Electronic, didactic and innovative platform for learning based on multimedia assets

e-DIPLOMA

Funded by the European Union

Baselines for the framework development of co-creation

HISTORY OF CHANGES			
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3. Codesign Methodology

In project months 8-10 the codesign methodology first version was put together. Together with the responsible partners for hackathons and codesign activities we collected ideas about what types of hackathons are needed in the first period to test out e-DIPLOMA software solutions. We also prepared the first guidelines for coordinating codesign workshops. The main development was done in regard to how the codesign practices should be designed to improve the e-DIPLOMA learning modules and test out learning effects. The guidelines will be further adapted for each codesign workshop according to the requirements of the learning activity under testing.

3.1. Codesign methodology draft

This chapter contains a guide into codesign methodology for codesign actions conducted in WP3 T.3.1. The guideline must also be used for developing the module lesson descriptions.

3.1.1. Hackathons

A hackathon is an event that brings together experts and creates a collaborative environment for solving a certain problem. Hackathon may have competitive elements to motivate participants.

e-DIPLOMA hackathons are conducted at M9-M12 by technical partners of e-DIPLOMA to test out e-DIPLOMA early prototypes. Hackathons are open to a wider public who have experience with e-learning (in higher educational, vocational educational, and edtech training companies' context). Input from hackathons is used to improve the e-DIPLOMA platform early prototypes.

1. **Hackathon for co-designing recommendation system and gamification in e-learning**

Hackathon idea: We plan to conduct a focus group with testing in which 8-10 people with different backgrounds will be asked to give their opinions (through a semi-structured interview) about the use of RV and RA in addition to the recommendation system and gamification in e-learning.

Who will organise: INIT UJI.

When do you want to conduct the hackathon: We would want to celebrate it at the beginning of October taking into account the meeting's schedule of the UJI Ethics Committee. We plan to do it on October 5th.

Location: UJI

Who will participate: We want to make an appeal to university or VET students (+18), lecturers, developers, and parents. We will strive to ensure gender balance and engage profiles of diverse individuals. For the recruitment process we will use contacts of the INIT network and Associated Partners.

What solution do you want to test out from e-DIPLOMA (e.g., the backend features, frontend aspects, interaction aspects): We want to **test the acceptance and level of convenience of the use of emerging technologie**s by giving the participants **interactive demonstrations with VR and AR** so that they can report on their experience and the potential they see of their use in education.

In addition, a **content recommendation engine will be tested out through a chatbot, and gamification will be presented via videos.**

For what purpose do you want to use the feedback from the hackathon for the e-DIPLOMA development: We aim to use the feedback extracted from the hackathon to gain insights into the **end-users' acceptance of disruptive** technologies in education. Specifically, we are interested in understanding and detecting recurrent positive and negative aspects derived from their experience with these technologies as well as the use of gamification and a content recommendation system. This **feedback will enable us to refine the**

pilot content taking into account the preferences of the end-users and **determine the requirements for developing a gamified platform with the recommendation system.**

What technical things (paper prototype, prototype etc. you need to prepare): We are considering using our own prototypes developed by the INIT (not completely related to e-DIPLOMA content pilot) in which the participants can experience the use of immersive VR and AR with glasses. In addition, through explanatory videos and examples we will explain the gamification techniques in order to be assessed. The recommendation system will be tested using a chatbot demo.

The agenda, time you will need:

- Welcome - introduction of the e-DIPLOMA project and the objective and procedure of the focus group. (15 min)
- Collect the signed informed consent (5 min)
- Semi-structured interview to know about the participants' relationship with disruptive technology and use of traditional e-learning platforms. (30 min)
- Coffee-break with testing technology (30 min)
- Semi-structured interview to know the participants' specific insights of the interaction of disruptive technologies and opinions about gamification and content recommended systems. (40 min)
- The interviews will be audio recorded and transcribed to be subsequently analysed.

The Hackathon will use the following interview guide:

This is the script that the moderator of the focus group will follow so that the group of attendees (between 8-10 people) can give their opinion and debate.

General part of the interview

1. What negative or positive aspects would you highlight of the current e-learning platforms?
2. What opinion do you have about the use of VR and AR in education?
3. What opinion do you have about the use of the IA in education?
4. What relation do you have with activities that use game elements in professional, educational or social environments (with the gamification)?

