Deliverable Report

Extending Design Thinking with Emerging Digital Technologies

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(Integration of emerging new technologies into education and training)

Deliverable 2.3

Guidelines for Mass Deployment [V1]

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1 Abbreviations

Abbreviation	Definition
DT	Design Thinking
ET	Emerging Technologies
LA	Learning Analytics
TPD	Teacher Professional Development
VPN	Virtual Private Network

2 Summary

This deliverable reports on the first version of the Mass Deployment Guidelines for the first version of Exten.(D.T.)^2 Framework [V1] (Deliverable 2.2.). These Guidelines were created as a result of the Exten.(D.T.)^2 project research so far, using information from previous project deliverables and literature. The focus of the Guidelines [V1] is primarily on teachers but also on other stakeholders who may be interested in incorporating Design Thinking (DT) and Emerging Technologies (ET) into their practices. It is important to note that the current version of the Guidelines serves as a starting point with aspects to consider and will be revisited to reflect the findings from the project's work in the upcoming years. The following Guidelines are organised according to three core elements, as they are defined in the Framework [V1]: Components, Perspectives, and Competencies.

The Guidelines for mass deployment are made available as a section of the project's website. This report complements the content of the project's website and in the Annex includes figures from it.

3 Introduction

3.1 Objectives of this Deliverable

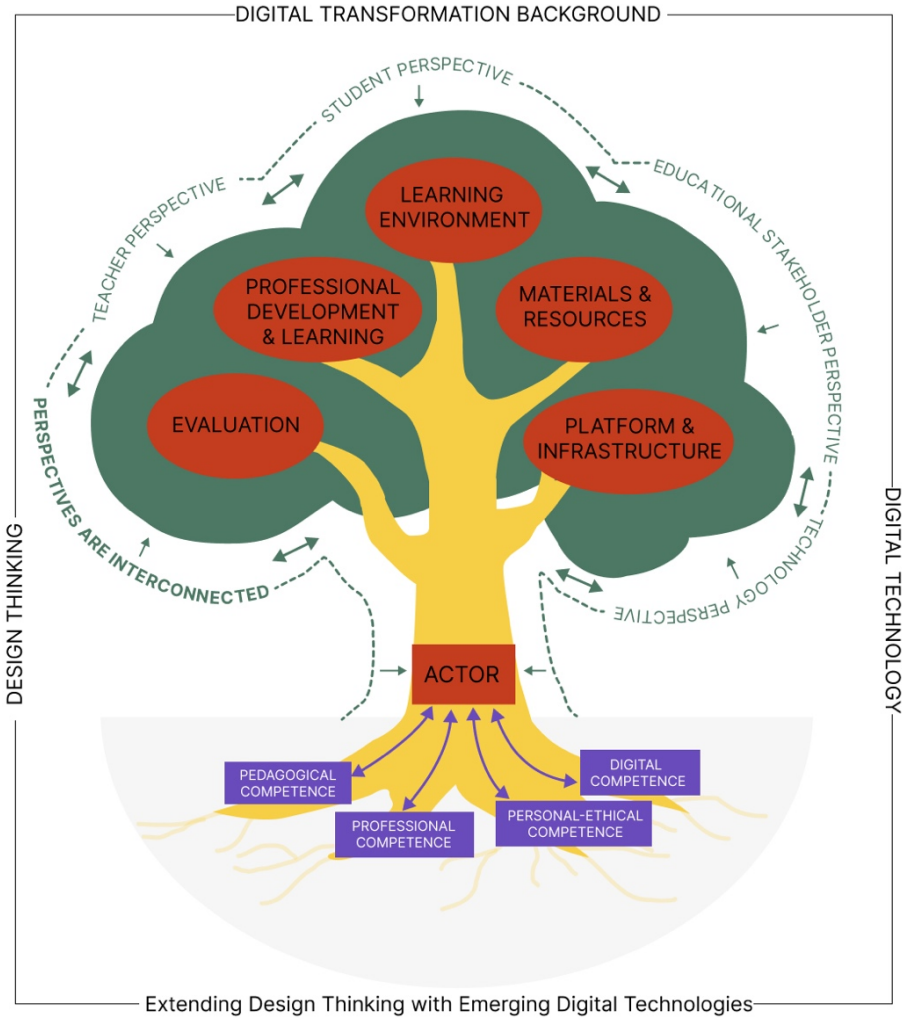
This deliverable reports on the first draft of a set of Guidelines for supporting the massive and inclusive deployment of the Exten.(D.T.)^2 Framework [V1] (Deliverable 2.2).

The Guidelines aim to provide instructions for adapting the content of the Exten.(D.T.)^2 Framework for online and blended learning to preserve its resilience to possible crises. In addition, they provide guidance for reassuring the equal and ethical inclusion of all students in the proposed activities, technologies and tools concerning ethics, data handling, and gender equality (e.g., team formation and student collaboration).

3.2 The Exten.(D.T.)^2 Framework [V1] and the Guidelines [V1]

The Exten.(D.T.)^2 Framework aims to reflect the ongoing digital transformation in education and the opportunities emerging in education with the advancement of digital resources, media and technologies. The primary purpose of the Exten.(D.T.)^2 Framework is:

- to allow involved stakeholders to identify specific elements (e.g., components, perspectives and competencies) essential for supporting DT Learning with ET.
- to facilitate the implementation of DT activities, the adoption of ET, and the integration of DT with ET for students of all genders and in different (online and blended) learning contexts.



The Exten(D.T.)² Framework [V1]

The Figure above visualises the constructs and the interconnectedness of the elements presented in the Exten.(D.T.)² Framework [V1]. For example, one of the core elements is the components shown in the red bubbles and block. Another element is the perspectives presented in the green text, lines and arrows. The last core element concerns the competencies, shown in the purple boxes with arrows. Components, perspectives, and competencies in the Exten.(D.T.)² Framework [V1] are all interconnected and may also have overlapping aspects. For example, this means that perspectives can help with the implementation of all components, and competencies refer to both the actors' ability to take action on other components (such as evaluation, professional development and learning, learning environment, etc.) and at the same time can be enhanced by the implementation of actions related to components and perspectives. The competencies throughout the process will also be enhanced and will be beneficial for the subsequent cycles of employment.

At this stage, the Exten.(D.T.)² Framework [V1] is designed to mainly focus on teachers and be useful to other stakeholders of DT learning who may be interested in incorporating ET into their practices. Anyone who is interested in employing the Framework in their practices can consider these elements (i.e., components, perspectives and competencies). This deliverable gives some Guidelines on how each of these elements should be approached for implementing the Framework. It has been formed at this early stage from the first months of research in the Exten.(D.T.)² project.

3.3 Objectives of the Guidelines [V1]

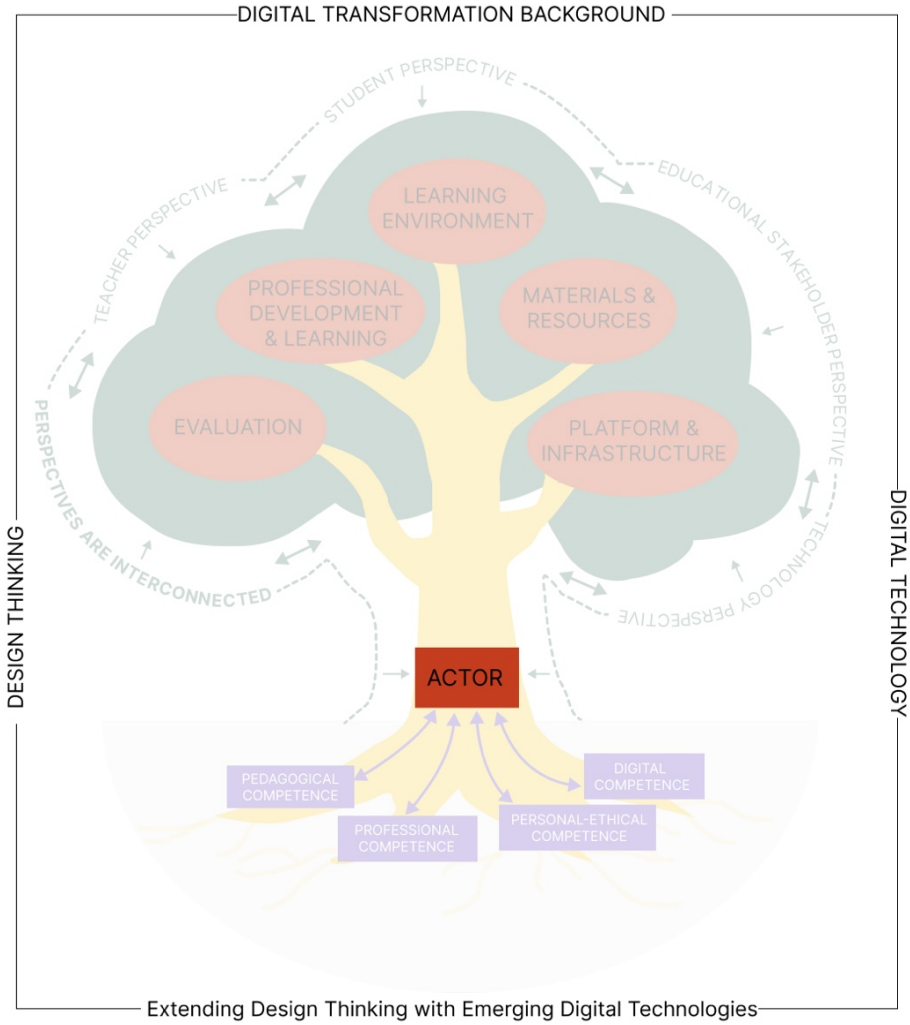
These Guidelines have been developed within the Exten.(D.T.)² project. The focus of the Guidelines [V1] is on teachers and other stakeholders who may be interested in incorporating DT and ET into their practices (**Objective 2.3** of Exten.(D.T.)² project). This deliverable presents a set of Guidelines as suggestions and aspects to consider based on insights from the literature, including relevant frameworks, reports, and guidelines.

