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The value perspective of technologically disrupted social dimension of a learning space

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Abstract. Technologically enhanced social dimension of a learning space is under researched, yet it plays an important role in supporting the learners. The aim of the study was to explore the values that underpin the construction of the social dimension of a learning space supporting adult education practices. Perceptions of higher education learners, learning facilitators, and educational technologists were collected in the form of group-interview workshops. Results indicated that disruptive technologies encourage the appearance of engagement, interactivity, effectiveness, empowerment and empathy in relation to the social dimension of a learning space. Findings suggest that disruptive technologies have the potential for the emergence of enhanced accessibility to learning, rise in learner autonomy and equity of the learning parties. However, questions regarding privacy, surveillance, trust and coercion of the social dimension might arise due to the technology integration.

Keywords: learning space construction, social dimension, values perspective, disruptive technologies, higher education

1 Introduction

The space for learning in educational institutions has been regarded as a socio-spatial room responding to the changing educational paradigms [1], emphasising the dynamic core of the space. Moreover, the term has been widely discussed in the light of architectural standards for educational institutions. As a constantly transforming multilayered construct [2], learning space is an abstract space consisting of physical, social, mental or psychological, sometimes digital and power dimensions [3][4][5][6] construed by the subjects in the space, their relations with each other and behaviour, goals, memories, beliefs as well as the relationship with the surrounding physical environment [3] [7]. Learning space exists only in the time and space of its participants,

learners and learning facilitators [8]. Thus, it can be defined as a space actively construed by its participants and influenced by the cultural context and social practices surrounding it.

Given that well-designed learning spaces have a direct impact on learners´ academic performance and outcomes [9] we as educators should prioritise understanding the core principles and nature of creating learning spaces that support the learner. Yet according to Leijon et al. [10] there is not enough research and theories revolving around the nature and construction of learning spaces. Its dimensions have received attention from many researchers, focusing on discussing and exploring relevant design principles for enhancing learning spaces [9][11][12] or developing typologies of learning spaces [13]. However, when thinking of abstract building blocks of a space dedicated for learning, it could also be observed through values of space participants or as a value space because these are always involved in a learning process [14]. Values could be understood as criteria used to assess and gauge people or occurrences [15] or as principles that inform human behaviour which are acquired or learned generationally and culturally through social interactions, even though their order of importance can change in new social contexts [16]. In the context of a learning space, the values of participants construing the space along with societal and contextual values they carry become evident through the interactions and meaning making process between the learning parties (learners, facilitators).

Technology-integration is expected to transform learning space and practices [7] and, therefore, through interactions also the foundational values of the learning space. In adult education, meaningful integration of disruptive technologies opens up more opportunities for students' engagement in learning [17]. Furthermore, technology can amplify social support learners need in e-learning and blended learning environments [18] such as offering possibilities for collaboration, sense of connectedness and social presence that influence learning efficiency and motivation among other qualities [19]. Continuous active integration of technologies into learning activities raises questions on the influence of technologies on learning space construction as well as teaching practices.

Challenges that the conceptions of teaching and learning principles were subjected to during the global pandemic, gave rise to the comparative inspection of physical, virtual and hybrid learning spaces [8][20]. There is a need to get a comprehensive understanding of the construction of new technologically mediated learning spaces [10] and especially the social dimension of a learning space since it could affect the learning outcomes of students [21][22]. Attention is drawn to the lack of research regarding the social dimension of the learning space as well as absence of support for learning facilitators in using learning spaces or transforming their learning practices to

accommodate active and social learning in technologically enriched learning spaces [23][10].

Using and integrating technologies in education might cause disruptions – breaking usual ways and creating a need for obtaining new skills, changes in teaching and learning approaches, even interactions [24]. Research concerned with technologies with the potential to disrupt learning tends to overlook the importance of the social aspects of learning [25]. The social dimension has similarly received less attention also in the context of e-learning [19][26][27]. This gap motivates us to explore the foundational values of particularly the social dimension of learning space construction in the light of technology transition. Being aware of the values bound to the social dimension of a learning space enhanced by technologies could aid construction of supportive learning spaces for the learners.

The pandemic set the tone for future learning ecosystems as described in the Troyes Declaration [28] referring to the bridges that technology allowed to build for all kinds of societal processes. However, the declaration also draws attention to discussions to be held on the design of human-technology interactions in the era of disruptive technologies such as artificial intelligence. We argue that taking a value perspective on technology-integrated learning spaces allows deeper reflection on the nature of such learning spaces. By exploring the interplay of the social dimension and technology, the findings can contribute to imagining how future learning spaces should be constructed to meet the diverse needs of individuals and communities.

This study seeks to give an insight into the foundational values of the learning space where emerging technologies (such as AR, VR, AI and telepresence robots) with the potential to disrupt traditional learning practices (disruptive technologies) have been integrated. For expanding research on best practices of integrating technology into learning spaces e.g. [8], we aim to explore the construction of the social dimension in higher education context. We study the perceptions of learners and learning facilitators by identifying the values supporting the construction of a learning space following adult education principles. The research will be guided by the following questions:

1) Which values do facilitators and learners associate with the construction of the social dimension of a learning space with disruptive technologies?
2) What values do learning facilitators perceive as supportive or hindering the social dimension of a learning space with disruptive technologies?

Research results will help to identify a set of values to be considered in future studies for designing learning with disruptive technologies, aiming to specifically support the social dimension of adult learning.

2 Theoretical Background

Theoretical lens taken in the study is grounded in adult education principles that support the social dimension of a learning space, an analysis of technologies with the potential to disrupt these principles, and an exploration of the values that are central to these kinds of disrupted learning spaces. We outline the basis for understanding the interplay between technology, social dimension of a learning space, and values underpinning learning with technologies.