Specific part of the interview (after the testing of the technologies)

Block about the integration of disruptive technologies in e-learning platform

1. Do you have any concerns about the use of these technologies in education?
2. Why do you think the use of technologies could be a reason to enroll or not in an e-learning course?
3. What adaptations do you think would be necessary to increase the reach of e-learning platforms (adaptations for vulnerable groups, for people with special needs, those affected by the digital divide…)?
4. What do you propose to make e-learning more collaborative and social?
5. After testing these technologies, how has your opinion on the use of these technologies in education changed?

Block about the use of a content recommendation system

1. In which way do you expect that a recommendation system in the e-learning platform will support you?

Block about gamification

1. What kind of recommendations do you think are most motivating within the e-learning platform?

2. Hackathon for testing e-DIPLOMA platform backend and gamification

Hackathon: *Game Jam*

Time: September 2023

Organizer: BME, cooperating with METU (https://www.metubudapest.hu/).

Location: BME building I or Q.

What solution do you want to test out from e-DIPLOMA (e.g., the backend features, frontend aspects, interaction aspects):

The e-DIPLOMA platform as a whole, including:

- cloud-based backend
- lobby/matchmaking website
- launcher
- Moodle integration
- Unreal Engine integration
- Unity integration

Game mechanisms in education, including:

- Groupwork
- Activity recording and replay
- Procedural content generation (e.g., the virtual city)
- Voice chat with AI

What technical things (paper prototype, prototype etc. you need to prepare): by September to publish a version of the e-DIPLOMA platform and operate it as a service.

For what purpose do you want to use the feedback from the hackathon for the e-DIPLOMA development: Hackathon Game Jam intends to develop educational game mechanisms that can be useful in e-DIPLOMA platform.

Participants: Game Jam is an event with an open call for participants, targeting aspiring game developers and game designers. An in-person event.

Hackathon idea: The goal is to design educational game mechanisms that can be useful in those scenarios, possibly with prototype/mock-up implementations.

Hackathon timeline:

- A list of selected Learning Scenarios will be offered.
- Teams are formed at the beginning of the event.
- Participants will design educational game mechanisms that can be useful in those scenarios, possibly with prototype/mock-up implementations.

- Every team gives a presentation on their work at the end of the event.
  There is a jury of experts, and awards are given. They are no big monetary prizes.

3. **Hackathon for testing e-DIPLOMA platform backend and gamification of learning objects**

Hackathon: *Hackathon Week and Hackathon Day*

Time: November 2023

Organizer: BME, cooperating with METU (https://www.metubudapest.hu/).

Location: BME building I or Q.

What solution do you want to test out from e-DIPLOMA (e.g., the backend features, frontend aspects, interaction aspects): Gamified e-DIPLOMA Learning Objects.

e-DIPLOMA game mechanisms in education, including:

- Groupwork
- Activity recording and replay
- Procedural content generation (e.g., the virtual city)
- Voice chat with AI

For what purpose do you want to use the feedback from the hackathon for the e-DIPLOMA development: The goal is to turn one or more of the Learning Objects into gamified versions using the e-DIPLOMA Applications as a baseline or a framework. We would adjust the technical parameters of the cloud backend based on the feedback (e.g., regarding startup times, performance, rendering times, network communication lag). We improve the UI based on the feedback. Any recorded gameplay can be used as preliminary test data when designing the evaluation analytics for the pilots. Game mechanisms for Learning Objects in Prototype 2 will be reinforced or discarded based on the feedback, or perhaps new ones will emerge.

What technical things (paper prototype, prototype etc. you need to prepare): Between September and November a new version of the platform is created. e-DIPLOMA contributors will work on concepts devised at the Game Jam, turning them into e-DIPLOMA applications.

- The entire e-DIPLOMA backend (running on AWS)
- For Hackathon Week we will need 1-3 selected e-DIPLOMA Applications, as well as a few selected Learning Objects.
- 3-4 computers capable of running the games with sizeable displays for the public to follow.
- Presentation stage with projector

Participants: Invited and walk-in participants. There will be an open call for groups of developers (in practice all higher ed students). Hackathon day will be advertised to a wider public (via emails, posters), but mostly university students, teachers, leaders, and parents are expected to show up.

Hackathon timeline:

- Hackathon Week [An online event]
  Some matchmaking support to help find teammates will be offered. Teams can enter the race.
- One week before Hackathon Day, one to three selected e-DIPLOMA Applications will be presented, as well as a few selected Learning Objects.

