours across contexts by the use of visualisation through ICT-AT (Hunt, 2021; Parette & Stoner, 2008)

### 3.2.2. Types of ICT-AT

There are different types of categorisation or taxonomies of ICT-AT, based on different types of criteria such as technical aspects, function or areas of implementation. For example:

1. Technical aspect
  - a. low-tech/no-tech, e.g. visual schedule, picture symbol display books/boards, ...
  - b. mid-tech/low-tech, e.g. talking book, screen magnifier, voice amplification, switch adapted toys, ...

- c. high-tech, e.g. AAC device, text-to-speech, and generally new technologies with digital aspect
2. The function for which it is used:
    - a. Vision, e.g. magnifiers, braille displays, screen reading software, text-to-speech technology, ...
    - b. Hearing, e.g. amplification systems, sound-field systems, hearing aids, ...
    - c. Communication, e.g. symbol software, voice amplification, speech-to-text technology, taking switches ...
    - d. Learning, cognition and developmental, e.g. talking books, Accessible Digital Textbooks, specialised apps, ...
    - e. Computers and related peripherals, e.g. specialised software/apps, alternative input devices, alternative keyboards/mouse, joysticks, voice recognition, ...
    - f. Play , e.g. switch adapted toys
    - g. Mobility, e.g. power-cars
  3. Per perspective under which they are implemented
    - a. To train and rehearse, under a more behaviourist model of learning. In terms of inclusive education it is suggested to keep this approach to background and only when needed, though it has its place for training in specific skills on an individual basis.
    - b. To assist learning, which brings to mind ‘assistive technology’, linked mostly to compensation of disabilities (mostly as impairments), and considered adjunct to learning rather than the key agency.
    - c. To enable learning, where the use of technology makes learning possible where it was not possible before.

(Abbott, 2007; Hunt 2021; Judge, Floyd, & Jeffs, 2008; Lohmann, Hovey, Gauvreau, & Higgins, 2019; State of Minnesota, n.d.)

If you are looking for an appropriate ICT-AT solution for children in your classroom you can best take contact with a local service delivery system (also see 3.2.4.3 Service delivery system). You can find an overview of some websites with resources and examples of ICT-AT in Annex 2. In Annex 3 you can also find an overview of ICT-AT tools for early learners with disabilities.

### 3.2.3. Strategies in using ICT-AT

Assistive technology devices can be used by learners with disabilities with or without assistance, in and outside the formal learning environment. ICT-AT can be used to train or rehearse, and to assist and enable learning for early learners at risk or with disabilities by eliminating barriers for learning.

(Ahmad, 2015) In inclusive ECEC, ICT-AT can be used to support a variety of skills, including play skills and interactions with peers (Lohmann, Hovey, Gauvreau, & Higgins, 2019).

If ICT-AT is an enabler for learning, actions for identifying and addressing the unique ICT-AT needs of each individual child must take place as early as possible (Early Identification and Early Intervention) by a transdisciplinary team of professionals. This is to ensure that young children interact as much as possible with the world around them and that by the time the child goes to school, the use of AT is already an acquired habit and does not create an additional barrier. However, the identification and

provision of ICT-AT should not be limited to education use only, but should be provided for use by the child in all settings and situations, above and beyond education applications. (Hunt, 2021)

A first step in using ICT-AT, after the first contact with the service delivery system, is to determine the need for the assistive technology (needs assessment process) by professionals who are trained to work with children with disabilities. The second step is to identify and select the most appropriate fit-for-purpose ICT-AT. The ICT-AT needs to fit the lifestyle, culture, environment, goals, expectations, strengths and needs of the child with disabilities, enabling the child with disabilities to achieve his/her full potential. Therefore, it is also important to involve the family in the ICT-AT decision-making process. When the appropriate ICT-AT has been chosen, it must be acquired, installed and personalised. The next step is to teach children how to effectively use the technology in different learning context by practice with feedback, as well as collaborating with parents, families and other stakeholders, and providing training and facilitated the effective involvement of the support mechanism/group. Then, the ICT-AT needs to be embedded within the (play based) activities, in and out of school for maintaining continuity and engagement. Finally, it is important to regularly evaluate the ICT-AT for effectiveness and satisfaction as the needs of the child can change over time, hardware and software may need to be upgraded or new ICT-AT may be required. Stakeholders that should be involved are: the child and his/her family, AT service delivery system/AT experts, school professionals and health professionals, and then maybe providers, funding agencies, designers for customized adaptations. The ICT-AT should be integrated in the Individual Education Plan (IEP) of the child but at the same time transfer the relevant objectives and learning outcomes in the mainstream – inclusive classroom practices. (Ahmad, 2015; Desideri et al., 2016; Hunt, 2021; Lohmann, Hovey, Gauvreau, & Higgins, 2019; Traina, & Hoogerwerf, 2018).

### 3.2.4. Integrating ICT-AT in Early Childhood Education and Care

When integrating ICT-AT in Early Childhood Education and Care it is important that the requisite infrastructure is supplied and maintained, and that it is ensured that these ICT-AT investments are matched with teacher training on knowledge and competences (also see ICT-AT teachers competence development), (technical) support for teachers and other policies aimed at effective ICT-AT use (e.g. a system for referrals to local ICT-AT agencies/experts). In addition, it is also important to involve the parents in the ICT-AT implementation process at school. (Ahmed, 2015)

#### 3.2.4.1 ICT-AT infrastructure

“Out of the 114 countries, which responded to the 2005 “Global survey on government action on the implementation of the Standard Rules on the Equalization of Opportunities for Persons with Disabilities,” 48% did not have policies in place relating to the provision of assistive technology, and half had not passed relevant legislation.” (Botelho, 2021)

Very few countries have a national assistive technology policy (World Health Organization, 2018). In many countries the access (quantity, quality, affordability and variety) of ICT-AT is non-existent or poor (Botelho, 2021; World Health Organization, 2018). Even in high-income countries ICT-ATs are often not included within health and welfare schemes or there are boundaries to the set of ICT-AT that are eligible for public provision (AAATE, 2012; World Health Organization, 2018). ICT-AT remain out of reach for many learners due to cost (both for schools as learners), lack of information and limited availability (Ahmad, 2015).

### 3.2.4.2 *Teacher ICT-AT competences*

Effective integration of AT in education will depend on the educators' ability to structure new learning processes and classroom environments based on the principles of universal design, to combine new technology with a new pedagogy, to develop active classrooms that encourage cooperative interaction, collaborative learning and group work (Traina & Hoogerwerf, 2018).