2.1. Principles of Supporting the Social Dimension of a Learning Space in Adult Education

The construction of learning spaces in adult education emphasises the creation of conditions conducive to the facilitation of learning [29] reflecting on the supportive role of the lecturer or learning facilitator in the knowledge construction process. Learning as knowledge construction instead of mere information consumption approach is a social process starting from acknowledging that we assign meaning to everything surrounding us using the instruments of language and culture [30], that is emphasising the role of linguistic tools and the socio-cultural and socio-technical environment surrounding us. The core of contemporary learning space ought to be rooted in constructivist, social constructivist and socio-cultural paradigms [7][8] that give importance to the social context of learning [31], reinforcing that learning is a communal activity shaped by social interactions. Peers play a significant role in engagement and attainment of learning [32] as learners actively participate in learning activities and seek meaningful interaction with their peers [33] in higher education but also widely in adult education context where learners' interactions with the surrounding context are vital for the learning process [34]. Therefore, collaborative learning methods are central to adult education practice. These kinds of methods require active involvement of the learner in the collective knowledge construction process [35].

In order to provide a learner-centred scaffolding approach [36] in higher education, learning design could be informed by the andragogical model of learning and teaching in universities [37]. The theoretical assumption for the model based on socio-cultural and socio-constructivist approaches includes an interpersonal process consisting of interactions, dialogue and participation as the ground principle of learning design next to the intrapersonal aspects of a learner such as autonomy, responsibility [37]. The cultural background of the learner plays an important role in facilitating meaningful learning experiences [38].

The adult learning theories characterise the social dimension of a learning space by its inseparable connection to human experiences [39] and participation in communities [40][41]. According to activity theory, in the timespace of the construction of a learning space, the learners and their cultures are inevitably tied to and in constant interaction with the system, community or group [42], resulting in shared culture. The social dimension in computer-supported collaborative learning can be observed in levels, such as group, classroom and community [43] where social practices occur. In the learning process, a common goal, social practices, agreements, roles, responsibilities, rules and mediating artefacts are established [44][45] which are crucial features for learning to take place. It frames the cultures, communication and agreements between the learning parties (facilitators, learners, peers) as well as learning activities.

Social engagement and shared experiences have a critical role in learning [46], Bandura [47] highlighting the learning process as inherently social by nature [48]. In addition to the socio-cultural context, various authors have developed taxa aiming to support the cognitive, affective, metacognitive and social aspects of learning in their endeavour to construe the foundations of understanding learning process and its distinct aspects [49].

Aligning with the andragogical model of Karu [37] in its constructivist nature and acknowledging the role of former experience in the learning process, taxonomy of significant learning [50] specifically for higher education aims to take a holistic view towards teaching and learning. The underlying principle of the taxonomy is that the learner undergoes a transformation during or as a result of the learning process. While the facilitation of such transition might require personalised approaches, Fink [51] highlights universal aspects of significant learning design such as the *human dimension* (learners are able to learn about themselves and improve interactional skills), *caring* (turning attention to learners interests, values and feelings) and *learning to learn* (emphasising new learning strategies and abilities of becoming a self-directed learner) as crucial principles for creating conditions for significant learning. In addition to the transition within the learner in adult education [34], the experiences and needs of them regardless of age ought to be considered in transforming a learning space, as well as the foundational values learners associate with technologies.

The organisation of the physical room as well as relevant facilitation strategies and instructional methods affect learning [35]. Learning space as a physical place is actively constructed by the participants of learning through social practices and rules or traditions of the specific cultural context [2]. In addition to delineating physical, mental, social and digital dimensions of a learning space [4][5], Montgomery [6] highlights the group dimension involving learning parties and the power dimension which emerges within the formal education system due to the hierarchical nature of interactions and social constructs. These studies touch upon the social aspects of the learning space such

as the role of peers and facilitators in learning, social relations and intrapersonal aspects influencing the learner.

Proceeding from the rise of constructivist paradigm in the context of higher education where knowledge is actively constructed by the learner and facilitated by learning facilitator in a joined social effort [51], the construction of a learning space is, similarly, a mutual endeavour [7], meaning that all learning parties have the agency to shape and change the learning space by their participation [52]. This requires the understanding of the learners of acknowledging the influence they have in a learning space. Learning spaces ought to be constructed with the intention to facilitate learner-centred teaching and learning approaches, especially in the context of technology-enhanced learning with the aim to support "active, social, collaborative and independent learning" [23] but in the light of learners agency, the responsibility lies not only on the shoulders of the learning facilitator.

Learning space construction is also concerned with the question of the unpredictability of the interactions in the learning space [1]. The impact of physical dimension or design of the physical room to the social dimension of a learning space is undeniable and compels the facilitator to adjust accordingly [1][53], regarding the interactions, level of engagement or even academic performance [11]. However, technology as an interactive partner might change the norms of social interactions within a learning space [8]. Studying learning space as a versatile socio-cultural and socio-technical notion comprises attention to its social and values dimension [13] – ways the learners engage with their peers, learning facilitator, learning environment and content.

A social dimension of the learning space could be described as a result or a sum of organisation and operation of objects (including technological) or subjects and their interrelationships that exist together [54]. Therefore, a learning space could be observed as a multidimensional construct related to the theories in the realm of adult education, which is collaboratively construed in a process of co-creation by the interplay of relationships of learning parties, object and environment. The ever-evolving character of relationships and interactions of a learning space bring about constant changes of the space [2], especially a state of continual transformation of the social dimension.