- Participants have to turn one or more of the Learning Objects into gamified versions using the e-DIPLOMA Applications as a baseline or a framework.
- Hackathon Day [An in-person event]
  On this day, all participants of the development week gather to deploy, calibrate, and present their solutions at an exhibition-like event.
- Invited and walk-in participants can try the educational games.
- Teams will give presentations parallel to the exhibition.
- Participants will fill in questionnaires evaluating the experience, not only by giving numbers, but also in a free form.
- There can be a jury of experts and/or popular vote from the participants.
- Awards are given, possibly with some monetary prize - especially if there are interested sponsors.

Hackathon Day would take the most part of a day:

- Morning setup (2 hours): deploying and calibrating designed Learning Objects at the venue.
- Morning session (1 hour): some presentations from developer participants, Q&A
- Sandwich lunch break (1 hour):
- Afternoon session (1-hour): some presentations from developer participants, Q&A
- Jury break (30 minutes)
- Closing (20 minutes): awards presented

Most participants will not be expected to stay for the entire duration of the event, but walk-in, listen to some presentations, try a few Learning Objects, and provide feedback in writing or on video.

4. **Hackathon for testing VR interaction**

Hackathon idea: The hackathon will be organized as a brainstorming and experience event. The target is to discuss and collect ideas around typical VR-related tasks and then prototype them in Unity Engine. The prototypes are gamified through a competition with individuals voting for the group with their favourite prototype, excluding their own group. The winner will receive a price that is to be determined.

Who will organise: TU Delft.

Time: Planned for late October/early November

Location: Van Mourik Broekmanweg 6, 2628 CD, Delft

Who will participate: There will be an open call for BSc, MSc and PhD students, and experts in the field of VR. We tell participants that some level of experience with VR, Unity or both will be helpful but not necessary.

What solution do you want to test out from e-DIPLOMA.

Discussion and brainstorming around core topics in VR:

- Navigation*
- Interaction
- Visualization
- Collaboration*
- Demonstration

[*]: *We intend to create an interactive prototype on campus*.

For what purpose do you want to use the feedback from the hackathon for the e-DIPLOMA development: We have developed a few prototypes and collected several ideas for future developments, which we would like to discuss with others to investigate if all important elements are considered. We additionally hope to find new solutions to open problems in the field through the interactive prototyping session.

What technical things (paper prototype, prototype etc.) you need to prepare

- Presentation with slides
- VR/AR demonstration prototypes
- Unity VR-compatible sandbox project repository

The agenda:

10:30 | Morning setup: Preparation for the Unity environment (setup of the machines)
11:30 | Morning session: Presentation, problem description, existing prototype demos
12:00 | Lunch: Food and drinks, Q&A
13:00 | Breakout session: Prototyping, Q&A, individual demonstrations, and experiences
16:00 | Discussion: Global presentations, collection of results and feedback
16:45 | Awards: Voting for favourite idea or prototype, handing out rewards.
17:00 | Closing

3.1.2. Co-Design workshops

Co-design and participatory design have been adopted to support TEL innovation processes. Co-design is shifting the attention from the final product to the process and supporting collaboration. In co-design, the focus of interest lies in the collaboration between designers, end- users, and stakeholders because this is considered crucial in building a shared understanding and making sense of a given situation, as well as creating design ideas that may produce a positive change in the current situation. Co-design is influenced by the user-centred design (UCD) tradition, which advocates for centring each phase of the design process on the users and their needs. In innovation processes, co-design has also been considered valuable because it can support the faster and more effective adoption of solutions. In co-design, scholars have also argued for involving other people who may be directly or indirectly affected by the outcome of a project. Usually, these people are referred to as stakeholders. In order to ensure that design outcomes respond to people's needs and connect to their experiences, some voices have advocated for including a diversity of stakeholders, in addition to the people who are expected to be directly affected by the design solutions. The role of facilitators is to keep methods track and facilitate the codesign and build trust among the participants.

Special attention should be paid to methods and tools because they are key in supporting the designers' and end-users' active participation and sharing.

A popular format used in co-design consists of workshops in which designers and stakeholders engage in joint exploration to identify the opportunities and challenges related to the issues involved in a particular situation.

Codesign workshops of e-DIPLOMA are conducted M14-M24 (one per piloting country) to advance the initially proposed e-module ideas jointly through codesigned practices with pedagogical and technical partners. The results of the codesign workshops will be reported dynamically at knowledge sharing workshops (and for presenting the workshops dynamically at website) and thoroughly for WP2 purposes to prepare D. 2.1. The template of reporting will be followed.