Early childhood educators must also have basic ICT-AT knowledge (e.g. which ICT-AT exists and can be helpful) and skills to effectively incorporate ICT-AT in the ECEC curriculum (Parette & Stoner, 2008).

Educators own digital and more specifically ICT-AT literacy and competences are often connected to the factors of effective ICT-AT use by end-users/learners as well as the digital divide. Acknowledging the need for schools and educators' capacity in order to empower learners with disabilities in using ICT-AT, European and other endeavours took place for the development of ICT-AT competence frameworks for educators. Competence frameworks are structured overview of learning outcomes describing levels of competence and the progression of learning. Some of the most recently developed ICT-AT competence frameworks addressed to teachers and generally educators working with ICT-AT users/learners are:

**KPT:** a framework more focused on a rather narrower conceptualization of Assistive Technology, specific for persons with disabilities interpreted as limitations.

**ATLEC:** includes two different frameworks. One for ICT-AT trainers and one for learners with disabilities. The first one, specifically focuses on the competencies needed for a professional to support and train persons with disabilities to become effective AT users.

**ENTELIS+:** brings accessibility and disability issues into the attention of efforts for digital education, digital literacy and digital competence development, and aims more specifically those involved in the education and training of persons with disabilities to develop their own ICT-AT competences.

Existing frameworks address the needs of the general teacher/educators' population at all levels and they provide a very good overview of the competences required to effectively support the use of ICT-AT by end-users. However, none of them focuses on particular ages, groups of educators and school level. Acknowledging this gap the SKATE project has developed, based on the existing ones, a new short competence framework that focuses more on educators (teachers and their teams/collaborators) in inclusive education as a whole school approach with the support of digital (assistive) technologies. The SKATE framework is available in a separate document.

### 3.2.4.3 *Service delivery system*

There are large differences in access to technology between children with disabilities from different countries, regions, income levels, ages, impairments, cultures and languages (Botelho, 2021). There is a lack of nationwide service delivery systems for ICT-AT and the services are distant from where most children with disabilities live (Botelho, 2021; World Health Organization, 2018). In many low- and middle-income countries service delivery systems do not exist and high-income countries services are often stand-alone and not integrated (World Health Organization, 2018).

(ICT-)AT service delivery organization and mechanisms vary broadly within and across countries and may vary in relation to disability policy, socio-economic context, and history, thus resulting in a variety of service delivery systems (e.g., private/public) and models (Desideri et al., 2016). Therefore, it is best

to check the information from your local government about the ICT-AT Service Delivery System (for education) in your country. For the countries of the SKATE project, some information and interesting websites are listed in Annex 9.

## 4. Creating digital inclusive education in early education settings

This section of the SKATE Guidelines actually consolidates all previous sections towards actual practice for digital technology (ICT-AT) enhanced inclusive education in ECEC.

### 4.1. Goals of digital inclusive education in early education settings

As outlined in Section 1 in this Guidelines document Inclusive Early Childhood Education is at the core of the policies and directions in Europe and globally, where emphasis is now placed on equal opportunities for all learners right from the beginning of their education life, and even from birth. Section 3 of the Guidelines highlight the importance of digital technology, both ICT and ICT-AT, in the education and life of all children. Interest in and importance of digital technology has been increasing especially after the outbreak of the Covid-19 pandemic. UNESCO (2021) makes several references to the role of technology in Inclusive ECEC, and similarly does current literature (e.g. Hoogerwerf et al, 2021) on digital inclusive education. These can be interpreted into goals of digital ECEC inclusive education as follows:

- To promote the right of all children in a digitally (technologically) transforming education
- To increase provision and access to services and resources within the ECEC settings, including adaptive technology support for learning
- To reach learners with limited opportunities for education, care and interaction in early years
- To engage learners in motivating technology enhanced play, learning and creativity activities
- To provide possibilities for synchronous and asynchronous learning in early years
- To intensify efforts to ensure access to and accessibility of educational innovations in ECEC
- To keep stakeholders and families connected
- To provide options for implementing UDL principles through technology in ECEC curricula
- To engage young learners in early digital literacy competence development
- To increase participation of young learners in all curricula and extra-curricula activities (in-door and out-door learning and interaction)
- To promote the development of digital accessible educational content for ECEC
- To provide opportunities for ECEC educators' and staff's digital competence development and training
- To provide alternative approaches to evaluate young children's learning and development
- To provide digitally enhanced learner-centred approaches for collaborative learning, creativity and interaction in early years

Nevertheless, it is also highlighted that given the importance and the general goals of digital inclusive education in ECEC, we also need to ensure that digital technology does not become another factor for exclusion and exacerbate of inequalities. This was one of the impacts during the covid-19 pandemic where children in countries, educational settings, families and individual learners with limited technology resources and support were practically excluded from education during remote learning.

Section 3 of the Guidelines identifies a number of strategies and approaches to digital inclusive education in ECEC, including identification of needs in terms of learners, environment and resources;

modelling technology use by teachers and peers and support of families and involved stakeholders; and the use of technology with learners across curricula subjects and areas. In addition, Annex 4 provides examples of cases of implementation of the use of ICT-AT in ECEC, both from research and practice.

## 4.2. Universal Design for Learning in Practice

### 4.2.1. UDL and mainstream technology

Amongst educators, there might be present a misconception that a UDL framework is mostly associated with the use of technology in the educational setting. However, though UDL can strongly benefit from the use of ICT (used here to refer to mainstream technologies), UDL principles can still be applied without the use of technology, since UDL involves the design of pedagogical practices for all students (King-Sears, 2009). Still, the use of ICT can provide the means of applying the UDL principles through different ways. Technology integration in a UDL framework allows to expand options and possibilities in the ways of selecting, presenting and using educational material and resources, to accommodate each student's needs and preferences (King – Sears, 2009). The use of technological tools (low-tech and high-tech) offer educators flexible ways of applying the three principles of UDL, reducing barriers and further engaging all students.