2.2 Technologies with the Potential to Disrupt Learning

In an era where technology has permeated many aspects of our lives, its role in education is becoming increasingly pivotal, bringing about opportunities for transforming learning experiences. The transformations can be of sustaining or disruptive nature, respectively improving existing processes or rearranging processes [55], depending on the choice of technologies and their role in the learning process.

Danneels [56] discusses the moment a technology becomes disruptive and whether it represents a certain technological change. According to Hopster [57] disruptive technologies create an external disturbance or destruction on markets and businesses while having an effect on "social relations, institutions, epistemic paradigms, foundational concepts, values, and the very nature of human cognition and experience". While the term *disruptive technologies* stems from the field of technology that creates a change within the performance metrics and competition of companies [58], in education and higher education, disruption entails the change that technologies bring into existing methods, ways of communication, learning and teaching materials and learning efficiency, which has a direct influence on the entire educational system [59]. Therefore, disruptive technologies affect not only the social dimension of a learning space [52] but break norms in socio-technical systems that take on human qualities or capacities (such as reasoning, agency etc). The degree of disruption might vary depending on the social context and group along with the specific potential of technologies themselves [57].

In higher education, some of the technologies with the potential to disrupt learning include multimedia technologies like virtual reality (VR), augmented reality (AR), extended reality (XR) as well as technologies integrated or adapted to learning such as artificial intelligence (AI) and chatbots. These technologies have the capacity to create opportunities for e.g. practice-based learning, simulations, collaborative learning or working with objects in 3D settings [60] [61] when integrated into teaching and learning processes. Regarding technologies with the potential to disrupt the social dimension of a learning space, we have chosen four types of technologies (AR, VR, AI and a telepresence robot) for analysing the value space surrounding the integration of these technologies.

The values emerging from learning with disruptive technologies might be in the case of AR and VR engagement, interactivity, visualisation, safety of practising, gamified learning experiences, adaptability for individual needs, immersion etc. [62]. Integration of AI tools might exhibit qualities such as effectiveness, tutoring support, feedback, automatisation, inequity, privacy, ethics, empowerment, well-being etc. in learning situations [63][64]. Concerning the integration of telepresence robots, former studies [65][66] highlight accessibility, presence, engagement, adaptability, empathy and social connection among others as values surfacing in learning spaces. Knowing that technology has already changed our perception of learning spaces [7] it leaves us with the question about the nature of the changes technologies have brought about in regards to learning space construction. Evaluating the perceived changes of a learning space, we offer a value-elicitation perspective to analysing learning situations.

2.3 Values Related to a Learning Space Disrupted by Technologies

Values can be seen as guiding criteria for evaluating behaviour, processes and results which can be attributed to or categorised as individual, group, community values or to general cultural values, indicating the context for the construction of values. Regardless of being individual or collective, the values become evident in social interactions of groups either with the help of deliberative, non-deliberative or psychometric methods. [67] It can be inferred that values are constructed between people and can be attributed to certain people or groups. In the case of a learning space disrupted by technologies, we are able to determine the values of participants in the context of learning space construction (learners, learning facilitators, educational technologists etc.).

As educational institutions and processes unite groups of people as well as a general culture, the institutions are carrying certain values which have an effect on the learning space within them. While learning space design is often motivated by the goals or values of educational institutions [68] the possible effects of disruptive technologies on the construction of learning spaces, the enhancement or disruption resulting from this integration is evaluated by learning parties involved in it. Due to the non-neutral nature of technologies [69] educators as well as learners are bound to raise questions about the values that technology integration might entail for the learning space. In contrast, [8] argue that technologies are in a symbiotic relationship with space and pedagogy and rethinking teaching philosophy might disrupt learning in learners' experiences rather than the choice of technologies.

Values help not only to understand the role and influence of technologies in a learning space but provide insights to making meaningful and conscious decisions on technology usage and integration in all walks of life [69]. Knowing that technologies affect individual and collective behaviour in communities [69] they must also play a role in shaping learning processes. Furthermore, awareness on the base values of learning space design processes aids the possibility of shedding light on the perceptions of “learner agency, privilege, and the role of technology”[70]. Therefore, value-centred approaches to learning space construction aid well thought out decisions about the effects of technology integration to the social dimension of a learning space. Furthermore, just like design processes contribute to the integration of desired values for a space or a system [71], these approaches might contribute to construction of the desired social dimension of a learning space.

Learning and teaching mediated by disruptive technologies raises questions about the benefits and potential harms of it as technologies are not neutrally constructed. In general, social processes are based on and reflect on values making these also part of a learning space. The ethics and base values are seldom clearly considered in a learning design process [70]. Therefore, using the value elicitation approach enables us to study

whether disruptive technologies support creating supportive learning spaces or rather contribute to the obstruction of the social dimension of a learning space. Building on the ground principles of a supportive social dimension of a learning space we aligned them with some of the possible disruptions or qualities that technologies bring into the learning space (Table 1).

Table 1. Possible values disruptive technologies bring about in the supportive social dimension of a learning space.