Within the context of the Exten.(D.T.)² project, these Guidelines also reflect on the future actions relevant to the project, e.g., the digital technologies and platform that will be created and used (see section 4.4). It is important to note that the current version of the Guidelines serves as a starting point for teachers and other stakeholders to consider and will be revisited to reflect the findings from the project's work in the upcoming years.

In addition, the Framework contains some general aspects, such as perspectives and competencies, which are outlined in generic guidelines that offer actionable steps to approach them. The following Guidelines are organised according to three core elements, as they are defined in the Framework [V1]: Components, Perspectives, and Competencies (see Annex on how they are depicted on the project's website).

4 Guidelines on Components

4.1 ACTOR



4.1.1 What is *Actor*?

Actors are the end-users and stakeholders involved in the learning and teaching processes. This refers to any individual that plays a role or has an active involvement in DT activities with ET.

4.1.2 Guidelines for the *Actor* Component

☐ **Consider the actors who are relevant in your context**

- Start by thinking of the context.

Examples: The contexts that shape the teaching and learning experiences could, for instance, include the classroom context, blended learning context, and online learning context.

- Think of individuals who will be involved in the DT activities with ET.
- Keep in mind the role of the different actors that are important for the implementation of DT with ET, including their possible needs and expectations and relate those to the planning.
- Articulate the meaningful role each involved actor shall play in the process of using DT with ET.

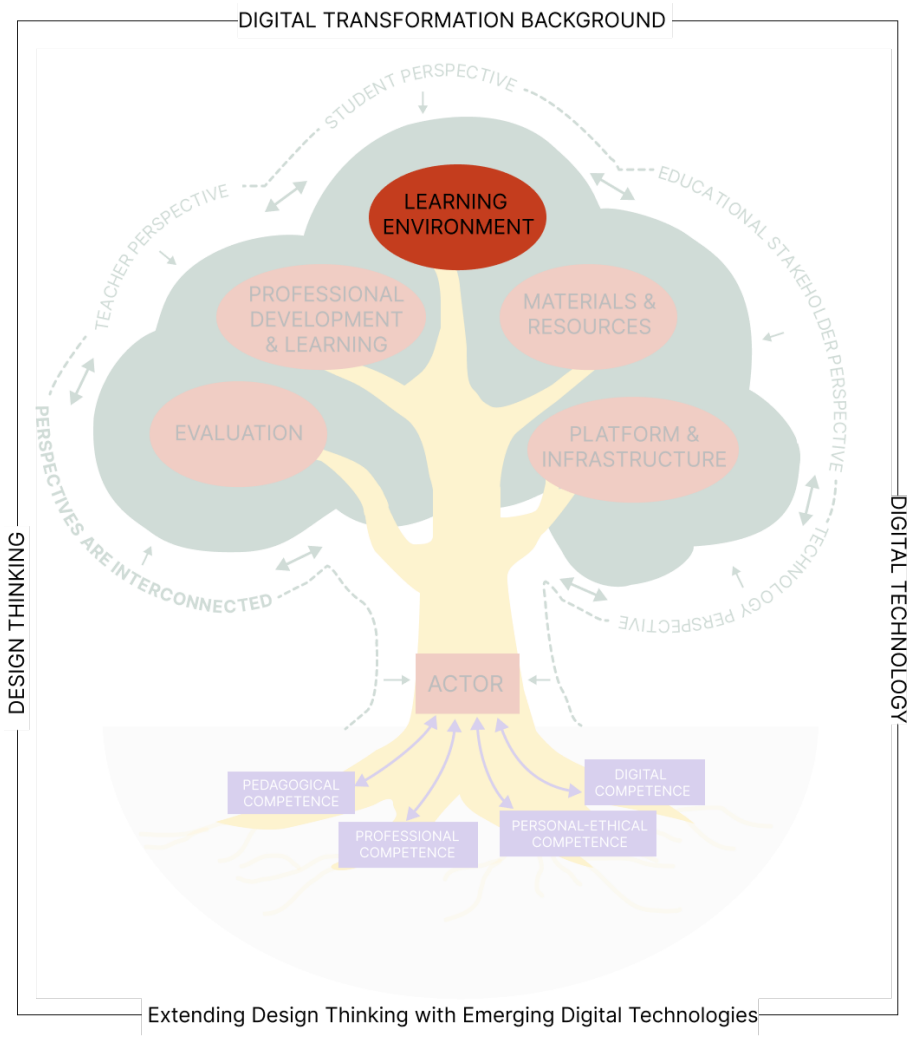
Examples: The actors may be students, teachers, and other educational stakeholders, e.g., principals, policymakers, school networks, technology and education scientists, learning designers and facilitators.

☐ **Involve the actors who are relevant in your context to your DT with ET activities**

- Relate the activities to specific actors' roles and needs.
- Provide actors with the data and information they need to be productive partners.
- Communicate and coordinate with actors who should take part in the initial decisions or any other possible formalities that require permission.
- Cultivate and establish common values and vision through regular partnership activities.

Examples: Relate the activities to specific students' needs e.g., disabilities or gender equality. Consider whether the school principal should participate in the initial decisions or any other possible formalities requiring permission. Allocate resources or apply for funding and who should be reached for that. Coordinate with other teachers in the same school or relevant school networks and organisations and/or get inspired and organise joined activities.

4.2 LEARNING ENVIRONMENT



4.2.1 What is *Learning Environment*?

Learning environment refers to the (physical or virtual) place and context where learning and teaching may occur. The context can vary widely, including traditional classrooms, online learning, or workshops.

4.2.2 Guidelines for the *Learning Environment* Component

☐ **Take into account different situations such as online, blended or face-to-face classroom learning**

☐ **Think about the context where teaching and learning may occur**

Consider:

- The curricular requirements and the relation to the subjects.

- The amount of time devoted to the activity, the available time for instruction and the sufficient teaching time required for good learning outcomes.
- The disciplinary climate or any related actions that can improve context during the delivery of DT with ET activities.
- The class size and what is the optimal setup for the collaborative learning experience for the students.

Examples: Consider how to assign students in groups or pairs and keep in mind if the class size allows collaborative learning for students. Manage the classroom in a way (e.g., monitoring class time, conflict resolution, and fostering teamwork) that is conducive to learning.

☐ **Make sure physical and virtual learning environments are accessible**

Examples: Support of accessibility on the web for students with disabilities.

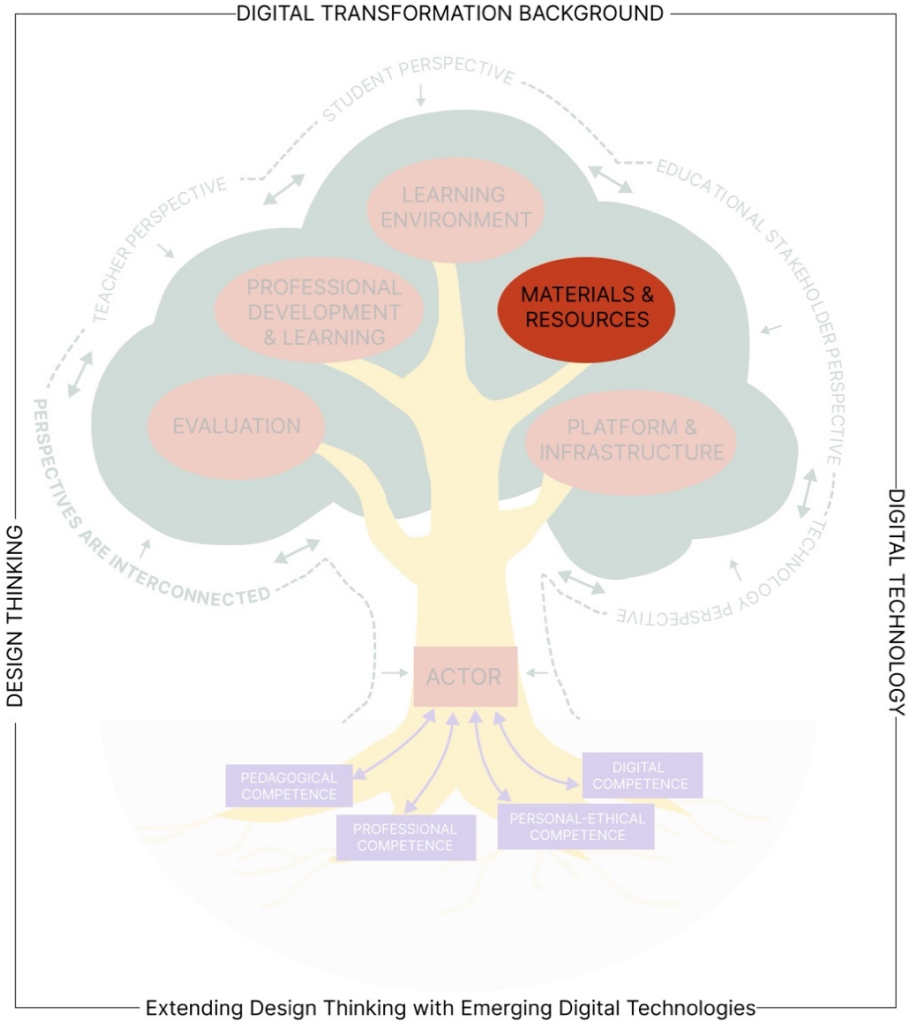
☐ **Keep in mind the decisions on the multimedia that will be used in learning to ensure adaptability to the different situations and contexts**

Examples: Provide multimedia content in multiple formats (e.g., digital using web-based platforms) and ensure they can adapt to and are compatible with different devices (e.g., desktop computers, laptops, tablets and smartphones) across different operating systems.