Knowledge sharing workshops among partners will be held to discuss the codesign process at monthly regular project meeting times at M14-M24. The knowledge sharing workshops may invite guests.

The codesign framework describes how systematic codesign is carried out across different stakeholders.

It incorporates the instruments for partners for interviewing the stakeholders throughout the process (values and learning effects)

Definitions:

- Module - a course such as e-learning modules in the e-DIPLOMA platform (1. Using Virtual Reality for learning Block Programming and managing sensors over a virtual environment; 2. Next Social Entrepreneurs Generation 3. VR Education). Module consists of a sequence of learning events.
- Event - a timestamped session of structured learning within the module. Event consists of a sequence of learning activities.
- Activity - predefined clear-cut instructional conditions for learning such as lecture, group work, individual assignment, etc.
- Interactions - operations with tools, objects, people during the activity

We suggest involving teachers and learners into hackathons and codesign using the following steps:

Pre-activity phase

- Methods planning for specific events must be done together with the Module developers, and the wp5 who plans specific measurements on specific learning effects of e-DIPLOMA interest. We have prepared an activity planning and reporting guide for it (see specifically section F).
- Designing the activity according to the experiential learning specific phase with x technology
- Preparing consents
  We need measurement consents
  We also need approvals (consents) to audio save anonymous interviews in which we focus on ethical dimensions of e-learning systems and practices and unforeseen consequences.
- Approval of the ethical committee (incl. translation of consents, method)
- Identifying and recruiting stakeholders - educators, edtech developers, educational technologists/technical support specialists, students (roles of experiencing)

Running the codesign event

- Introduction phase
  - Project and activity goal
  - Ensuring the consents
- Presentation phase
  - Goal of the activity is presented.
  - Technical and health instructions
- Codesign workshop with knowledge eliciting prompts for cognitive walkthrough
  CO-DEFINING PHASE: in this phase ideas may be generated.

  First inspirational materials are shared about the activity idea and technology opportunities. This may be paper prototypes, videos of using the tools in action or an opportunity of experiencing some technology functionalities.

  Next some eliciting support structures may be used for team discussion:

  Sometimes concept mapping techniques are used to associate technology functionalities with actions to have a better overview of what is possible.

Value cards may be used to associate values with personas and with the technology functionalities in actions of the activity. This helps to do a value-based design and avoid negative effects.
Interactivity scale may be used to make decisions about the learner engagement level in the learning activity.
Learning effects table may be used to discuss possible learning effects with the specific actions with the technology.

This phase may be a collaborative group activity when discussion of the experiences is done.

IDEATING PHASE: in this phase the user-friendly solution is sought for the activity.

Persona- card methodology may be used to specify user types, their needs, and expectations: learner, teacher, special needs learner, parent etc.

User-scenario method may be used, that storifies usage paths.

Activity path canvas may be developed to understand better how in each action different users interact with the technology, artifacts and with each other.

It is suggested to work in pairs and then combine more users to share their different views.

The combined views to the activity actions will be viewed from the viewpoint of users (different personas), and technology functionalities considering interactivity, learning effects and values.

PREPARING TESTING PHASE for validating the codesign products in action.

If e-DIPLOMA partners will want to test out specific learning phenomena (cognitive, affective, metacognitive, and psychomotoric/embodied), the team will discuss what is the opportunity to measure the specified learning effect.

It is recommended that there will be a presentation of the opportunities with what tools the measurement of learning may take place during or after the activity (survey, cognitive walkthrough during or after the activity, eye tracking, sensory tracking or other methods).

In this phase it is important to discuss the values again.

The decision will be made, which learning effects and what way will be measured. Note that e-DIPLOMA will measure only some specific learning effects, not all effects that are possible.

The final result of this phase may be a paper prototype for the developers to advance the learning module. The codesign may be also done to improve the initial activity idea further.

TESTING PHASE – actively trying out and taking measurements, particularly to calibrate the measurement tools.
Activity testing (individually, in pairs with student-teacher, students' group - teacher)
Measurement during the activity, it is important to test out if the measurement tools accurately measure what is intended.
Interviews about goals and values of the activity with the participants

3.2. Reporting the learning effects

(Annex 1)

Annex 1. Codesign lesson designing, event planning and reporting guide.

A. Partner who conducts the codesign event

B. Participants in codesign event: internal stakeholders from the project (researchers, teachers, students), external stakeholders (edtech, parents)
* Note anonymous, no need to collect personal data.