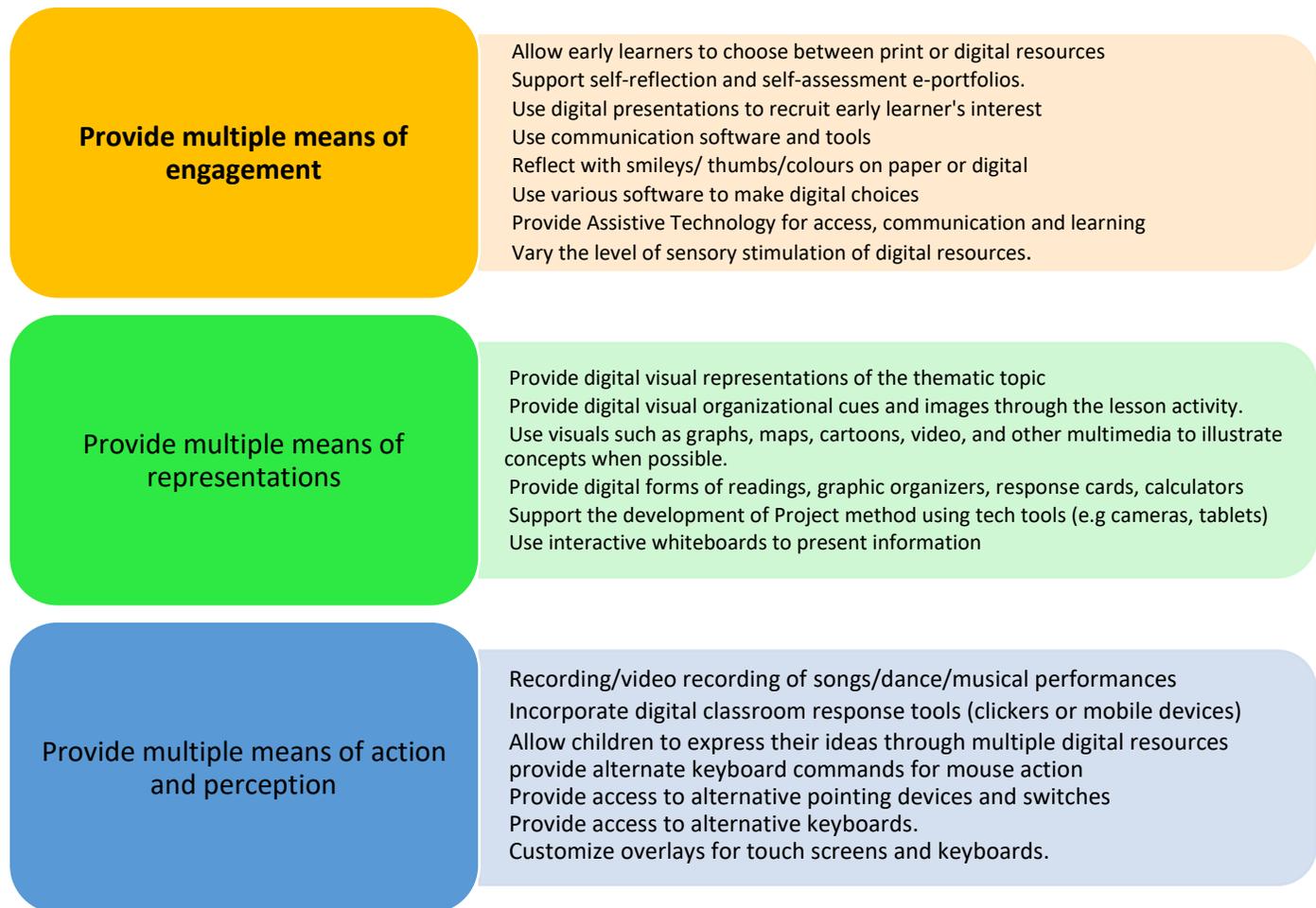
### 4.2.2. UDL and ICT-AT awareness

As mentioned earlier in section 1, Universal Design for Learning is a framework that allows the provision of multiple means of engagement, representation, as well as actions and expression, aiming to address the needs and preferences of each learner. CAST and the team that introduced UDL have made clear connections to the use of technology, both ICT and ICT-AT. However, sometimes there is a misinterpretation that ICT-AT refers to solutions remediating disability on a personal level, a perspective conflicting with the vision of UDL. Nevertheless, as described in section 3, ICT-AT, provides resources for learners with disabilities to overcome barriers and support their learning in the educational process. Hence, having ICT-AT focusing on the individual needs of the disabled student whereas UDL targeting the design of curricula and learning environments, in fact may be 'two sides of the same coin' (Rose et al., 2005: 507). Focusing only on the ICT-AT perspective through the deficit, medical model, student's disabilities in learning, are solely seen as a result of individual weaknesses and problem. Also, if the use of ICT-AT is not integrated into the learning objectives of a specific lesson, the implementation of inclusive pedagogies in the classroom will not be allowed. On the other hand, focusing only on a UDL perspective in learning, the 'problem' is seen 'as an environmental problem' (Rose et al., 2005: 510). However, in a technology advanced world, if the role of ICT-AT is not acknowledged, it may lead to a failure in adequately adapting material and recourses. Therefore, ICT-AT use is essential in the implementation of UDL, as it can increase the efficacy of universal designs (Hitchcock & Stahl, 2003).

### 4.2.3. UDL and ICT-AT in learning design and implementation

As mentioned earlier in section 1, UDL offers [a set of checkpoints](#) for each guideline that enables teachers to make decisions while designing their lessons or evaluate their teaching practice based on suggestions on how to implement UDL principles with or without the use of ICT-AT. In figure 5 below, an effort is made to suggest possible ways of integrating ICT-AT in a UDL framework in early education settings (adapted from CAST 2022 and Goalbook Toolkit (2022))

Figure 5: Examples of UDL principles implementation in ECEC



What is essential in the success of ICT-AT supported universally designed inclusive education is the definition of a clear and flexible implementation plan. After the assessment of needs and provision of any ICT(-AT) on individual or classroom basis, educators and school teams should design and apply an implementation plan. The plan should:

- take into consideration the learning and interaction context and condition,
- assess the opportunities for participation (i.e. activities to participate in, the content of the activities and the processes within the activity)
- assess barriers for participation and provide access by removing barriers (with (or without) technology)

- ensure training of all stakeholders involved
- identify time-schedule and milestones during the implementation
- design and apply learning for the present and the near future, to ensure continuity
- evaluate (ongoing and at milestones), follow-up, review and revise

Such practices for establishing a successful implementation plan call for collaboration of all involved stakeholders, flexibility and multi-disciplinarity.

### 4.3. Collaboration with involved stakeholders

Collaboration is defined as ‘an interactive process where a number of people with particular expertise come together as equals to generate an appropriate programme or process or find solutions to problems’ (NCSE 2006, X1).