☐ **Facilitate the usage of technological standards (for the digital tools that will be used) of interoperability and compatibility to enable integration into various situations and contexts.**

Example: Include clear instructions and documentation on how to integrate the digital tools in different settings such as online or blended learning environments. Collaborate with educational technology providers to ensure the digital tools align with their interoperability standards. Consider using an all-in-one platform that facilitates the seamless integration of digital tools into various virtual learning environments.

4.3 MATERIALS AND RESOURCES



4.3.1 What are *Materials & Resources*?

Materials and resources refer to a wide range of resources (e.g., financial, physical, human, and other educational resources) and various forms and formats of materials (e.g., physical or digital lesson plans and activity plans) that are needed or related to support teaching and learning.

4.3.2 Guidelines for *Materials & Resources* Component

☐ **Think about materials and resources that are needed and are related to teaching and learning in your context**

- Consider financial resources, such as public funding of individual schools.
- Take into account human resources, such as teachers, school leaders and other administrators.
- Be aware of physical resources, such as location, buildings and equipment.

- Keep in mind any other relevant resources, such as time availability, pedagogy, curriculum materials, and lesson and activity plans.
- Consider online supporting materials for students that leverage technologies and resources and support classroom implementations, e.g., video tutorials, brief and extensive manuals, and guidelines for the technologies and educational resources.
- Consider teacher training materials, e.g., tutorials, presentations, exercises, templates/lesson plans, examples of use, and videos.

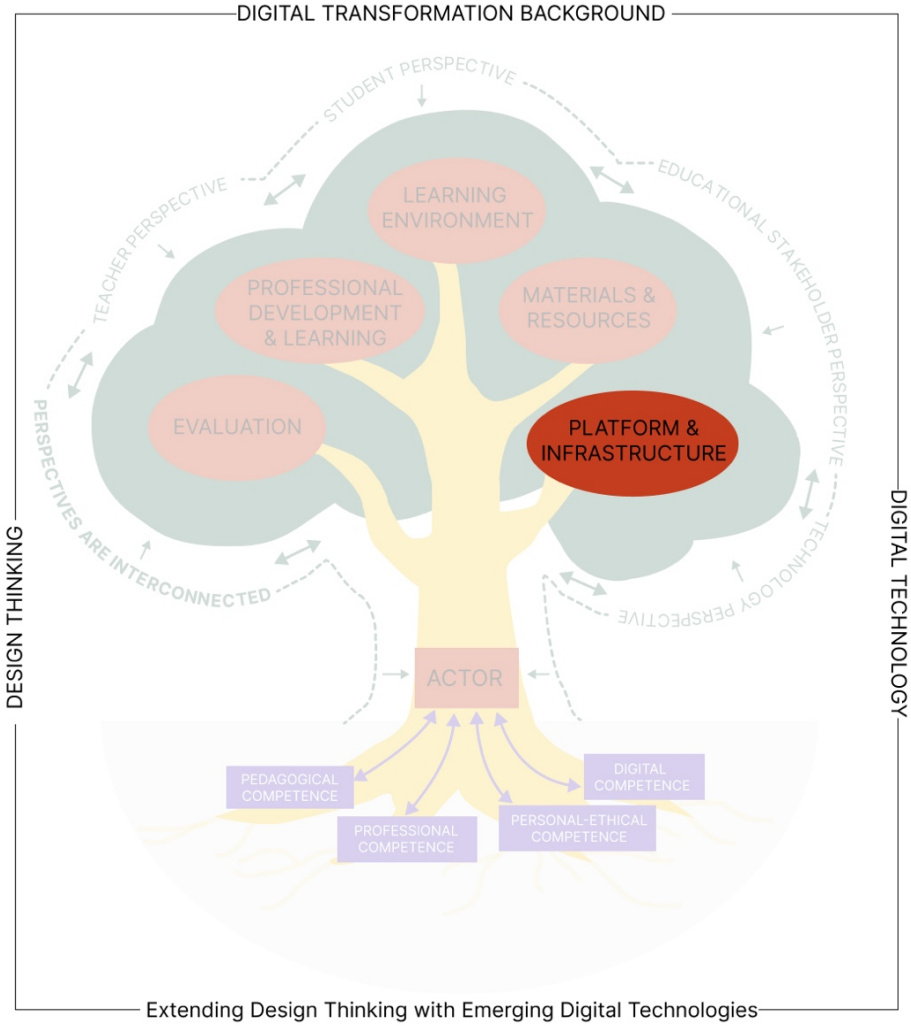
Examples: These can include any spoken, written or visual text or activity used or conducted in learning and teaching, such as textbooks, novels, films, plays, interactive simulations, educational websites, multimedia presentations, and digital learning resources, including video, audio, text, animations, images, lectures, speeches, and performances

☐ **Select and prepare suitable teaching and learning materials & resources**

- Recognise that the pursuit of efficiency and equity can go hand in hand when it comes to the allocation of materials and resources.
- Consider the words, behaviour, images or themes of the materials and resources.
- Check and ensure the teaching/learning materials and resources about religious and cultural beliefs and practices are handled with sensitivity.
- Ensure the teaching/learning materials and resources are appropriate to the age group of students.
- Check the reference to the curricula and align them with educational objectives.
- Consider using DT Activity Plan Template[1] for organising and implementing a DT activity in the classroom with ET.
- Consider using the Co-creation Planet Platform[2] to guide teachers through the different phases of developing a digital-based DT intervention using the DT methodology.
- Advise the resources available on the Exten.(D.T.)[2] website[3] about the use of specific technologies for supporting DT activities.

[1] See the Activity Plan Template: https://extendt2.files.wordpress.com/2023/03/extendt2_deliverable-5.1-report-on-the-activity-plans-for-school-interventions_final.pdf
[2] This is originally created to coach university students during a DT process. http://cocreationplanet.eu/
[3] https://extendt2.eu/

4.4 PLATFORM AND INFRASTRUCTURE



4.4.1 What is *Platform & Infrastructure*?

Platform and infrastructure include feature-rich platforms, technology-empowered infrastructure, educational tools and technologies, and repositories that are essential in enabling efficient interactions and operations and maintaining digital ecosystems. A platform can provide a software system or environment for applications and services, while infrastructure encompasses the physical and virtual parts supporting the functioning of systems.

4.4.2 Guidelines for *Platform & Infrastructure* Component

☐ **Consider integrating digital media as tools for modelling, co-construction and rapid prototyping throughout the DT process**

- Consider using educational robotics to enable the development and testing of realistic prototypes in virtual spaces.

- Consider using MaLT2[4] (MachineLab Turtleworlds2) to create and tinkle 3D dynamic graphical models during rapid prototyping.
- Consider using SorBET[5] (Sorting Based on Educational Technology) for playful learning through classification games.
- Consider using ChoiCo[6] for embedding choice-driven simulation games related to various real-life problems.
- Consider using nQuire[7] for conducting surveys and understanding the needs of the target group for which they are designing a solution and also collecting feedback for game prototypes.
- Consider using a Learning Analytics (LA) dashboard that allows flexible and customisable data presentation of DT learning activities and students' performance outcomes with explanatory visualisation support.

Examples: In the case of the usage of authorable LA, teachers can define which data should be captured from online learning tools and what should be presented on a dashboard. Also, consider ethical aspects in this stage and check if needed to get approval from students and parents.

☐ Use a secure technical infrastructure and platform

- Ensure the collected data are stored in cloud infrastructure with a private school network and preferably a Virtual Private Network (VPN).
  Examples: In the case of online learning, consider letting students be connected through VPN to the platform to ensure the security of the platform.
- Use a platform hosting an ecosystem of diverse web-based learning environments that will enable the seamless and interactive execution of digital DT activities.
- Use a learning platform that provides all the necessary infrastructure to facilitate seamless integration and interoperability of existing and new parts.

[4] MaLT2 is an open-source online tool of symbolic expression in mathematical activity by means of programming; http://etl.ppp.uoa.gr/malt2/

[5] SorBET is a Tetris-like sorting games in which the player sorts elements into the right category; students can create their own sorting games http://etl.ppp.uoa.gr/sorbet/

6 ChoiCo is an open-source, online authoring tool that provides an opportunity to play, design and modify choice-driven simulation games related to complex real-life issues; http://etl.ppp.uoa.gr/choico/