C. Codesign event schedule

D. Requirements for informed consents
For each event specific requirements what activities are done depend on what will be measured (see planning in section F)
Consent for videotaping, taking pictures for dissemination purposes at the website should be asked if this is planned.
Consent for anonymous interviewing for values about the activity

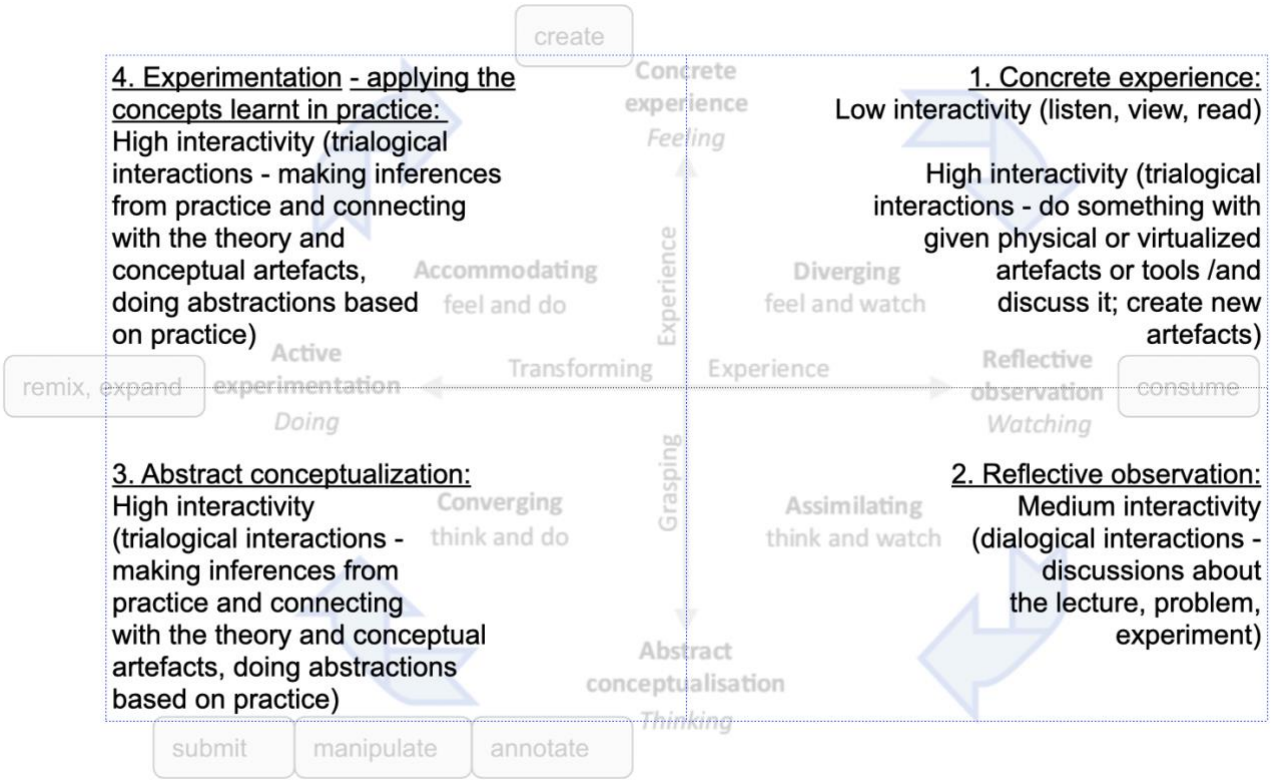
E. Tested learning activity description

- **Goal of the tested learning activity:** pedagogical goals
*note the general learning effects will be specified in section F.

- **Technologies used in the learning activity:** specify the specific technical e-DIPLOMA functionalities and other tools you are using in the activity.

- **Problem space elements (to use also screenshots in depiction)**
- How and with what information the problem situation is presented (e.g., texts, videos, AR objects, dynamic videos etc.)
- How problem-solving strategy is presented (e.g., formulas, rules, steps in the activity), what tools must be used to solve the problem (e.g. AR tools, physical tools, measurement instruments etc.)
- What solutions the problem will have (e.g., concrete known solutions, open solutions)

- **Learner engagement in the activity.** How practice situations use tools, reasoning (relates with interactivity in experiential learning phases of Kolb model). Select only one activity from the module and specify into which engagement type it fits.



- **Participants in learning activity**: describe who are participants, is it individual, group or pair learning.