Collaboration and collaborative practices are considered as essential for developing inclusive pedagogies in educational settings (Ainscow & Sandhill, 2010 ), as well as facilitating educator’s professional learning and practice. Professional learning is conceptualised as a way of stimulating thinking and knowledge, leading to change (in teaching practices, attitudes, beliefs) that support students’ outcomes (Attard Tona & Shanks, 2017). Collaboration can assist educators in their decision - making and problem – solving, developing deeper understanding, acquiring new skills, concepts and ideas, and potentially leading to transformative practices (Kennedy, 2014). For students with disabilities, collaboration amongst all stakeholders (educators, support teachers/facilitators, ICT-coordinator, educational needs coordinator, technology experts, parents) is integral for building a framework of digital inclusive pedagogies in action, informed by educators’ practice, observations and reflections (Florian, 2014 ). On the other hand, lack of teamwork or collaboration is found to have a diminishing impact in creating individualized educational planning that meets learners’ educational and developmental needs (Mitchell, Morton & Hornby, 2010).

#### 4.3.1 Communities of Practice for inclusive ECEC

Communities of practice are forms of group of people who share similar concerns, problems, or interest on a particular topic which they try to address through their interactions. Communities of practice are guided by the below principles (Wenger, 1998; Parette & Stoner, 2008):

**The domain:** they share a common area of interest

**The community:** they participate in common conversations and activities, helping and learning from each other, as well as sharing information.

**The practice:** the members of the group, share a varied repertoire of recourses, experiences, stories, knowledge according to their background and expertise through consistent and sustained interaction on a regular timeframe.

In the process of developing digital inclusive education initiatives in early education settings, communities of practice may offer opportunities to stakeholders involved to:

- Find solutions to problems that arise
- Assigning different and complementary roles to each stakeholder, according to their expertise
- Develop their professional learning and practice, which is understood as a collective rather than an individual endeavour

- Design how to organize specific information sessions/focus groups/workshops with stakeholders involved.
- Have a shared sense of community
- Delegate agreed roles amongst stakeholders to support the creating of a digital inclusive environment
- Develop individualised educational planning for inclusion

#### 4.3.2 Supporting Professional Learning: Self-reflection practices and strategies for educators

Self-reflection involves a thoughtful look about the teaching and the teaching process, in terms of 'what was done, what could have been done, and what should be done' (Galvez – Martin, 2003: 59). Put differently, it allows educators to self-evaluate themselves, providing an understanding of how they handled events in the past, and what could change to improve the way acted or engaged (Galvez – Martin, 2003). Self-reflection can be more effective when practiced through communities of practice, since this communicative framework allow educators to interact, exchange ideas and learn from each other (Devi et al., 2021).

Literature on self-reflective educational practice refers to various models of self-reflection practices and strategies. Most models of reflection include critical reflection on experience and practice that would enable identification of learning needs. Traditionally, some of the most known models outlined by Koutrouba et al (2020) are:

- Model introduced by Dewey (1933): Self-reflection as an intellectual process of 5 phases: problems, suggestions or perceptions of the individual to suggest solutions, intellectual processing of difficulties and complexities of the problem, assumptions and hypothesis for observation and information collection, analysis of hypothesis and hypothesis trials.
- Model introduced by Kolb (1984): Based on experiential learning and focusing on Dewey's philosophical approach, this model suggest that self-reflective practice starts from identifying a particular new learning experience, moves to self-reflective observation of the experience, then the examination of the experience through established theories and finally the trial of the theories on a practical level for solving a problem.
- Rogers' (2002), adds on the above the importance of collaboration and discussion with colleagues during self-reflection where new ideas and next steps may be identifying for educational choices, making this a group-reflection and peer supported experience.
- ALACT Model (Korthagen & Vasalos, 2005): a model that corresponds to **Action – Looking back – Awareness of essential aspects – Creating alternative methods of action – Trial**. In other words, starting from the teaching intervention educators identify/describe the fact/action that caused concerns (what goes wrong?), followed by reflection on the fact to identify what is important and design alternative approaches which will be tried in the action/fact.

Other systematic literature review studies (e.g. Mann et al, 2009) identify additional models of reflection introduced by researchers in various disciplines (e.g. Schon, 1983; Boud et al, 1985; Moon, 1999, etc, cited in Mann et al, 2009), all sharing the principles of critical assessment of own practice in order to identify possible solutions to educational concerns for improving learners' experiences.

There are also various strategies/approaches that educators may follow in implementing self-reflection in education. These include the following tools:<sup>4</sup>

- Personal journals, diaries, portfolios, jotting notes in written prose
- Tables, mind maps, lists and bullet points - your notes summarised in note form
- Recordings: CDs, digital recorder, video - documenting by voice recordings
- creative representations - icons, mind maps and diagrams
- group work: reflecting on your own and others' practices of group tasks

Self-reflection is considered one of the most effective approaches to improving teaching and learning practices. The advantages of self-reflective practice are summarized below:<sup>5</sup>

- It allows teachers to take informed actions that can be justified and explained to others and that can be used to guide further action.
- It allows teachers to adjust and respond to issues.
- It helps teachers to become aware of their underlying beliefs and assumptions about learning and teaching.
- It allows teachers to consciously develop a repertoire of relevant and context specific strategies and techniques.
- It helps teachers locate their teaching in the broader institutional, social and political context and to appreciate that many factors influence student learning.

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<sup>4</sup> Cited from: Open University (2020) Strategic study techniques: Be aware of your habits. Available at: <https://help.open.ac.uk/be-aware-of-your-habits> (Accessed: 09 March 2022).

<sup>5</sup> Cited from: NSW Government (2021) Reflective practice. Available at: <https://education.nsw.gov.au/teaching-and-learning/professional-learning/teacher-quality-and-accreditation/strong-start-great-teachers/developing-focus/reflective-practice#The1> (Accessed: 09 March 2022).