Disruptive technology	Value	Supportive characteristics of the the social dimension of a learning space in adult and higher education
VR & AR	engagement	social engagement; social practices on group; classroom and community levels
	interactivity	interpersonal process (interactions, dialogue, participation)
	practising safely	learners are able to improve interactional skills
	adaptability	unpredictability of interactions; facilitator adjusts to the physical space; the experiences and needs of learners ought to be considered
	immersion	connection to human experiences; participation in communities
AI	effectiveness	undergoing a transformation
	support	learner-centred scaffolding
	feedback	agreements between learning parties
	inequity	collective knowledge construction process (to avoid inequity)
	privacy	role of former experience in the learning process; unpredictability of the interactions

	empowerment	shared culture; shared roles and responsibilities; becoming a self-directed learner
	well-being	a common goal; agreements; holistic view towards teaching and learning
Telepresence robot	accessibility	all learning parties have agency to shape the learning space; participation in communities
	presence	active participation in learning activities; connection to human experiences
	engagement	social engagement and shared experiences
	adaptability	unpredictability of interactions; facilitator adjusts to the physical space
	empathy	turning attention to learners interests, values and feelings; acknowledging influence of learners in a learning space
	social connection	learning is a communal activity shaped by interactions; dialogue

3 Research Arrangement

We designed a group interview-workshop method for data collection, specifically designed to systematically elicit associations between learning scenarios involving the integration of disruptive technologies and a predefined set of values. Data collection was conducted within the framework of Horizon Europe project (HORIZON-CL2-2021-TRANSFORMATIONS-01) e-DIPLOMA (Electronic, Didactive and Innovative Platform based on Multimedia Assets) and collected from all project partners in seven countries: Bulgaria, Cyprus, Estonia, Hungary, Italy, the Netherlands and Spain. In each country a group-interview-workshop was facilitated for collecting data, besides Estonia where two workshops with different participants were conducted. Data collection took place over the course of February-March 2023.

In each workshop, the participants were divided into focus groups and provided with one out of four learning scenarios to get acquainted with. Next, the participants

were presented with 45 designed value cards (e.g. *flexibility: the quality of agents or systems adapting or responding to internal or external changes*) from a value-elicitation toolkit developed by Pärnpuu [71] to aid design processes focused on the integration of chosen values into systems. The toolkit was originally developed with an intention to understand and navigate inclusion in socio-technical systems and to design systems integrated by emerging technologies to express certain values mindfully [71] which aligned with the aim to explore the value perspectives in this study. By providing participants with a structured approach for prioritizing values, it enabled critical reflection and helped to connect abstract concepts (values) to practical application in a specific situation. Each value card presented one value with its meaning explained. Participants were instructed to choose 5-8 values out of 45 as well as to write down exemplary sentences to show the association between the scenario and the selected value. If they thought of a value not included in the value cards, they had a possibility to write down a new one. Participants submitted their responses as a group anonymously via Google Forms.

3.1 Learning scenarios

First scenario used virtual reality (VR) for fire extinguishing training for practicing the right approach and creating situational awareness (referred to as "VR scenario"). The second one consisted of using artificial intelligence based tools for measuring learners` physiological arousal in a physics lesson for monitoring collaborative learning (referred to as "AI scenario"). Third learning scenario used augmented reality in a cooking class delivered over Zoom to learn about food bacteria (referred to as "AR scenario") and the fourth scenario applied a telepresence robot for mediating learning a foreign language (referred to as "telepresence scenario"). All scenarios were adapted based on examples of former research [72, 73, 74, 75].

3.2 Sample and ethical considerations

The sample consisted of students from higher education as well as lecturers, educational technologists and learning designers from Estonia, Spain, Cyprus, Netherlands, Hungary, Bulgaria and Italy. From all of the countries, 26 groups of 2-5 people were formed. Participation in the study was voluntary and participants were asked to read through and sign informed consent forms prior to the start of the workshop. The study was approved by the ethical committees of each institution carrying out the data collection process. No personal data was collected in the data collection process.

3.3 Data Analysis

For data analysis, we applied qualitative content analysis [76] to answer the research questions. Firstly, the example sentences were coded *in vivo* by two researchers. The codes were then organised inductively into categories and subcategories. Once the categories and subcategories for the whole learning space were identified, the researchers approached data deductively, comparing the categories, subcategories and codes to the characteristics of the social dimension of the learning space. The subcategories not related to the social dimension were left aside and then the authors read each sentence next to the value it was connected to and assessed if the value had either positive, neutral or negative connotations. The prerequisite of the assessment was the leading question of whether learning with disruptive technologies is perceived to be supporting or hindering learning. As all of the authors are designing and facilitating learning, the lens used for such assessment was made from the perspective of preparing and facilitating learning.

4 Results

The study provides the opportunity to display the unique characteristics attributed to the learning situations by facilitators, educational technologists and learners that have not emerged or not been described in former studies. Data analysis revealed eight categories representing the values related to the whole learning space: learner´s educational needs, learning management, intrapersonal qualities related to learning, arrangement of the learning space, emotions related to learning, interpersonal qualities related to learning, resources for learning and sustainability of learning. However, in presenting the results we are focusing on the subcategories and respective values of the eight categories that emerged related to the social dimension as shown in Table 2.

Table 2. Categories and subcategories with respective values related to the social dimension of learning

Category	Subcategory	Values
Learner´s educational needs	Physical issues	accessibility
	Mental issues	adaptability, vulnerability, protection

Learning management	Communication	accessibility, autonomy, connectivity, consensus, continuity, fairness, flexibility, involvement, trust, vulnerability
	Learning process	accuracy, common sense, equity, individual and collective agency, trust
	Learning possibilities	agility, autonomy, engagement, inclusiveness, privacy, surveillance,wellbeing
	Inclusivity	accessibility, equity, responsibility, wellbeing
	Support for learners	empowering, empathy, flexibility, surveillance, wellbeing
Intrapersonal qualities related to learning	Facilitator´s readiness	accessibility, coercion, flexibility
	Learner´s readiness	autonomy, challenging, effectivity, empowering, individual and collective agency, insightfulness, participation productivity, responsibility
	Learner´s agency	autonomy, control, inclusivity, involvement
Arrangement of learning space	Controlled environment	coercion, confidentiality, control, flexibility, privacy, trust, vulnerability
	Safe environment	agility, confidentiality, reliable, resilience, respect, surveillance, vulnerability
	Interactive environment	autonomy

Emotions related to learning	Emotions	control, dignity, individual and collective agency, reliability, satisfaction, surveillance, trust, vulnerability
Interpersonal qualities related to learning	Collaborative learning	connectivity, consensus, efficiency, enhancement, empowering, power-sharing, responsibility
	Relationships	equity, relationships
	Learning from others	coercion, empathy
	Social Agreements	respect
	Social expectations	coercion
	Power relations	responsibility, power–sharing
Resources for learning	Spatial resources	accuracy
	Technological resources	adaptability, flexibility
Sustainability of learning	Sustainable learning	effectivity, wellbeing

The values are introduced according to the eight categories by bringing out the manifestation of the social dimension in the subcategories of each category, focusing on the positive, negative or neutral meanings of most distinctive examples.