- **Scaffolding types**: Please describe what type of support (scaffolding) you are providing by humans or with technology.
  - conceptual scaffolding (mechanisms for supporting students to reason through complex problems as well as concepts where misconceptions are prevalent, e.g., providing a hint to help students to reach a solution, coaching comments, providing feedback and advice on performance).
  - metacognitive (mechanisms for supporting underlying learning management processes and thinking about a task, e.g., students are encouraged to engage in introspection by being asked questions and having their weaknesses highlighted, prompted to recall a familiar experience or concept from their own lives);
  - procedural scaffolding (mechanisms for emphasising various ways to utilise the available resources and tools within a given environment, e.g., teachers can provide continuous assistance and guidance on the functions and capabilities of the system, as well as how to utilise them);
  - strategic scaffolding (mechanism for guiding students in examining and tackling learning tasks or problems, while emphasising the usefulness of alternative methods, e.g., informing the student about tools and resources that are accessible and could be beneficial in certain situations, while also offering instruction on how to utilise them)
  - affective scaffolding (mechanisms for supporting emotions and motivation, e.g., environmental resources)

F. **Results, outcomes of an activity. Reporting of learning effects.** Please select from the tables only some effect you want to validate. Please discuss with WP5 measurement people what can be/ what you decided to measure during the activity. *Note each codesign event should measure only some selected learning effects

Table 1. Cognitive learning effects in disruptive learning environments

Effect type	Measurement approach (sensors or questions or automatic in systems data)	Measured results
Cognitive information processing. Cognitive information processing issues Cognitive load problems, fatigue		
Attention. **Lack of attention, distractedness, feeling bored**, sensory problems Awareness. Situation awareness. Learning distractions		
Knowledge. Knowledge retrieval. Knowledge retention. Knowledge rehearsal. Recall. Remembering.		
Understanding. Comprehension. Deep learning. Bloom's taxonomy: remember, understand, create, apply, analyse, and evaluate. Higher order thinking skills. The processes of analysis and synthesis, deducing, inferring, and abducting. Critical thinking.		
Conceptual knowledge.		

Learning gains achievement **Misunderstandings** Understanding abstract concepts. Cognitive conceptual coherence.		
The processes of classification, associating and transformation. Association of past knowledge. Knowledge transfer. Perceived authenticity.		
Knowledge visualisation Knowledge mapping on situations. Creative visualisation The modelling processes from one knowledge representation to another. Representational coherence		
Group knowledge. Collaborative knowledge. Community practice. Collective level knowledge. Common ground in shared cognition.		

Table 2. Positive and negative metacognitive learning effects with disruptive technologies

Effect type	Measurement approach (sensors or questions or automatic in systems data)	Measured results

Autonomy		
Self-reflective feedback practices and actions lack of feedback, to search answers, to make insights		
Self-efficacy, overcoming obstacles, less time spent, perform well, reported comfortability		
Self-regulation skills such as self-observation, attentional flexibility, inhibition control, and other executive functions, for self-regulation		
Monitoring based customised supportive actions, perceived self-control.		
Dialogic interactions Identity		
Learning from mistakes		
Agency, being psychologically engaged, have sense of control over actions, progression, pervasiveness, persistence, confidence		

Table 3. Affective learning effects in disruptive learning environments

Effect type	Measurement approach (sensors or questions or automatic in systems data)	Measured results
extrinsic and **intrinsic motivation**		
positive emotions: happiness, decreased nervousness, reduced **anxiety, e**njoyment, excitement, fun, sense of empathy, learning satisfaction, hedonism,		
negative emotions: **anger, fear, sadness,** anxiety, learning pressure, psychological safety		
interest, curiosity, engagement, enthusiasm		
self-efficacy, subjective satisfaction, attitudes towards learning		
Social constraints, negative social behaviours, isolation, lack of collaboration and support, cybersecurity issues, privacy violation		

Table 4. Psychomotor and embodied learning processes with disruptive technologies

Effect type	Measurement approach (sensors or questions or automatic in systems data)	Measured results
Immersion Seamless spatial presence Virtual presence		
Cognitive disability Physical discomfort Sensory disability		
Motion-sickness, dizziness, claustrophobia, migraine		
Manipulation of objects, Coordination, kinesthesis, Motor problems		
Identity confusion		
Spacial location 3D movement time and space		
Skills training		

G. Reporting of values related to the disruptive technologies for participants (to give some value card dimensions to discuss at the interview)

- Personal
- Societally related
- Institutional and learning instruction related.
- Sustainability values

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