## 5. ANNEXES: Additional Information and Tips

### ANNEX 1: Ethics and the use of digital technology in early childhood education settings

While there are numerous potential benefits of digital technology, there are also a number of ethical issues when using ICT(-AT) with early learners (UNESCO, 2010):

#### Concerns about the time of early learners being exposed in screens

Maintain a comparatively short time for early learners when using screen devices (e.g., 10 – 20 minutes for 3-years-old, maximum of 40 minutes for 8 years old)

#### Concerns about harmful physical effects

Use appropriate furniture, suitable lighting and adopt principles of ergonomics

#### Concerns about children's learning, cognitive, social, and emotional development

Integrate the use of ICT-AT with other activities that provide plenty opportunities for social interaction and cognitive development

#### Concerns about exposure to harmful contents

Monitor the exposure of young learners to inappropriate content using parental control applications

#### Concerns about ICT(-AT) displacing other important learning and play activities

The use of ICT(-AT) should not be used at the expense of open – ended and creative playing, but could be used alongside other kinds of activities

## ANNEX 2: Resources and examples of Assistive Technology

Name	Website address	Description
<b>AT and Me</b>	<a href="https://www.atandme.com/">https://www.atandme.com/</a>	Provides information of the various assistive as well as mainstream technologies and resources that are available and useful for persons with disabilities and not only.
<b>GoalBook</b>	<a href="https://goalbookapp.com/">https://goalbookapp.com/</a>	Guides educators working with people with disabilities on how to design and implement effective strategies for differentiating instruction, including Universal Design for Learning.
<b>Inclusion Europe (Easy-to-Read)</b>	<a href="https://www.inclusion-europe.eu/easy-to-read/">https://www.inclusion-europe.eu/easy-to-read/</a>	Information and Guidelines about creating easy-to-read material for education and not only
<b>EASTIN (The Global Assistive Technology Information Network)</b>	<a href="http://www.eastin.eu/">http://www.eastin.eu/</a>	An easy-to-use tool that opens the door to several national assistive technology products databases at the same time, so you can look up the information you require and have it immediately translated into your own language, where necessary.
<b>Techmatrix</b>	<a href="https://techmatrix.org/">https://techmatrix.org/</a>	A website of the National Center for Technology Innovation (NCTI), previously funded by the U.S. Department of Education which offers a large database of assistive and technology tools and resources to support learning for students with disabilities and their classmates.
<b>Eerste hulp bij moeilijkheden met communiceren (First aid for communication difficulties)</b>	<a href="https://ikkannietpraten.be">https://ikkannietpraten.be</a> (Flanders, Belgium)	A website of Modem, an expertise network on Augmentative and Alternative Communication (AAC) in Flanders that also gives individualised advice for persons with disabilities, with information on AAC.
<b>Hulpmiddelen en aanpassingen (Aids and adaptations)</b>	<a href="https://www.vaph.be/hulpmiddelen/algemeen">https://www.vaph.be/hulpmiddelen/algemeen</a> (Flanders, Belgium)	The website of the Flemish agency for people with disabilities with information on aids and adaptations used by persons with disabilities and their proxies. This website also contains information on the reimbursement of aids and adaptations.
<b>Useful Educational Resources</b>	<a href="https://drive.google.com/file/d/182QUvqoUNG13TquyQIUGgljMCA01su7g/view">https://drive.google.com/file/d/182QUvqoUNG13TquyQIUGgljMCA01su7g/view</a>	A list of mostly open source and free educational resources created by members of the SKATE team

### ANNEX 3: TIPS to Educators and Parents: Information, guidance, involvement and participation

#### ICT-AT tools for early learners with disabilities – An overview for parents<sup>6</sup>

There are ICT-AT tools to support your children and your students in:

Listening	Reading
Math	Writing
Organization and Memory	Communication
Mobility	Leisure

***Ask your school inclusion support team and contact your local AT services***

#### Some ICT-AT tools that your children and students may use

For accessing technology:	For Learning:
Alternative keyboards	Computers
Alternative mice (pointing devices)	Laptops and tablets
Switches	Portable word processors
Speech synthesizers/Screen readers	Proofreading programs
Speech recognition programs	Smartphones
Optical character recognition	Audio books, publications, DAISY books
Braille displays and braille keyboards	Word prediction programs
Touch screens and touch interfaces	Variable speed tape recorders
Eye control/eye gaze technologies	Abbreviation expanders
Magnifiers: devices and software	Graphic organizers and outlining
<b>For communication:</b>	Talking calculators Free-form database software
Personal FM listening systems	Electronic math worksheets
Hearing aids	Information/data managers
Augmentative and Alternative Communication systems	Talking spell-checkers and electronic dictionaries
<b>For mobility and manipulation:</b>	Robots for learning
Wheelchairs	Symbols and symbolization software
Rollers	Text readers
Walking aids	Interactive whiteboards
Writing Aids	Simulations
Robotics	Virtual and Augmented reality

<sup>6</sup> Adapted from Great Schools (2008). An e-ssential Guide to Assistive Technology. Available at <https://www.greatschools.org/gk/articles/parents-guide-to-assistive-technology/>

<b>Your child's profile</b>	
<b>Some factors to consider when evaluating ICT-AT tools for your child</b>	
What are her specific needs and challenges?	What are her strengths?
What is her interest, skill and experience in using technology?	In which settings will she use ICT-AT tools
<b>Selecting the appropriate technology for a learner with disabilities, involves a careful consideration of the relationship between the individual, technology, task, and context</b>	

<b>Strategies/tips for integrating ICT – AT in ECE (adapted from UNESCO, 2010: 104 – 115)</b>	
<b>Develop your potential</b>	<ul style="list-style-type: none"> <li>• Familiarize yourself with the ICT-AT service delivery system of your country</li> <li>• Start developing your own ICT-AT competency</li> <li>• Study research/sources of good practices in integrating ICT-AT in ECE</li> </ul>
<b>Classify your position</b>	<ul style="list-style-type: none"> <li>• Clarify who is the initiator of this process and why (parents, children's needs, professionals, local or high educational authority researchers)</li> <li>• Clarify your goals when using ICT-AT and how they relate with the curriculum</li> <li>• Clarify how you use ICT-AT to support learning (e.g. are they part of Universal Design for Learning and Differentiation, or used in specific learning activities)</li> <li>• Explore the potential of establishing collaboration with involved stakeholders (such as the 'communities of practice' discussed in section 4.3.1.)</li> <li>• Explore whether/how your early education setting already uses ICT-AT in the learning process</li> <li>• Engage in self-reflective practices (see section 4.3.2.)</li> </ul>
<b>Set up your goals and objectives</b>	<ul style="list-style-type: none"> <li>• Keep your (inclusive) goals and strategy simple, and flexible</li> <li>• Think about areas of learning, play and development and ways to support inclusive education through ICT-AT</li> </ul>
<b>Build your environment</b>	<ul style="list-style-type: none"> <li>• Adapt your environment in ways that supports Universal Design for Learning and Differentiation</li> </ul>