4.1 Values related to learner´s educational needs

Learner's needs as a category is described by two subcategories: physical issues and mental issues. Mental issues were related to the value of *vulnerability* in case of mental impairment and emotional wellbeing, emerging related to the AI scenario:

Emotional wellbeing is disturbed.

The *vulnerability* of the learners was possibly considered in relation to providing data about their arousal, which might disturb them. However, the subcategory was also described by physical and mental impairment associated with *adaptability* in the context of the AR scenario:

the student can be home due to illness, distance, disability etc, and still be able to participate in the lesson.

as well as mental safety related to *protection* in VR scenario:

It is important for everyone's mental safety to be ensured.

Here the disruptive technologies were considered to support the learners with educational needs. Nevertheless, the value of *accessibility* was negatively associated in regard to the subcategory of physical issues, indicating the possible exclusion of learners due to special needs in the AR scenario:

It doesn't come out how special needs (hearing impairment, visual impairment, ATH) are taken into account.

Learners' physical and mental educational needs had, therefore, mostly negative connotations to values of *accessibility* and *vulnerability*. On the other hand, disruptive technologies seemed to provide support for the social dimension of the learning space based on the values of *adaptability* and *protection*, indicating the need to take care of the wellbeing of all the learning parties.

4.2 Values Related to Learning Management

The category is described by five subcategories: communication, learning process, learning possibilities, inclusivity and support for learners. Communication subcategory was perceived in relation to the value of *continuity* in the telepresence scenario:

Telepresence allows continuous communication with people abroad, which allows for longer contact than, for example, exchanges that are usually made for a limited time range.

The positive connotation of connecting learners was recognized through the *autonomy* of learners to interaction with their peers as well as interacting with the environment. Similarly, *involvement* emerged related to providing channels for communication for the learners and the opportunity of a telepresence robot to create *trust* by conveying body language to learners. Values like *connectivity*, *consensus* and *vulnerability* were perceived to be neutral in terms of communication in a technologically enhanced social dimension of a learning space. Nevertheless, *fairness* of data application was questioned in the case of AI scenario:

It is not clear how the teacher, given collected data, applies this data in a manner that remains fair.

Communication subcategory in a disrupted social dimension had mixed connotations from the perspective of learning facilitators. From the subcategory of learning process the value of *common sense* stood out in the AI scenario, referring to teacher´s ability to measure the success of learning based on tracking data:

> *Teachers should take feedback data with a grain of salt, and use it as a guide to enhance natural cooperation between students and teachers, not as a silver bullet for measuring the success of teaching.*

This was perceived as a possible negative impact as teachers might be relying too extensively on the collected data. However, the role of AI tools in the same scenario was observed to be a positive opportunity for objective assessment and related to the value of *equity*:

> *The initial assessment comes from an AI that is not influenced by the teacher's emotional background in relation to the student.*

Therefore, the subcategory displays the ambiguous perceptions of values related to using disruptive technologies in a learning process. *Individual and collective agency*, *common sense*, *trust* and *accuracy* appeared in connection with the subcategory and were mainly indicating negative traits that disruptive technologies can bring about, e.g. overestimation of learner´s abilities or a need for accurate behaviour to receive relevant feedback.

The subcategory of learning possibilities shed a positive light on the integration of disruptive technologies. For example, concerning the value of *wellbeing,* empowerment of the learner was reflected by possibility of participating in learning using the robot in the telepresence scenario:

> *If the student is forced to stay away from study for a longer period of time, then participating in the study through a robot offers him satisfaction (there will be no lag behind).*

Additionally, the value of *engagement* surfaced from the VR scenario as a good example of creating several ways of engagement:

> *It is possible to look at the participant in VR glasses and be involved even without glasses, giving advice, this creates a situation from several points of engagement.*

On the contrary to the overall perceived positive tone of the subcategory related to *agility* of diverse learning activities, learners *autonomy* on receiving feedback and *inclusiveness* related to participation in learning, the value of *surveillance* surfaced in relation to the AR scenario, indicating the possible discomfort of the learning situation for some learners:

> *It may not be suitable for everyone to act before the eyes of others, including their own group members.*

On the other hand, *surveillance* emerged in the subcategory of support for learners as an aid to the teacher in the AR learning scenario:

> *Surveillance could be ensured by chatbots, too, if the number of students is too high compared to the number of teachers.*

The subcategory had an overall positive connotation, noting the values *empowering*, *flexibility* and *empathy* as qualities surfacing in relation to the social dimension of a learning space. The same applies for the subcategory of inclusivity, where *accessibility* emerged in relation to learners´ access to education in the case of VR, AR scenarios as well as the telepresence scenario:

> *From the student's point of view, he will have the opportunity to participate in the activities of the lesson and participate directly in the study, which he will not have in the absence of a robot.*

Equity was connected to the disruptive technologies offering equal access and learning experiences. In contrast, *responsibility* was associated with the increased obligation for learning designers in creating services and devices aiding learning. The value space emerging from the category was related to the positive qualities of a technology-integrated social dimension of a learning space, associated with the values of *flexibility, empathy, autonomy, accessibility, empowering, equity* etc. Critical perception or negative connotation of learning management disrupted by technologies was conveyed through the values of *responsibility, surveillance, accuracy, fairness, individual and collective agency*, and *vulnerability*. *Trust, consensus,* and *connectivity* were perceived to have a rather neutral connotation in terms of learning management.