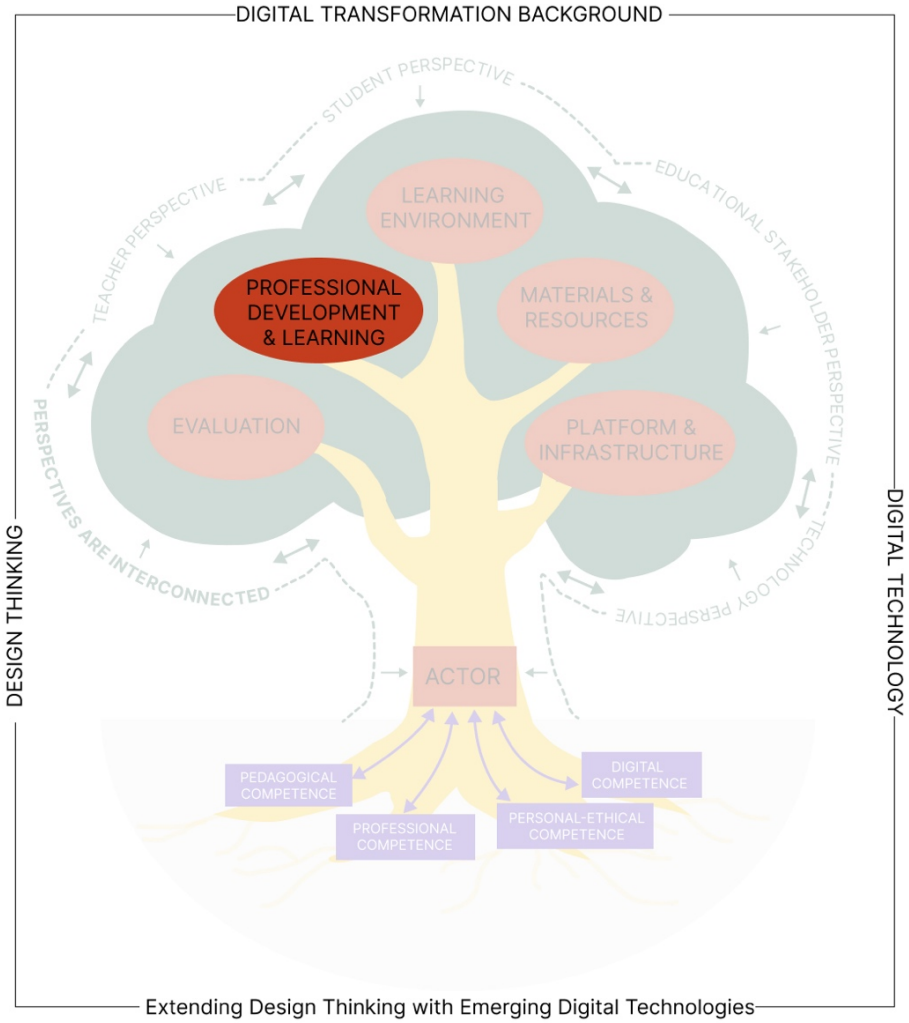
[7] nQuire is a web-based community and citizen science platform designed and maintained by the Open University UK, a version of which (nQuire for students) has been created for students use; https://nquire.org.uk/

- Use a platform that has the ability to intercept and log user interactions, allow processing, analysis, and visualisation of data, and enhance learning activities with automated support.
- Use online authoring systems that support non-technical users like students to develop and share their digital products, providing a tangible and accessible means to structure the DT process and deal with its ambiguity issues.

☐ Assign a dedicated person to manage and monitor the platform

Examples: Consider some actors like school technicians or IT administrators to manage the platform, monitor the security of data storage, and make sure that the platform is always available for physical and online learning.

4.5 PROFESSIONAL DEVELOPMENT AND LEARNING



4.5.1 What is *Professional Development & Learning*?

Professional development and learning refers to how teachers (or other relevant educational stakeholders) are being prepared for the instruction regarding the learning tasks, pedagogical objectives and experience, implementation and guidance.

4.5.2 Guidelines for *Professional Development & Learning* Component

☐ **Think about and pay attention to the professional development of teachers**

- Enable Teacher Professional Development (TPD) by offering step-by-step training.
- Use DT as a framework to educate teachers and reframe their engagement with curriculum planning.
- Use technological pedagogical content knowledge (TPACK) as a framework[8] to prepare teachers with related knowledge to integrate DT with ET.
- Prepare exemplary lesson material for teachers during TPD.
- Point teachers to project supporting materials related to the use of ET available on the Exten.(D.T.)^2 project website[9].
- Identify the level of readiness of individual teachers in terms of technology and understanding of DT and point them to the right set of training resources.

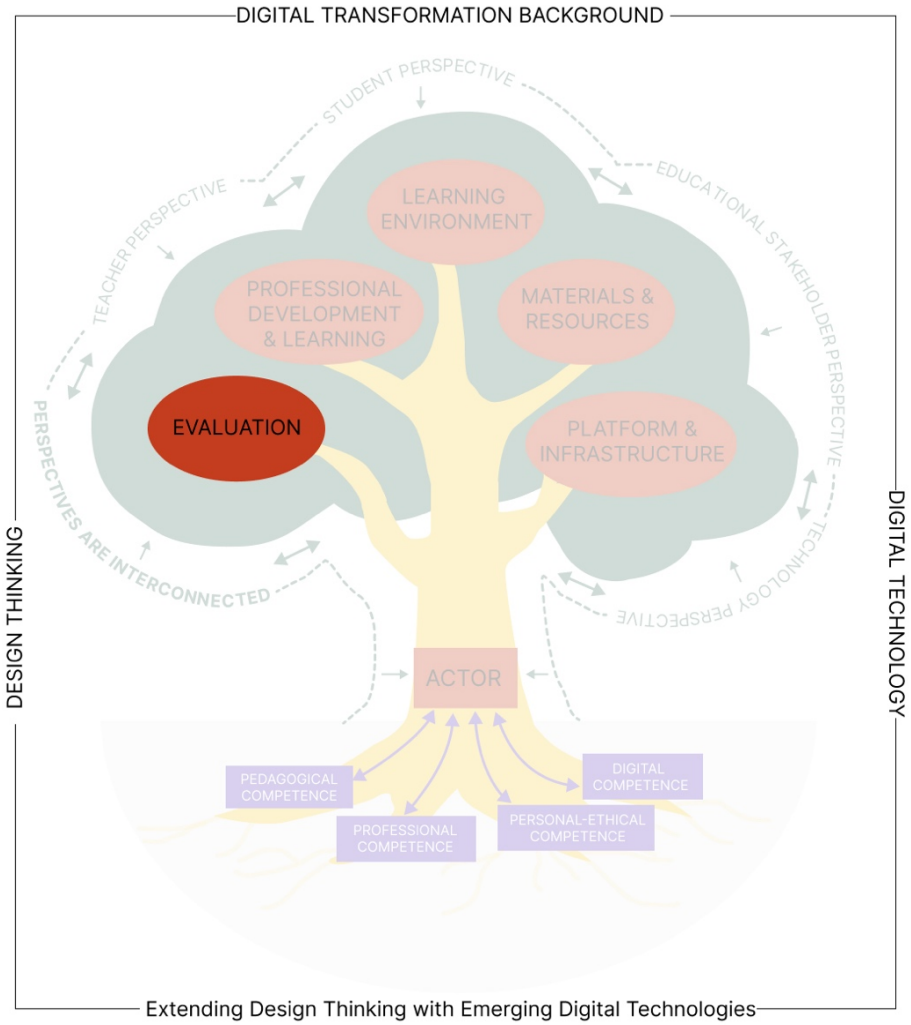
☐ **Pay attention to teachers teaching practices**

- Build consensus on curricular goals and values.
- Identify the learning goals, and plan the activities to allow pauses and time for reflection and creativity.
- Coach students and instruct them on the learning tasks, pedagogical objectives and experience.
- Communicate the learning goals to the students in the beginning, including what DT is and what the stages of it are.
- Identify the teaching methods best suited to the material and the students.
- Provide meaningful and timely feedback to students to improve learning.
- Create reflection sessions that allow students to participate, find new, creative ways of learning, and get excited about learning.
- Focus on skill development and self-reflection through the online sharing of digital productions and the collection of feedback.
- Focus on group formation and dynamics before the activity.

[8] **https://educationaltechnology.net/technological-pedagogical-content-knowledge-tpack-framework/**
[9] **https://extendt2.eu/**

- Monitor and evaluate group progress by analysing students' digital constructions using ET as the output of the DT process.
- Identify key 21st-century skills that may emerge from the activity, including collaboration, argumentation, taking individual responsibility in groups, creativity and innovation, coding/programming, and interactions.

4.6 EVALUATION



4.6.1 What is *Evaluation*?

Evaluation refers to assessing DT learning with ET from multiple sources and diverse angles, such as regarding the students' outcome (e.g., learning, skills and attitudes), the effectiveness of TPD in integrating DT with ET, the role of the platforms and infrastructure and other aspects that each stakeholder may think are relevant of evaluation in their context.

4.6.2 Guidelines for *Evaluation* Component

☐ **Think about the evaluation in your context in terms of measures to evaluate students, teachers, and the use of ET in DT activities**