	<ul style="list-style-type: none"> <li>• Consider and take actions for any safety/ergonomic issues when using ICT-AT (wires, lighting)</li> <li>• Consider the usage/functionality of ICT-AT and how these may be integrated in different kinds of activities, and/or how they correspond to children’s needs</li> </ul>
<b>Promote professional development of your staff</b>	<ul style="list-style-type: none"> <li>• Understand that the integration of ICT-AT in inclusive early educational settings is an ongoing process</li> <li>• Estimate/evaluate the ICT-AT competency of your teachers</li> <li>• Think of ways to increase motivation in using ICT-AT in inclusive educational settings</li> <li>• Develop your strategy for designing the professional development of your staff</li> <li>• Support the development of a learning community</li> </ul>
<b>Integrate, observe and reflect</b>	<ul style="list-style-type: none"> <li>• Start with simple activities of using ICT-AT to facilitate inclusion (e.g. drawing pictures through the use of a drawing program)</li> <li>• Integrate more categories/types of ICT-AT, apply principles of UDL (provide multiple means of engagement, representation, action &amp; expression)</li> <li>• Observe how children use ICT-AT in activities</li> <li>• Document students’ progress (through e.g. e-portfolios) for your peers and parents, to support the design of future activities</li> <li>• Continuously improve your reflective practice</li> </ul>
<b>Build partnerships and networks</b>	<ul style="list-style-type: none"> <li>• Inside your early education learning centre – to create a common vision and plan for integrating ICT-AT in inclusive educational settings</li> <li>• With the parents of young learners – to learn from and teach them about the process</li> <li>• With other educators and professionals – to exchange ideas</li> <li>• With educational authorities – to receive approval and support</li> <li>• With research institutions – to acquire new knowledge/involve in relevant projects</li> <li>• With primary schools – to continue the work after learners’ graduation from the early education setting</li> </ul>

ANNEX 4: Examples/case studies/good practices of integrating of (Assistive) technology in the daily work with children in preschool institutions, and scientific evidence

<b>Examples from literature and research evidence</b>
<p><b>Using ICT- AT with young learners</b></p> <p><b><i>Example from Brodin &amp; Lindstrand (2008, p. 18):</i></b>            Charles, four-and-a-half years old, has a serious motor disability and slurred speech, but his intellectual capacity is good. He gained access to a computer, and was able to borrow training programmes from the Datatek (regional computer play centres for children and young people with disabilities). It soon became evident that he could read short words, was well acquainted with numbers, had good visual capacity and was willing to learn more. With the help of the computer he could exhibit the skills which he did in fact have, but that otherwise might have been difficult to detect. This gives him opportunities to play with other children in the preschool, and thus to feel that he was included in the activities.</p>
<p><b>Using ICT in early childhood education</b></p> <p>Kerckaert, Vanderlinde &amp; Braak (2015) in their research in Flanders, conducted an online survey to map the use of ICT to early education settings by teachers. Results indicated that though teachers were positive towards ICT, they rarely integrated it in the educational process. Researchers identified some factors related to the use of ICT in early childhood education, e.g. the age of the children (considering that they are not suitable for children below 3-years-old), teachers' related characteristics and competences in ICT, highlighting the importance of ICT professional development.</p>
<p><b>Using a UDL framework in early childhood education</b></p> <p>McGuire-Swartz &amp; Arnt (2007) in their action research examined how 41 teacher candidates in early childhood education understood and applied the principles of Universal Design for Learning (UDL) in their teaching design and instruction. Authors found that teacher candidates, when using UDL, were more able in engaging students in the lesson, further understanding their individual needs and characteristics and reflecting on how UDL principles may transform teaching processes in the classroom.</p>
<p><b>Using a UDL framework in early childhood education towards inclusion:</b></p> <p><b><i>Example: Pairing Verbal Instructions with Visual Representations</i></b>            Miss Suzie's preschool class is comprised of a diverse range of young learners. Several children are multilingual, and one family has just immigrated to the US. Several other children have communication delays and impairments, and use speech generating devices or the Picture Exchange Communication System (Bondy &amp; Frost, 2004) to communicate. Given the unique expressive and receptive communication needs of all children in the classroom, the team decides to create large visuals with illustrations of the expectations for each activity. While Miss Suzie already uses a visual schedule</p>

during the day, the team notices that many children still struggle to follow directions during transitions. By showing children large visuals with symbols for handwashing, lining up, walking to the bus, and other important daily routines, in addition to the verbal large group directions, the team observes children following these routines and engaging in on-task behavior much more independently.

Cited in Gauvreau, Lohmann & Hovey (2019: 4-5)

#### **Examples from the SKATE Project Pilots**

## ANNEX 5: Resources for evaluation of educational computer software

Tool/Rubric	Short description	Link/resource
Systematic Evaluation of Computer-Based Education	A description of fourteen pedagogical dimensions of computer-based education (CBE), each based on some aspect of learning theory or learning concept, that can be used as criteria for evaluating different forms of CBE.	Reeves T. (1994) <a href="https://ro.ecu.edu.au/cgi/viewcontent.cgi?referer=&amp;httpsredir=1&amp;article=7865&amp;context=ecuworks#page=222">https://ro.ecu.edu.au/cgi/viewcontent.cgi?referer=&amp;httpsredir=1&amp;article=7865&amp;context=ecuworks#page=222</a>
The Software v-List	A checklist for evaluating Educational Software for use by students with disabilities.	Boone, R., & Higgins, K. (2012) <a href="https://www.researchgate.net/publication/286638012_The_Software_-_List_Evaluating_Educational_Software_for_Use_by_Students_with_Disabilities">https://www.researchgate.net/publication/286638012_The_Software_-_List_Evaluating_Educational_Software_for_Use_by_Students_with_Disabilities</a>
Early Childhood Educational Technology Evaluation Toolkit	A tool to more efficiently and effectively identify unique technology needs as well as evaluate the most important components of educational software.	McManis, L.D., & Parks, J. (2012) <a href="https://www.eschoolnews.com/files/2012/01/EvaluatingTechnology_ebook_toolkit.pdf">https://www.eschoolnews.com/files/2012/01/EvaluatingTechnology_ebook_toolkit.pdf</a>
Comprehensive Evaluation of Electronic Learning Tools and Educational Software (CEELTES) tool	The evaluation tool consists of sets (catalogues) of criteria divided into four separately assessed areas: <ul style="list-style-type: none"> <li>- the area of technical, technological and user attributes;</li> <li>- the area of criteria evaluating the content, operation, information structuring and processing;</li> <li>- the area of criteria evaluating the information processing in terms of learning,</li> </ul>	Karolčík, S., Cipková, E., Hrušecký, R., & Veselský, M. (2015) <a href="https://eric.ed.gov/?id=EJ1079014">https://eric.ed.gov/?id=EJ1079014</a>