4.3 Values Related to Intrapersonal Qualities Related to Learning

Intrapersonal qualities related to learning as a category was described by subcategories of learner´s readiness, facilitator´s readiness and learner´s agency. A negative perception related to the value of *coercion* in the subcategory of facilitator´s readiness is exemplified by the AI scenario:

> */.../ in order to overcome resistance from students/parents they should be prepared in advance.*

Equivalently, *accessibility* surfaced in connection with high demands for the learning facilitator in using disruptive technologies such as VR. However, adapting to learners' needs with the help of disruptive technologies was perceived to be supportive of facilitators readiness, indicated by *flexibility*.

Regarding the subcategory of learner´s readiness, *individual and collective agency* had a negative connotation in terms of being prepared to learn with disruptive technologies in the VR scenario:

> *Overestimation of one's own abilities might occur or unrealistic dependance of the collective.*

Similarly, the value of *effectivity* was associated with the telepresence scenario in relation to creating a disturbance in a learning process:

> *Potential distraction from learning.*

The subcategory included values like *autonomy* and *empowering, noting* negative connotations related to the time-consuming nature of learning, and requirements for preparation of learning. Furthermore, learner´s readiness was connected to the value *challenging* in the meaning of needing to be open to failure and *responsibility* regarding the possibility of experiencing learning as a game in the VR scenario:

> *VR is a game .. Use it seriously.*

On the contrary, in the subcategory of learner´s agency the value of *involvement* indicated a higher possibility of learners´ involvement:

> *A simulation provides more involvement than "just" a theoretical introduction.*

The value of *inclusivity* was associated with the AR scenario regarding equal participation:

> *it enables each of the learners to participate equally with ideas and activities.*

Additionally, *autonomy* was perceived to be supportive of the learners ability to try their own strategies.

Both subcategories of facilitator´s readiness and learner´s readiness were associated with considerable time contribution and effort from all learning parties as a precondition for learning with disruptive technologies. Values like *coercion, individual and collective agency, effectivity, empowering, autonomy, challenging, responsibility, productivity and participation* emerged with mostly negative, in some cases neutral implications of the impact disruptive technologies have on the social dimension. However, the subcategory of learner´s agency conveyed that disruptive technologies might support the learner in gaining agency in such learning spaces, indicated by the values *involvement, autonomy* and *inclusivity*.

4.4 Values related to the arrangement of the learning space

The category arrangement of the learning space is described by subcategories of controlled environment, safe environment, and interactive environment. Controlled environment was on several occasions associated with the value *confidentiality,* described by accessibility and misuse of data, legal compliance and control over sensitive information in the case of the AI scenario:

> *Deeply personal biometric data is utilised. The acquired data should be restricted for classroom use only. Students should have control over what parts of their conversations are recorded.*

Similarly, value of *control* appeared to have a negative connotation in the AR cooking class scenario, with teacher having control over the learning situation:

> *Control is in the hands of the lecturer from what the learner sees and hears, with whom he gets into the same room.*

Controlled environment was associated with *coercion* in the VR scenario, illustrated by supervisor controlling and forcing the participant:

> *Supervisor VRs have too much control, forcing the participant to enter an unpleasant situation.*

Issues of the facilitator´s control over the learner were expressed negatively through values of *confidentiality, privacy, trust, vulnerability* and *coercion* regarding accessibility to sensitive data and legally compliant data management. The subcategory opposite in the meaning – safe environment – was described by safety, personal boundaries, controlled conditions without physical risk, practising distressing situations in a safe environment. Again the value of *confidentiality* emerged, this time in a positive light related to the feeling of safety in the AI scenario:

> *The confidentiality of the discussion is guaranteed because it is available to the teacher*.

Similarly, using VR for practising real life distressing situations in a safe manner brought about the addition of the value *reliable* by the workshop participants, described as following:

> *VR allows you to practise in controlled conditions, it allows you to be more confident in a real situation, /.../ that everything important will be responded to. Improvement and training of skills without physical risk.*

Physical safety of learners associated also with *agility* and *resilience*, was contrasted with the mental safety of the teacher through the value of *vulnerability*, in connection to the teacher becoming a possible subject of cyberbullying. Data analysis revealed concerns about the ethicality of learners´ behaviour related to using a telepresence scenario:

> *the teacher is not protected from cyberbullying (e.g. a robot has a magnifying function that can zoom in on a person in a big way). Students can feel more "bold" as robots and indulge in more than is ethical.*

Learning space integrated by disruptive technologies was considered a safe environment, which offers the learner a sense of *respect* by being able to sustain personal boundaries. Nevertheless, *surveillance* emerged in relation to the inconvenience of being observed. As a distinct subcategory, interactive environment stood out, related to *autonomy* in a positive meaning and described by interaction with the environment in the context of learning with the telepresence robot:

> *The user has the option to interact with the environment.*

Arrangement of the learning space as a category had emphasis on the *control* and safety that participants perceive in relation to the learning environment. Social dimension of a learning space enhanced by disruptive technologies is associated with the value of *confidentiality* at times offering opportunities for it and in other cases posing questions related to sensitive data. *Autonomy, agility, resilience* were reflecting the positive aspects of integrating disruptive technologies while *surveillance, vulnerability* and *privacy* indicated the uncertainty of the integration on protection of data or from cyberbullying.