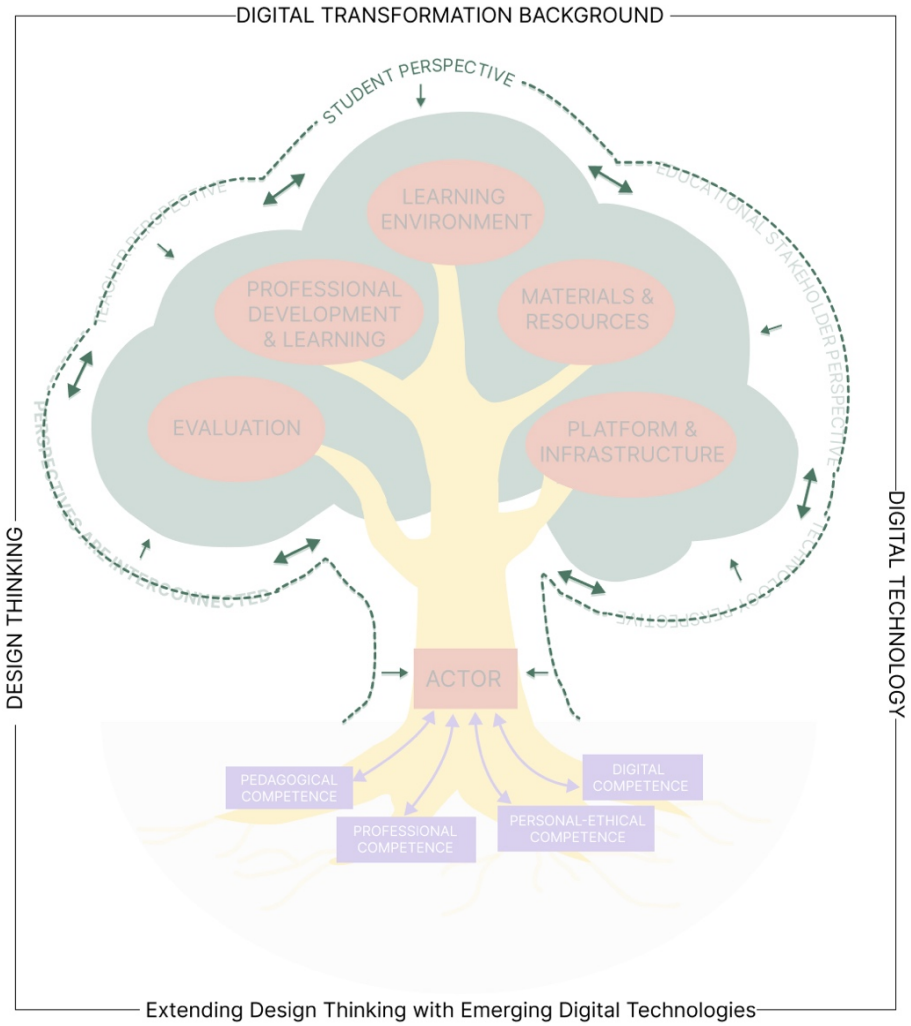
- Check and align the assessment with the learning goals.
  Examples: check students' learning goals (and refer to rubrics), reflection, portfolio and documentation of learning activities and digital artefacts to get inspiration for assessment (the same applies for the teacher's aspect, for example, for the evaluation of their PD and the delivery of the teaching practices)
- Evaluate the usability of the tools and the impacts on learning outcomes.
- Evaluate students' DT knowledge, skills and attitudes that are stimulated and enabled with the use of ET during DT.
- Consider the gendered, cultural, geographical and societal effects regarding the use of ET in DT activities as aspects of evaluation.

☐ **Collect data from multiple sources relevant to the evaluation in your context**

- Collect data from learning outcomes, surveys and interviews, LA to systematically evaluate how students' DT knowledge, 21st-century skills and attitudes are stimulated and enabled with the use of ET during DT.
- Evaluate the quality of pre-service and in-service teachers' professional development outcomes based on interviews, focus groups, or other means.
  Examples: Consider offering students insight into their learning via the LA dashboard, enabling them to self-evaluate.

5 Guidelines on Perspectives

5.1 STUDENTS



5.1.1 What is the *Student's Perspective*?

The student perspective refers to a student-centred way of looking at or approaching DT activities with ET.

5.1.2 Guidelines for the *Student's Perspective*

☐ **Promote gender equality in the classroom and ensure that boys and girls alike are treated fairly when using technology so everyone can benefit from it**

☐ **Actively and intentionally confront and dispel stereotypes and biases about the abilities and skills of students**

☐ **Honour and respect the diverse ways students process and learn information, striving to be mindful and inclusive in their engagement**

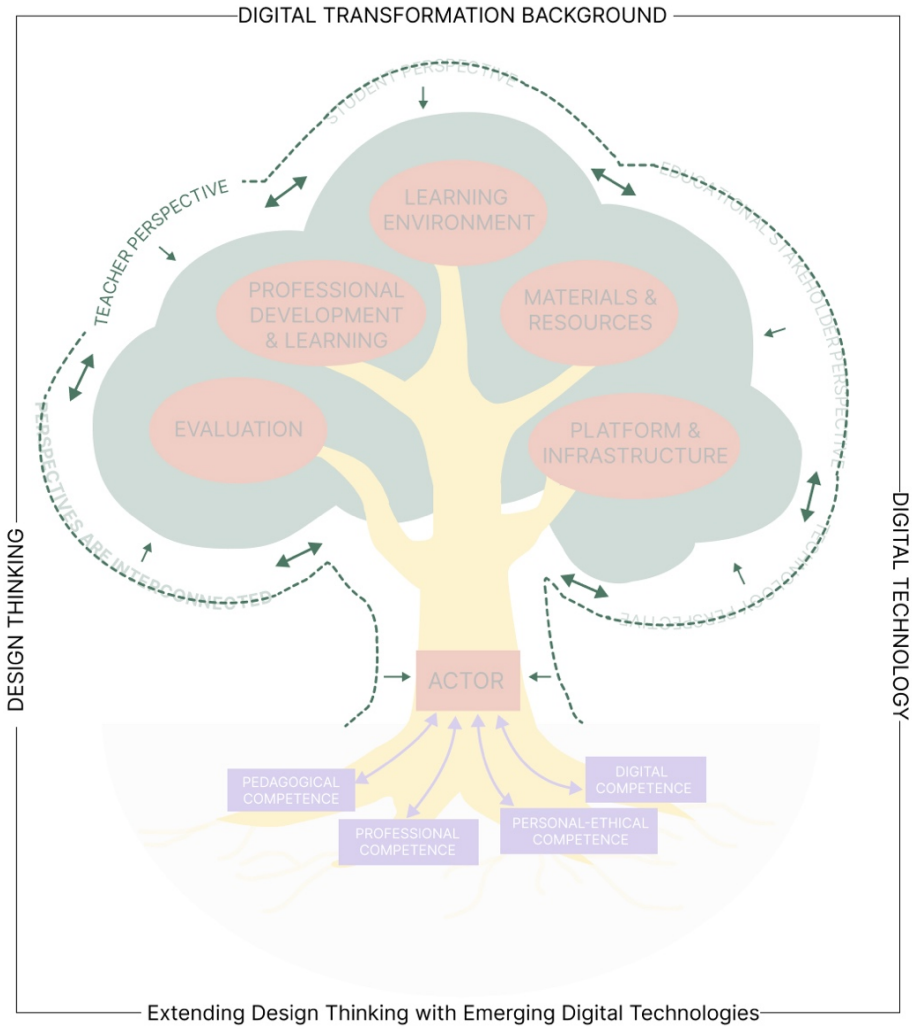
☐ **Remember that students with disabilities should have equal access to all aspects of the learning process**

☐ **Foster resilience and persistence in students when facing failures and frustrations**

☐ **Make educational materials, resources, and learning accessible for different languages and cultures**

☐ **Incorporate student voices and perspectives throughout the curriculum and classroom experience**

5.2 TEACHERS



5.2.1 What is the *Teacher's Perspective*?

The teacher perspective refers to a teacher-centred way of approaching DT activities with ET.

5.2.2 Guidelines for the *Teacher's Perspective*

☐ **Be open to quickly changing roles (e.g., teachers, facilitators, supporters, and peers)**

Examples: Teachers play a different role in DT than one expects in traditional learning contexts. For example, teachers often act as a facilitator organising the learning activities, providing instruction on the DT process and learning tasks, and providing feedback and evaluation to students. The dynamic roles and responsibilities teachers experienced in DT also created challenges for them to manage and switch balance frequently depending on the context.

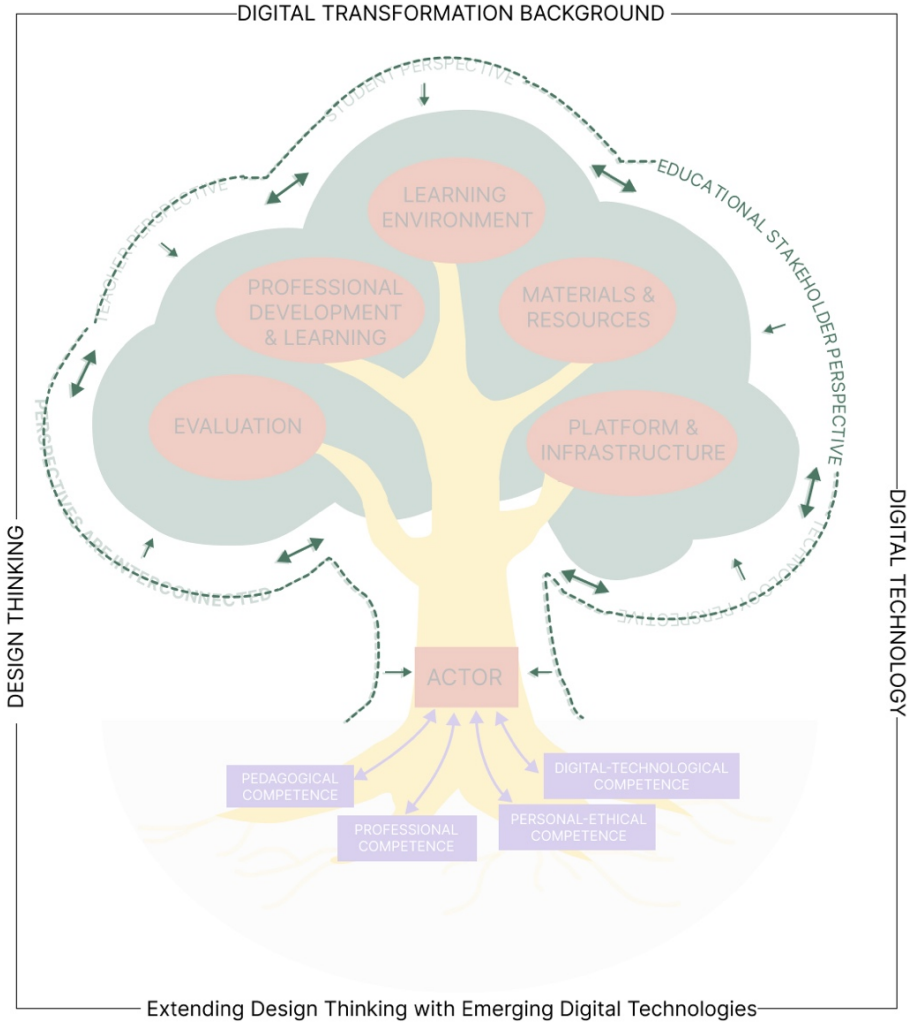
☐ **Develop teachers' mindsets entailing openness, curiosity, responsiveness, and willingness to use technology and materials**

☐ **Refer to the Universal Design for Learning (UDL) Framework[10] to offer flexible and inclusive approaches that can be customised and adjusted to fit each student**

☐ **Refer to the Equality, Diversity, and Inclusivity (EDI) Framework[11] to sustain an inclusive education for students**

[10] https://udlguidelines.cast.org/
[11] https://www.apa.org/about/apa/equity-diversity-inclusion/framework#:~:text=The%20EDI%20framework%20is%20an,coordinated%20strategy%20towards%20dismantling%20racism.