	<p>recognition, and education needs;</p> <ul style="list-style-type: none"> <li>- the area of criteria evaluating the psychological and pedagogical aspects of a digital product.</li> </ul>	
An evaluation rubric for assessing the educational quality of YouTube videos	<p>Four key criteria (Age appropriateness, Content quality, Design features and Learning objectives) to evaluate the educational quality of YouTube videos for early learning (young children 0 to 8 years old).</p>	<p>Neumann, M. M., &amp; Herodotou, C. (2020)  <a href="http://oro.open.ac.uk/70187/">http://oro.open.ac.uk/70187/</a></p>

## ANNEX 6: Resources for evaluation of educational apps

Tool / Rubric	Short description	Link / resource
Questionnaire for evaluating the educational potential of children's apps	A thorough and user-friendly tool accessible by a wide audience: app developers, researchers, caregivers and educators for assessing the educational potential of apps for preschooler (complemented by a second tool specifically addressed to researchers)	Kolak, Norgate, Monaghan, & Taylor (2020) <a href="https://tinyurl.com/4xxv94kr">https://tinyurl.com/4xxv94kr</a>
E.T.E.A.: Evaluation Tool for Educational Apps	A thirteen-item (Questions) assessment instrument based on the following dimensions: Usability, Efficiency, Parental Control, and Security	Papadakis, Vaiopoulou, Kalogiannakis, & Stamovlasis, (2020) <a href="https://tinyurl.com/57dfbvvn">https://tinyurl.com/57dfbvvn</a>
REVEAC: Evaluation of Educational Apps for preschool Children	An 18 items rubric for the evaluation of educational apps for preschool, focused on four areas: Educational content, design, Functionality, Technical Characteristics	Papadakis, Kalogiannakis, & Zaranis, (2017) <a href="https://tinyurl.com/yc68xujm">https://tinyurl.com/yc68xujm</a>
Preschool App Evaluation Guide	A tool for assessing apps in terms of Accessibility, Content and Individualization, by the use of twenty-seven items across the three sections.	More & Travers (2013) <a href="https://tinyurl.com/5ekskrzs">https://tinyurl.com/5ekskrzs</a>
ACE: App Checklist for Educators	A twenty-six-item assessment instrument targeting K-12	Lubniewski, McArthur, & Harriott, (2018) <a href="https://tinyurl.com/bdefrbxh">https://tinyurl.com/bdefrbxh</a>
Rubric for the evaluation of apps for early communication, language and literacy	A set of educational criteria which has been produced to enable the assessment of the quality of early language, literacy and communication apps.	UK Department for Education, (2019) <a href="https://tinyurl.com/ycydt4mb">https://tinyurl.com/ycydt4mb</a>
The App map: a tool for systematic evaluation of apps for early literacy learning	A framework for elementary teachers' selection of apps for early literacy instruction. It guides teachers through a systematic evaluation of apps to identify affordances, and determine value added to instruction through the use of apps for literacy learning.	Israelson (2015) <a href="https://eric.ed.gov/?id=EJ1079816">https://eric.ed.gov/?id=EJ1079816</a>

## ANNEX 7: Resources for evaluation of IoT toys

Tool / Rubric	Short description	Link / resource
Checklist met tien aandachtspunten voor ouders (Checklist with ten points of attention for parents)	A checklist of ten points of attention for consumers of IoT toys	Nederlands netwerk voor mediawijsheid (Dutch Network of Media Literacy) (2016) <a href="https://netwerkmediawijsheid.nl/wp-content/uploads/sites/6/2017/02/connectedtoys_checklist.pdf">https://netwerkmediawijsheid.nl/wp-content/uploads/sites/6/2017/02/connectedtoys_checklist.pdf</a>
ChildShield	A rating system with 15 factors for assessing privacy and security of internet of toys	Allana, S., & Chawla, S. (2021) <a href="https://www.researchgate.net/publication/343448375_ChildShield_A_rating_system_for_assessing_privacy_and_security_of_Internet_of_Toys">https://www.researchgate.net/publication/343448375_ChildShield_A_rating_system_for_assessing_privacy_and_security_of_Internet_of_Toys</a>

ANNEX 8: Resources on ICT service delivery system in the four project partner countries