4.5 Values Regarding the Emotions Related to Learning

The category is manifested in one subcategory: emotions. The subcategory was described by the sense of inferiority, feeling bold, getting scared, negative emotions related to learning experience, enjoyment, personal satisfaction, confidence, enhancing confidence and lack of security. *Surveillance* emerged in connection with negative emotions related to learning experience in the AI scenario:

> *As conversations are recorded, the student feels pressured to speak (or not speak at all) and over their use of language - not feeling at ease.*

Controversially, *surveillance* was found to be positive and described by enjoyment in the AR scenario:

> *The use of technology can make the class more dynamic so the student enjoys the teaching and pays more attention.*

Dignity was associated negatively with the sense of inferiority in the VR scenario:

> *it can also hurt the way someone performs the task, people may experience a sense of inferiority from it.*

Values of *trust* and *reliability* emerged in relation to feeling bold or confident in the VR scenario, highlighting the role of the technology positively:

> *Practising in a virtual environment can provide self-confidence to solve the problem.*

On the contrary, description of feeling bold got a negative meaning in relation to *vulnerability* the telepresence scenario:

> *Students can feel more "bold" as robots and indulge in more than is ethical.*

Therefore, a feeling of confidence when learning with disruptive technologies is perceived simultaneously as a positive and negative attribute of the social dimension of a learning space. Value of *individual and collective agency* emerged unfavourably from the VR scenario, described by the learner getting scared. Similarly, lack of security described the value of *control* in the case of the AI scenario:

> *As a result, the learner no longer feels comfortable - the learner's lack of security and the data are not reliable.*

In the AR scenario, the value of *satisfaction* surfaced, conveying the individual contentment of a learner:

> *Each of the learners has the opportunity to practise self-reflection on their own achievements, which creates prerequisites for personal satisfaction with the process.*

Emotions related to learning show the dual nature of the impact of disruptive technologies on learners' emotions, highlighting both the positive connotations to values, such as *trust*, *reliability*, but also *surveillance*, along with the negative meanings to values, such as *dignity*, *vulnerability*, *individual and collective agency* and *control*.

4.6 Values in Interpersonal Qualities Related to Learning

Data analysis revealed the category of interpersonal qualities related to learning which is divided into six subcategories: collaborative learning, relationships, learning from others, social agreements, societal expectations and power relations. The subcategory of collaborative learning emerged in relation to the AR scenario, associated with the value of *empowering* and described by group collaboration:

> *The group process of strangers or little-collaborated learners (group collaboration) takes more time virtually than being physically together.*

Even though the value has a positive connotation linguistically, the time-consuming nature of group work in the scenario was perceived negatively. Values *efficiency* and *enhancement* described positively the opportunity of a group work experience while *responsibility*, *connectivity* and *power-sharing* transpired the neutral connotation working in groups by distributing the roles and responsibilities. It is important to note that the subcategory of collaborative learning might have emerged due to the collaborative nature of learning activities in the learning scenarios.

Relationships as a subcategory came up in the telepresence scenario due to a connection with the value of *relationships* which participants added to the list of existing values:

> *A great way to build relationships between learners and have a more social aspect in language learning.*

This reflects on the perceived positive impact of disruptive technologies on forming the relationships within the learning space alike to perceived *equity* in the relationship of the learner and facilitator in the AI scenario. A beneficial role of technologies was also recognised in the subcategory of learning from others, described by peer learning related to the value *empathy* in VR scenario*:*

> *Empathy of monitoring agents towards the trainee lets them learn and put themselves in the trainee's place.*

On the other hand, *coercion* was likewise connected to learning from others experience:

> *A forced situation in front of other players can generate ratings; lessons can be learned from the experience of others.*

Observing the learner with VR glasses is interpreted as a possible learning resource for the whole group as well as a way of drawing unwanted attention to the learner. Similarly, the impact of AI tracking tools in a learning situation brought about the subcategory of power relations and the value of *power-sharing* from an unfavourable perspective:

> *The teacher has a great information advantage, and power over the students.*

Responsibility was associated with power relations through obeying the instructions for a supported learning experience in the example of VR scenario. Importantly, the subcategory of social agreements arose from analysis in regards to *respect* emerging from shared agreements in the VR scenario:

> *mutual respect is promoted, since each person shall respect its own rights and boundaries but also the people around them.*

The value space of the category of interpersonal qualities related to learning consists of increased *efficiency*, *enhancement* of group work experience, possibility of building *relationships* and ensuring *equity* in the relationship of a learner and a facilitator. In addition to those foundational values for a supported social dimension of a learning space, applying *empathy* when learning from peers and mutual agreement of *respect* were indicated as supportive of learning with disruptive technologies. On the contrary, *power-sharing* and *responsibility* were associated with power relations. *Coercion* to be observed in the learning situation and the *empowering* but nevertheless time-consuming process of group collaboration described the negative connotation of disruptive technologies on the social dimension of a learning space.

4.7 Values Related to Resources for Learning

The category of resources for learning consists of two subcategories related to the social dimension of the learning space: technological resources and spatial resources. The value of *flexibility* emerged in technological resources subcategory, referring to the positive attribute of connecting learners with each other in the telepresence scenario:

> *By connecting to a device we can easily reconnect*

as well as through the ability to respond to changing conditions in the AR scenario:

> *Technology allows you to quickly respond to unexpected changes.*

Similar attribute was highlighted positively in regards to *adaptability* the technology conveys in the learning spaces by creating changes in the physical dimension of the learning space. The subcategory of spatial resources was described

through *accuracy*, indicating the positive consequences of learning associated with in the AR scenario:

> *It is possible to use creativity/humour to illustrate the "consequences/dangers" (potentially increases memorization).*

Technological and spatial resources of a learning space were regarded as solely enhancing the social dimension of a learning space. The enhancement of disruptive technologies manifested in the values of *flexibility, adaptability* and *accuracy*.