5.3 EDUCATIONAL STAKEHOLDERS



5.3.1 What is the *Educational Stakeholder's Perspective*?

The educational stakeholder perspective refers to a stakeholder or community-centred way of approaching DT activities with ET.

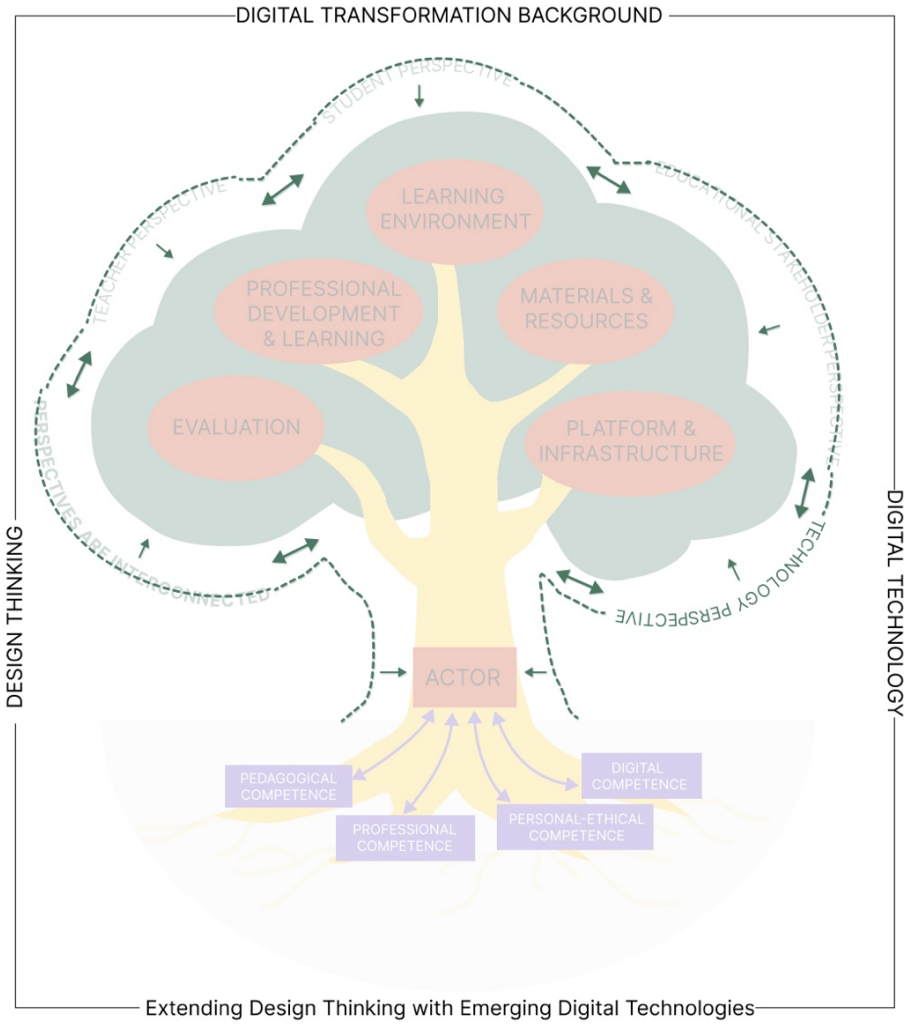
5.3.2 Guidelines for the *Educational Stakeholder's Perspective*

☐ **Be open to collaboration opportunities with other educational stakeholders**

☐ **Build a stakeholder community between teachers and other educational stakeholders**

☐ **Ensure knowledge transferability and best practices in different institutions and sectors (e.g., schools, universities)**

5.4 TECHNOLOGY



5.4.1 What is the *Technology Perspective*?

The technology perspective refers to views on how technology supports DT with ET, including how data will be collected and analysed from especially students and how this will impact people and society.

5.4.2 Guidelines for the *Technology Perspective*

☐ **Provide students with flexibility in modalities and playfulness in technologies and tools used in DT learning activities**

☐ **Respect the rights of the users of technologies and ensure they receive clear, straightforward information about the technology's and system's nature and capabilities**

☐ **Legitimise data collection and ensure consent is genuinely informed and freely given; data is truly anonymised**

☐ **Guarantee individual privacy in data collection, storage and management**

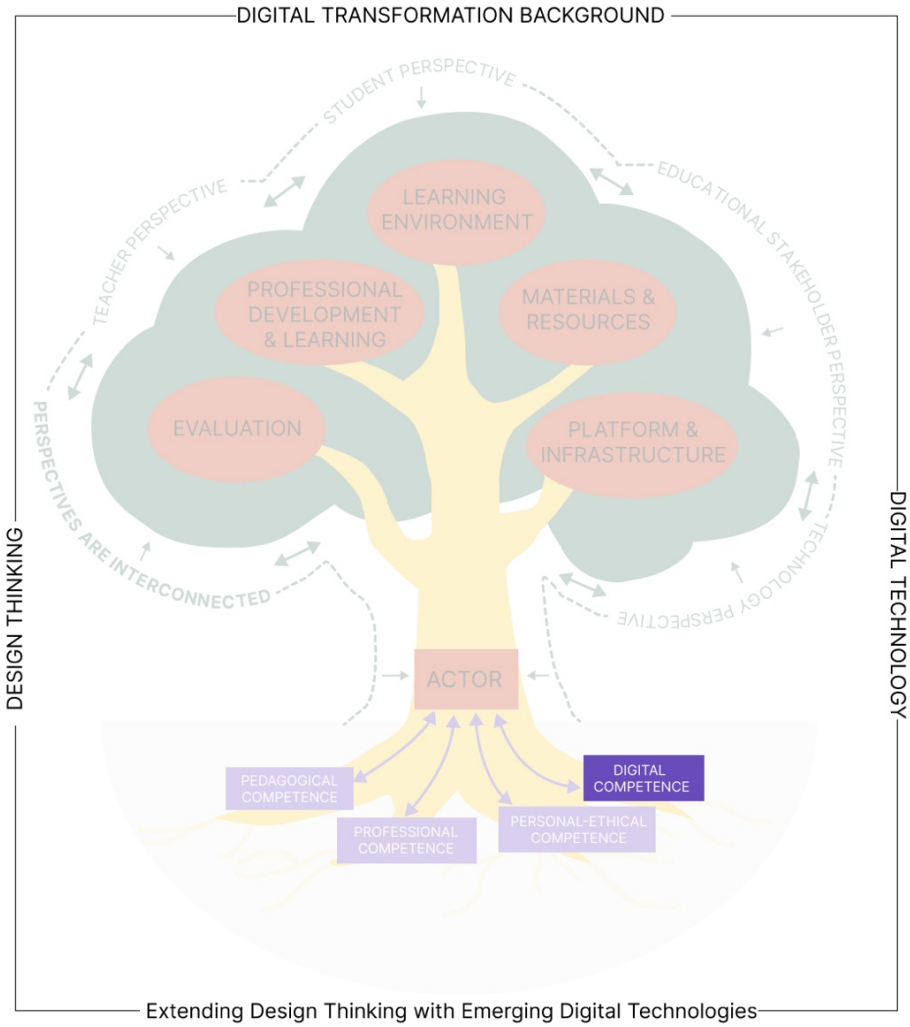
☐ **Adopt clear and transparent obligations with any external agencies involved with the data**

☐ **Respect data ownership and be open about the intentions and objectives of data collection**

☐ **Consider the full potential of green data centres and the efficiency of technologies in terms of their use of energy and resources and other sustainability aspects**

6 Guidelines on Competencies

6.1 DIGITAL COMPETENCIES



6.1.1 What are *Digital Competencies*?

Digital competencies, such as ICT skills, literacy, and technology proficiency, are necessary to prepare students, teachers, and technologists to access data, navigate information, and interactively and effectively use ET during DT.

6.1.2 Guidelines on the *Digital Competencies*

☐ **Give students and teachers opportunities to acquire and enhance the basic skills, knowledge and attitudes necessary in the use of digital tools and technologies**

Examples: This includes basic computer skills, understanding of how to access data, internet and information navigation, and proficiency in interactively and effectively using tools.