<b>Information websites ICT service delivery system in Belgium, Cyprus, Italy and North Macedonia</b>	
<b>Belgium</b>	<p>ICT – Flemish Department of Education and Training</p> <ul style="list-style-type: none"> <li>• ICT: <a href="https://onderwijs.vlaanderen.be/nl/directies-en-administraties/organisatie-en-beheer/ict">https://onderwijs.vlaanderen.be/nl/directies-en-administraties/organisatie-en-beheer/ict</a></li> <li>• ICT in the classroom: <a href="https://onderwijs.vlaanderen.be/index.php/nl/onderwijspersoneel/van-basis-tot-volwassenenonderwijs/lespraktijk/ict-in-de-klas">https://onderwijs.vlaanderen.be/index.php/nl/onderwijspersoneel/van-basis-tot-volwassenenonderwijs/lespraktijk/ict-in-de-klas</a></li> <li>• European project: digital transformation in Flemish education: <a href="https://onderwijs.vlaanderen.be/index.php/nl/europees-project-digitale-transformatie-in-het-vlaamse-onderwijs">https://onderwijs.vlaanderen.be/index.php/nl/europees-project-digitale-transformatie-in-het-vlaamse-onderwijs</a></li> <li>• Digisprong: from lag to lead. ICT plan for a qualitative digital education (Vision paper) <a href="https://www.vlaanderen.be/publicaties/digisprong-van-achterstand-naar-voorsprong-ict-plan-voor-een-kwalitatief-digitaal-onderwijs-visienota">https://www.vlaanderen.be/publicaties/digisprong-van-achterstand-naar-voorsprong-ict-plan-voor-een-kwalitatief-digitaal-onderwijs-visienota</a></li> </ul> <p>ICT in daycare - Child&amp;Family</p> <ul style="list-style-type: none"> <li>• <a href="https://www.kindengezin.be/nl/thema/spelen-en-bewegen/digitale-kinderwereld">https://www.kindengezin.be/nl/thema/spelen-en-bewegen/digitale-kinderwereld</a></li> </ul>
<b>Cyprus</b>	<p>ICT – Ministry of Education, Culture, Youth and Sports and Cyprus Pedagogical Institute</p> <ul style="list-style-type: none"> <li>• ICT Unit: <a href="http://www.moec.gov.cy/monada_tpe/">http://www.moec.gov.cy/monada_tpe/</a></li> <li>• Educational Portal: <a href="http://www.schools.ac.cy/">http://www.schools.ac.cy/</a></li> <li>• E-learning: <a href="https://elearning.schools.ac.cy/index.php/el/">https://elearning.schools.ac.cy/index.php/el/</a></li> <li>• Digital Education Policy – Launch: <a href="http://www.moec.gov.cy/psifiaki_ekpaidefsi.html">http://www.moec.gov.cy/psifiaki_ekpaidefsi.html</a></li> <li>• Cyprus Pedagogical Institute – Educational Technology Sector: <a href="https://www.pi.ac.cy/pi/index.php?option=com_content&amp;view=article&amp;id=58&amp;Itemid=79&amp;lang=el">https://www.pi.ac.cy/pi/index.php?option=com_content&amp;view=article&amp;id=58&amp;Itemid=79&amp;lang=el</a></li> </ul>
<b>North-Macedonia:</b>	<ul style="list-style-type: none"> <li>• The official web site of the Ministry of Education and science: <a href="https://mon.gov.mk/en/">https://mon.gov.mk/en/</a></li> <li>• The Bureau for Development of Education: <a href="https://www.bro.gov.mk/">https://www.bro.gov.mk/</a></li> <li>• The national platform for E-textbooks: <a href="https://www.e-ucebnici.mon.gov.mk/">https://www.e-ucebnici.mon.gov.mk/</a></li> <li>• The national platform for e-learning: <a href="https://schools.mk/">https://schools.mk/</a></li> <li>• An interactive platform Eduino: <a href="https://www.eduino.mk/">https://www.eduino.mk/</a></li> </ul>
<b>Italy:</b>	<ul style="list-style-type: none"> <li>• ICT National Network of AT Centres: <a href="https://www.centriausili.it/">https://www.centriausili.it/</a></li> <li>• Education: <a href="https://www.miur.gov.it/acquistare-ausili-per-la-didattica-inclusiva">https://www.miur.gov.it/acquistare-ausili-per-la-didattica-inclusiva</a></li> <li>• Institute for Educational Technology (CNR-ITD): <a href="https://www.itd.cnr.it/en/">https://www.itd.cnr.it/en/</a></li> <li>• National Institute for Documentation, Innovation and Educational Research: <a href="https://www.indire.it/en/">https://www.indire.it/en/</a></li> </ul>

**ANNEX 9: Resources on ICT-AT service delivery system in the four project partner countries**

<b>Information websites ICT-AT service delivery system in Belgium, Cyprus, Italy and North Macedonia</b>	
<b>Belgium</b>	<p>In Flanders, information on the ICT-AT service delivery system (and reimbursement) can be found at two Flemish agencies/departments.</p> <p>Flemish agency for people with disabilities</p> <ul style="list-style-type: none"> <li>– Aids and adaptations: <ul style="list-style-type: none"> <li>○ <a href="https://www.vaph.be/hulpmiddelen/algemeen">https://www.vaph.be/hulpmiddelen/algemeen</a></li> <li>○ <a href="https://publicaties.vlaanderen.be/view-file/49093">https://publicaties.vlaanderen.be/view-file/49093</a></li> </ul> </li> </ul> <p>Flemish Department of Education and Training</p> <ul style="list-style-type: none"> <li>– Special educational tools: <ul style="list-style-type: none"> <li>○ <a href="https://www.onderwijs.vlaanderen.be/SOL">https://www.onderwijs.vlaanderen.be/SOL</a></li> </ul> </li> </ul>
<b>Cyprus</b>	<p>In Cyprus there is no official established system or policy.</p> <p>Ministry of Education, Culture, Youth and Sports provides (ICT)-AT assessment and products for children in the public education system through the Special Education Provisions: <a href="http://www.moec.gov.cy/eidiki_ekpaidefsi/index.html">http://www.moec.gov.cy/eidiki_ekpaidefsi/index.html</a></p> <p>Department for Social Inclusion of Persons with Disabilities: Technical Means Provision Scheme: <a href="http://www.mlsi.gov.cy/mlsi/dsid/dsid.nsf/dsipd19_gr/dsipd19_gr?Openform">http://www.mlsi.gov.cy/mlsi/dsid/dsid.nsf/dsipd19_gr/dsipd19_gr?Openform</a></p>
<b>North-Macedonia:</b>	<p>There is no formal ICT&amp;AT delivery system in North Macedonia. ICT devices could be purchased from the regular IT retailers. Regarding AT, according to the Law for primary education, the schools should provide AT to those students that need it. Usually all AT devices are imported and shared as donations or purchased by the individuals. Since recently some assistive technology devices are available for purchase from: <a href="https://assistive.mk/">https://assistive.mk/</a></p>
<b>Italy:</b>	<p>AT solutions are provided through public funding.</p> <p>Provision is generally organized at regional level and delivered primarily by centres for technical aid and/or local centres for educational support (<i>Centri territoriali di supporto</i>), where a team of experts, usually in collaboration with professionals from the Local Health Authority (Azienda Sanitaria Locale – ASL), conducts an assessment to match the student with a disability with the most appropriate AT solution</p> <p>Ministry of Education: Teaching tools and aids for children with disabilities: <a href="https://ausilididattici.indire.it/">https://ausilididattici.indire.it/</a></p>

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## 7. List of Abbreviations

AAATE: Association for the Advancement of Assistive Technology in Europe

AT: Assistive Technology

ATLEC: Assistive Technology Learning Through A Unified Curriculum (Project)

DPF: Digital play framework

ECCE: Early childhood care and education

ECEC: for Early Childhood Education and Care

ENTELIS+: Entelis+, Accessibility skills for a technology enhanced learning in an inclusive society (Project)

EU: European Union

ICT: Information and Communication Technology

IO: Intellectual Output

IoToys: Internet of Toys

KPT: Keeping Pace with Assistive Technology (Project)

LTTA: Learning Teaching Training Activity

MOECYS: Ministry of Education, Culture, Youth and Sports (Cyprus)

OECD: Organisation for Economic Co-operation and Development

SpEd: Special Educator/Special Education

TEL: Technology-Enhanced Learning

TM: Thomas More

UDL: Universal Design for Learning

UNCRPD: United Nations Convention on the Rights of Persons with Disabilities

WHO: World Health Organisation

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