4.8 Values Related to the Sustainability of Learning

Sustainability of learning was construed in the analysis process by only one subcategory: sustainable learning. Regarding the social dimension of a learning space, the value of *wellbeing* was connected to teachers contentment arising from a more sustainable use of their time in the telepresence scenario:

> *The satisfaction of the teacher is supported by the fact that it does not require additional obligations from the teacher /.../ The teacher in this case also wins in time.*

Social dimension was also touched upon from the learners perspective related to the value of *effectivity* in the telepresence scenario:

> *At the environmental level you can be anywhere without having to travel.*

Disruptive technologies were perceived to support the sustainability of the social dimension of a learning space in regards to the learning parties, associated with the values of *well-being* and *effectivity*.

5 Discussion and Conclusions

In order to study the influence of disruptive technologies on the social dimension of a learning space, we took a lens of values to explore the implications of technologies to the social dimension. The research questions focused on the values perceived to have a connection to the social dimension in the understandings of learners, learning facilitators, learning designers and educational technologists and which of these values could support or hinder the knowledge construction process. Considering the importance of the social dimension on the learning experience [31][32][33] we identified the general aspects of the social dimension construction and aligned them with possible qualities or values that disruptive technologies would transmit to a learning space. The study added to the list of values that emerged related to the social dimension, but also mirrored the results of former studies [62][63][64] regarding *engagement*, *interactivity*, *effectiveness*, *empowerment*, *accessibility* and *empathy* that

disruptive technologies could induce in the perspectives of learning parties. Thereby, learners' social engagement, participation and dialogue, shared roles and responsibilities, considering learners interests and feelings as well as being able to participate in learning were perceived important and present in the social dimension. However, *accessibility* to learning spaces enhanced by disruptive technologies was questioned in case of learners with physical impairment and skill requirements for facilitators in working with those technologies.

Values identified in former studies such as *privacy* [63], but also *vulnerability*, *trust* and *coercion* often referred to the invasive nature or usage of disruptive technologies in learning situations, possibly hindering the construction of a supportive social dimension due to the lack of attention on the feelings and emotional well-being of the learner [50]. These values might also represent Weinberg´s [69] position on the biassed nature of technologies as the functionalities of those technologies enable certain actions for learners and learning facilitators in a learning situation. Therefore, these values manifest directly in the construction of the social dimension through power dynamics created by the positioning of the learning parties – whether they perceive to have *control* over the technology (e.g. *vulnerability* to cyberbullying) or loss of *control* (related to *privacy* in case sensitive data is collected) or if the technologies ensure neutral assessment (*trust*). Technologically integrated social dimension of a learning space seems to express the hierarchical formal education context, indicating the interrelation between the social and power dimension [6].

The social dimension of a learning space is based on the results possibly hindered in case the *wellbeing* of learning parties is not guaranteed or learning parties are confronted with the value of *surveillance*. The social dimension enhanced by disruptive technologies was perceived as supportive of if the emotional state of the learning parties would be ensured, in regards to facilitators time resources and learners ability to participate in learning. Based on the findings, *surveillance* might occur in relation to the learner being observed or coerced to perform actions due to them being recorded though the value was also perceived to be helpful resource for the teacher in case of many learners in need of support.

The findings from analysis show that *adaptability* and *flexibility* are closely linked with facilitators approaches towards the construction of the learning space as well as the compatibility of technologies to learners' educational needs. Disruptive technologies seem to provide learners with more *autonomy* in their interactions, opportunities for receiving feedback (e.g. from AI) and choosing their own strategies which is considered to be a positive phenomenon in the understanding of the learning parties. Value of *reliability* aligned with the study of AlGerafi et al. [62] as findings confirmed that disruptive technologies enable the possibility of practising safely in the understanding of learning parties. Furthermore, *equity* was associated with disruptive

technologies, enabling equal access to education with equal learning experiences and perceived to diminish power dynamics between learners and facilitators. Additionally, disruptive technologies seemed to support the emergence of *respect* related to the social dimension of a learning space by ensuring personal boundaries and generating mutual respect. As stated by Gray & Boling [70] the *agency* of the learner was highlighted through the lens of values as disruptive technologies seemed to encourage the involvement and participation of the learner in the construction of the social dimension of the learning space.

In order to construe a supportive social dimension of a learning space enhanced by disruptive technologies, we recommend to ensure the awareness of all learning parties about their agency to learning space construction. We suggest that there are foundational values related to a supportive social dimension of the learning space facilitating the meaningful learning in higher and adult education, which empower the experiences and needs of the learner while supporting the birth of collaborative, interactive and participatory practices. Educators in higher and adult education ought to consider *accessibility*, *autonomy*, *adaptability*, *empathy*, *engagement*, *individual and collective agency*, *responsibility*, *respect* and *trust* in preparing and designing teaching and learning activities. Critical attention ought to be given to the risks related to learners' *wellbeing* and, hence, *confidentiality* and *vulnerability* of the learner. Nevertheless, the list is not extensive and other values might be considered more important depending on the type of technology and learning activity while the choice of technology and learning space construction should always correspond to the needs of the learners. Future studies could focus on the impact of specific technologies on learning spaces by alternative research designs of both qualitative and quantitative nature. Furthermore, the results of this study could lay the ground for future studies on the nature of learning ecosystems in the light of changes in educational paradigms and technological developments.

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