☐ **Focus on students' and teachers' understanding of the importance of digital security, privacy measures and information literacy**

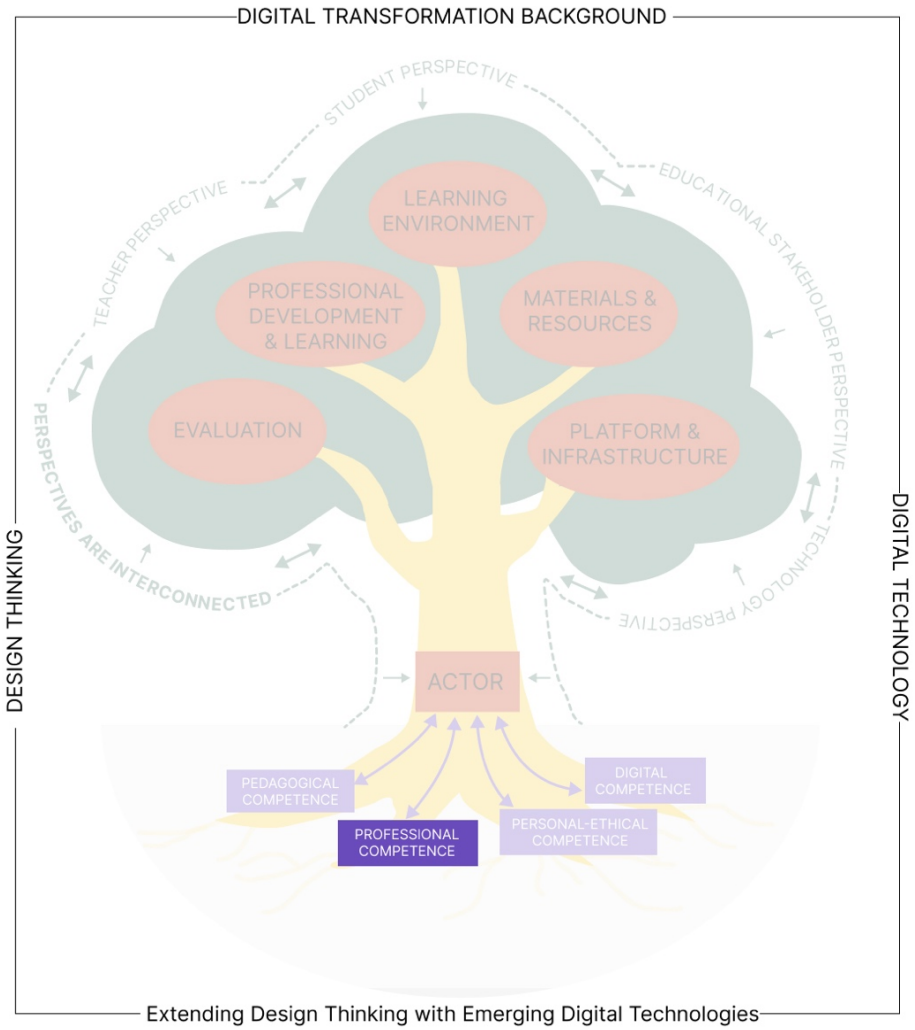
Examples: This includes basic knowledge of cybersecurity practices, including password management, protecting personal information, and recognising and avoiding online threats, misinformation and fake news.

☐ **Connect the use of technologies for DT and skills acquisition for students and teachers**

☐ **Focus on students' and teachers' ability to create and express themselves using digital tools and platforms**

Examples: This may include basic skills in digital content creation, such as video editing, coding, graphic design, and creative problem-solving using digital technologies.

6.2 PROFESSIONAL COMPETENCIES



6.2.1 What are *Professional Competencies*?

Professional competencies for teachers include their abilities for professional engagement, such as organisational communication, professional collaboration, and reflective practice.

Professional competencies refer to students' ability to carry out DT activities and learning effectively. This includes competencies such as planning and time management, reflection and documentation, collaboration and teamwork, presentation and communication, 21st-century skills, and design literacy.

6.2.2 Guidelines on the *Professional Competencies*

☐ **Focus on students' skills, knowledge and attitude that support their learning and personal growth**

- Focus on students' skills and abilities in self-management and organisation, including planning and setting goals, time management and creating schedules, managing resources and self-motivation.
- Focus on students' abilities in collaboration and teamwork.
  Examples: this includes respecting diverse perspectives and sharing responsibilities in groups, collaborating with peers and valuing teamwork.
- Focus on students' abilities in presentation and communication.
  Examples: consider developing good verbal and written communication skills such as expressing ideas clearly, presenting information effectively, and listening actively.
- Focus on students' 21st-century skills and design literacy.
  Examples: design literacy involves teaching students the values of participatory design, raising their awareness about decision-making in technology design, and the potential impact of technology.

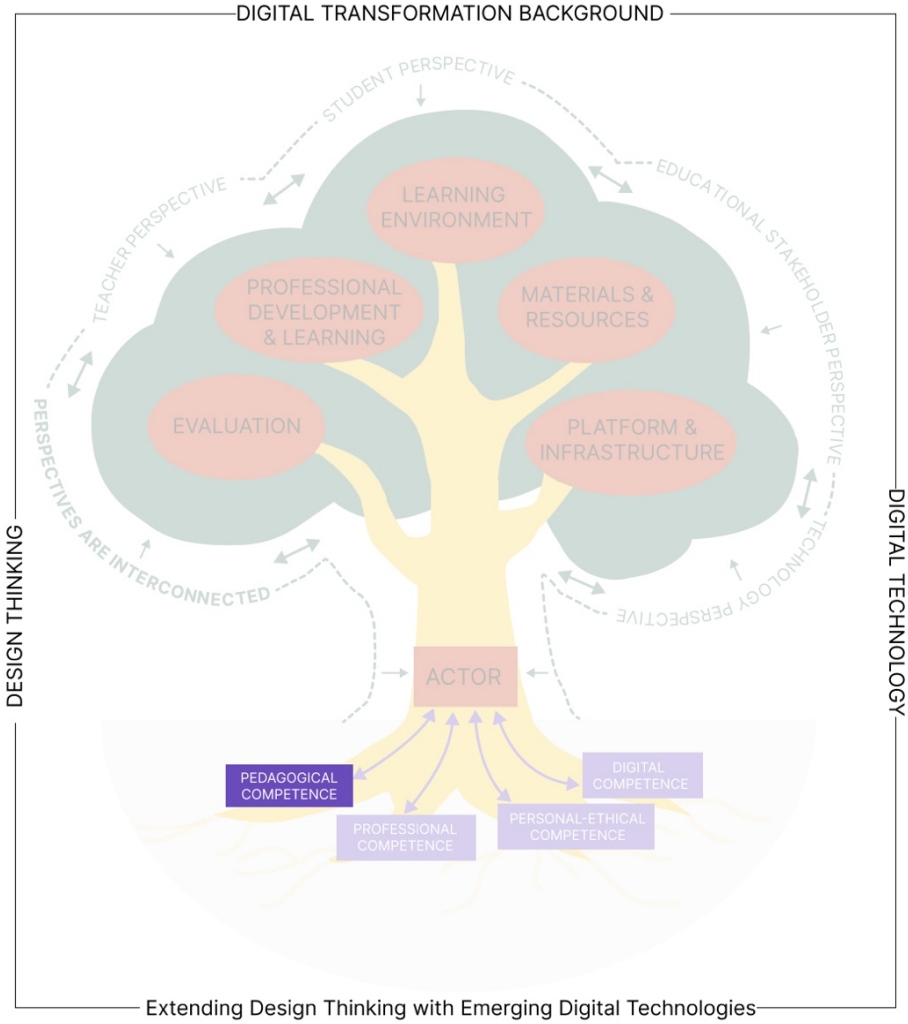
☐ **Focus on teachers' professional engagement, such as organisational communication, professional collaboration, and reflective practice**

Examples: consider engaging in ongoing reflection and self-assessment to improve teaching practice. This can include seeking feedback from colleagues and experts and continuously striving for professional growth and development.

☐ **Focus on teachers' commitment to continuous professional development**

Examples: This includes attending TPD workshops and seminars, participating in professional learning communities, gaining advanced degrees, seeking potential opportunities for growth, and staying abreast of best practices.

6.3 PEDAGOGICAL COMPETENCIES



6.3.1 What are *Pedagogical Competencies*?

Pedagogical competencies refer to the ability to plan a learning program, relate DT activities to learning goals and possible school curricula subject, manage and guide the learning process, and perform an assessment.

6.3.2 Guidelines on the *Pedagogical Competencies*

☐ **Focus on teachers' content knowledge, e.g., understanding of the subject matter or discipline to teach**

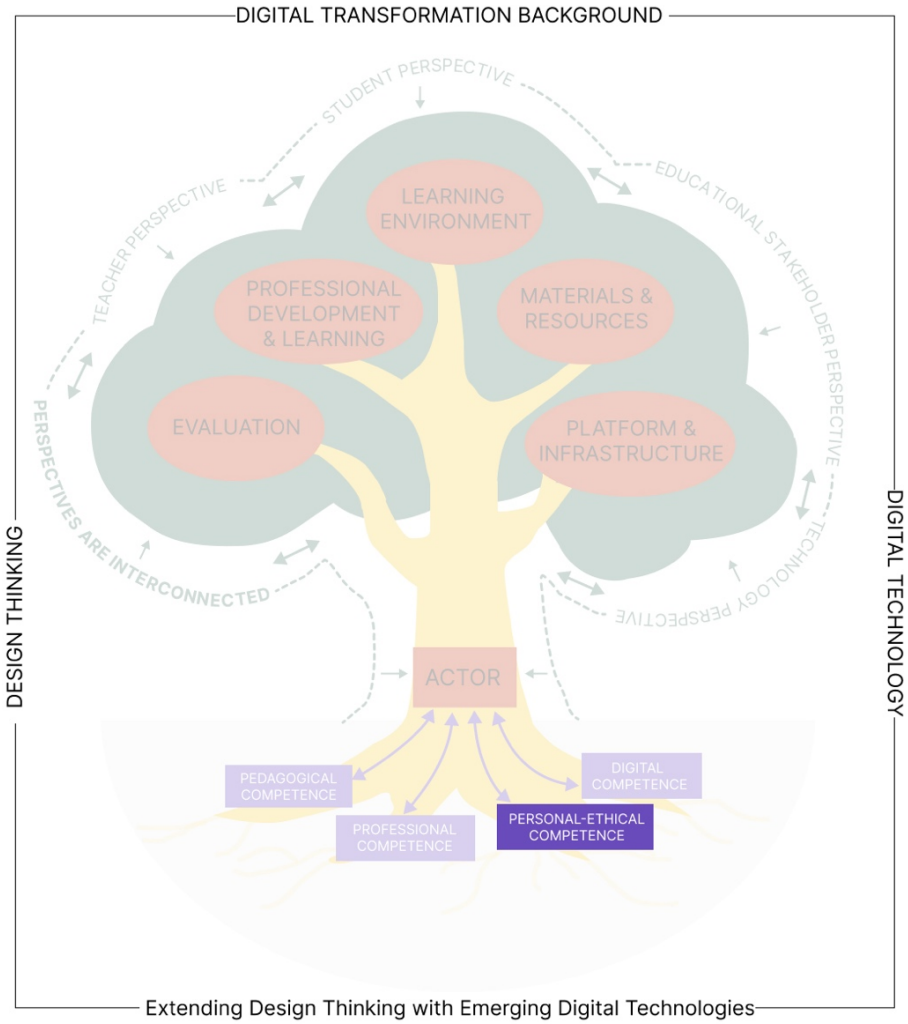
☐ **Focus on teachers' teaching strategies and assessment practices, e.g., incorporating diverse teaching techniques to engage and support students**

☐ **Focus on teachers' technology integration skills, e.g., utilising digital tools, software, and platforms to support teaching, instruction, assessment and communication with students and other stakeholders**

☐ **Pay attention to and practice teachers' classroom management skills.**

Examples: This includes implementing strategies for behaviour and disciplinary management, fostering a respectful and safe classroom culture and promoting a sense of belonging for students.

6.4 PERSONAL AND ETHICAL COMPETENCIES



6.4.1 What are *Personal-Ethical Competencies*?

Personal and ethical competencies describe the abilities of students and teachers from the individual or collective level. This includes competencies in exercising digital citizenship, ethics and judgement, managing personal experience, safety and well-being, and positive acceptance of failure.

6.4.2 Guidelines on the *Personal-Ethical Competencies*

☐ **Beware of and manage personal experience and well-being of themselves and others (e.g., students, teachers)**

Examples: consider a healthy and balanced relationship with digital technologies such as managing screen time, understanding the impact of these digital technologies on mental and physical health, and practising self-care in the digital era.

☐ **Consider the impacts of digital technologies on people, society and the environment**

Examples: This includes understanding the ethical implications of sharing and accessing digital content and the societal implications of technology in decision-making. Also, consider practising responsible online behaviour, respecting copyrights and intellectual property rights, and exercising digital citizenship, ethics and judgment.

☐ **Consider sustainable education and address global sustainability challenges in DT projects, including climate change, unsustainable use of resources, and inequality**

☐ **Persist in the face of challenges in learning DT with ET and adhere to intended course of action**

Examples: consider embracing a growth mindset, a willingness to learn and adapt to new learning opportunities continuously, and being open to acquiring new competencies.

7 Conclusion

This report presents the initial version of the Mass Deployment Guidelines for the Exten.(D.T.)^2 Framework [V1]. These Guidelines were created as a result of the Exten.(D.T.)^2 project research so far, using information from previous project deliverables and literature. The Guidelines [V1] consist of three main elements: Components, Perspectives, and Competencies, each with several subcategories and examples. For instance, the Components include the actor, learning environment, materials and resources, platform and infrastructure, professional development and learning, and evaluation. The Perspectives encompass the viewpoints of students, teachers, educational stakeholders, and technology. The Competencies cover digital, professional, pedagogical, and personal-ethical competencies. It is important to acknowledge that these Guidelines are a starting point and will be revised as the project progresses and new findings emerge.

ANNEX

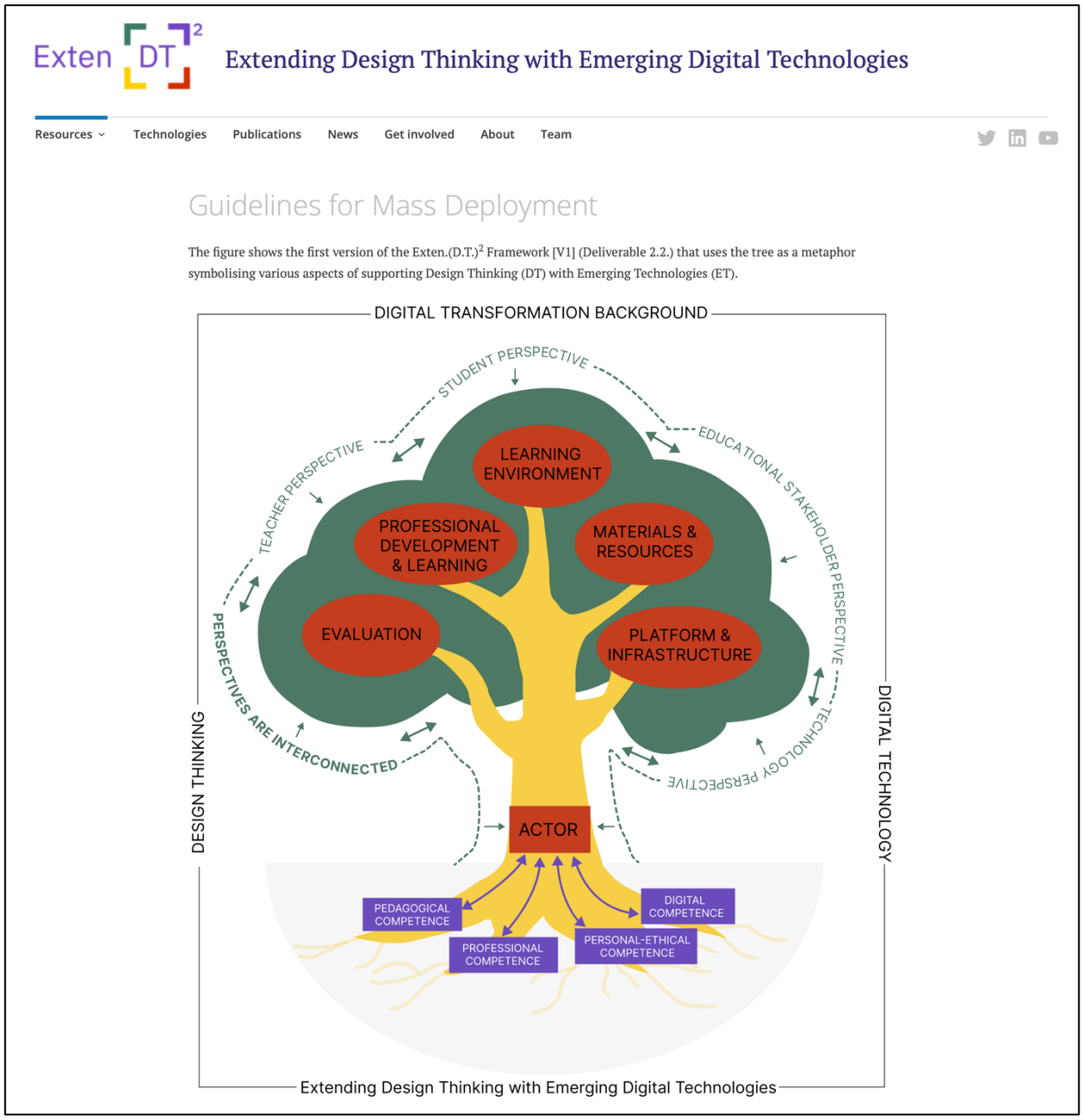
Based on the plan of the WordPress[12] that the Exten.(D.T.)² project is using for its website, the Framework and the Guidelines were included in the section where the project "Resourses" are available (see Annex - Figure 1 below).

Clicking on the "Guidelines for Mass Deployment" leads to the page with the metaphor figure of the tree for the Framework, with summary headings of the detailed information available (See Annex - Figure 2 below).

Below the figure of the tree are the list of Guidelines, represented under "Components" "Perspectives" and "Competences", being the elements of the Framework (See Annex – Figure 3 below). By "clicking" on the respective links, detailed information of these elements, which form the Guidelines, are viewable and may also be downloaded.

Annex - Figure 1

[12] https://wordpress.com



Annex - Figure 2

For the tree:

- The **trunk** symbolises the different actors (component shown in red block) in this context who will be empowered by their competencies to actively engage in the DT activities with ET.
- The cluster of **leaves** represents the five core components (shown in the red bubbles) that are related to the actor component and are essential for supporting DT with ET.
- Perspectives (presented in the green text, lines and arrows) are listed around the tree as crucial considerations (next to the components), which symbolise the **air** to promote the growth of the tree.
- The **roots** signify the foundational competencies (shown in the purple boxes with arrows) that students, teachers, or educational stakeholders possess. These suggest that branches should be connected to the roots, and they are the essential building blocks for further growth and development and underpin effective DT learning with ET.

This metaphor helps visualise and understand the interconnected nature of the elements presented and sometimes overlapping aspects emphasising the importance of a holistic approach to integrating ET in DT education.

At this stage, the Exten. (D.T.)^2 Framework [V1] is designed to mainly focus on teachers and be useful to other stakeholders of DT learning who may be interested in incorporating ET into their practices. Anyone interested in employing the Framework in their practices can consider these elements (i.e. components, perspectives and competencies).

We give some guidelines on how each of these elements should be approached for implementing the Framework as it has been formed at this early stage from the first months of research in the Exten. (D.T.)^2 project (until May 2023).

Guidelines

Components

- Actor
- Evaluation
- Learning environment
- Materials & resources
- Platform & infrastructure
- Professional development & learning

Perspectives

- Educational stakeholder‘s perspective
- Student’s perspective
- Teacher‘s perspective
- Technology perspective

Competencies

- Digital competencies
- Pedagogical competencies
- Personal-ethical competencies
- Professional competencies

Annex - Figure 3