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Exploring Value and Ethical Dimensions of Disruptive Technologies for Learning and Teaching

Terje Väljataga[1]([✉]) , Kai Pata[1] , Andrea Annus[1], Michelle Andrade Calisto[2] ,
Agueda Gomez Cambronero[2] , Elmar Eisemann[3] , Athina Kasini[4],
Ricardo Marroquim[3] , Inmaculada Remolar[2] , László Szécsi[5] , Amir Zaidi[3] ,
and Rubén García Vidal[2]

[1] Tallinn University, Narva mnt 25, 10120 Tallinn, Estonia
terje.valjataga@tlu.ee
[2] Universitat Jaume I, Castello de la Plana, Comunitat Valenciana, Spain
[3] Delft University of Technology, Mekelweg 5, 2628 CD Delft, Holland
[4] Center for Social Innovation, 62 Rigenis Street, 1010 Nicosia, Cyprus
[5] Budapest University of Technology and Economics, Műegyetem rkp. 3, Budapest
1111, Hungary

Abstract. Disruptive technology has become an integral part of our lives, and it has brought about a significant transformation in the way we interact, communicate, and share information, also in the field of education. Innovation in technology needs to be based on ethics and values of the intended result. As the use of disruptive technology continues to grow, so does the need to understand and consider ethical and value dimensions. How can disruptive technology be developed and used in an ethical way for learning and teaching? What are the values the development and implementation of disruptive technology for education should take into account? How to measure and evaluate values and ethical dimensions of disruptive technology for educational purposes? Are some of the important questions to address. This workshop paper presents a method for eliciting values and ethical dimensions of learning scenarios with disruptive technologies in vocational and higher education settings and illustrates its implementation in the context of the Horizon Europe e-DIPLOMA project. The workshop method, combining value cards and learning scenarios with disruptive technologies, was implemented in seven different countries. The preliminary results of the workshops are presented. The method has the potential to draw peoples' attention to prospective value concerns and ethical aspects necessary for understanding and acknowledging the consequence of implementing disruptive technologies in education.

Keywords: Disruptive Technologies · Value Elicitation · Ethics · Higher Education

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1   Introduction

Technology has been and will be constantly evolving and developed further disrupting all levels of society, institutions, existing processes, social relations, values and the nature of human cognition and experience (Hopster 2021). This opens up new possibilities for improving the quality of life and work, but also brings along a number of threats, questionable values and unexpected conditions. The rapid development of disruptive technology challenges ethics and values, creating a situation in which social and ethical norms often struggle to keep up with technological development (Kritikos 2018). Without a question, there is a need to reconsider ethical and value aspects of emerging technologies, some, which have recently arisen, not been under focus or even thought of in earlier times. Among some others, particularly sensitive towards technological developments is the field of education, especially learning and teaching with disruptive technologies. Disruptive technologies refer to an innovation that displaces an established technology transforming traditional approaches and significantly altering existing ways of learning and teaching, therefore, having a potential to change the current understanding of education. Opening a discussion on ethical and moral values of constantly emerging disruptive technologies that are used for educational purposes has of utmost relevance in the midst of ever growing smart algorithms, constantly developing machine learning, data sets of digital traces and big data analytics, artificial intelligence, smart sensors, etc. (WCO 2019). Consequently, it is important to raise the questions such as How can disruptive technology be developed and used in an ethical way for learning and teaching? What are the values the development and implementation of disruptive technology for education should take into account? How to measure and evaluate values, ethical dimensions and sustainability of disruptive technology for educational purposes?, but also provide evidence-based solutions. This workshop paper presents a method for eliciting values and ethical dimensions of learning scenarios with disruptive technologies and illustrates its implementation in the context of the Horizon Europe e-DIPLOMA project.

2   Background

2.1   Disruptive Technologies and Ethical Considerations

Some emerging technologies are able to trigger profound changes and disrupt existing structures and norms, others not. The term "disruptive technology" was coined by C. Christensen, who used the term in the context of disruptive innovation theory in business (Christensen 1997). However, being criticized by many scholars (Tellis 2006), this understanding of disruptive technologies is not best suited for ethics because of its theory-laden conceptualisation (Hopster 2022). In recent years "digital disruption" as an emerging concept (Skog et al. 2018) has gained attention and has a potential in the context of ethics as it focuses on technology rather than innovation (Hopster 2022). According to Cambridge dictionary, to disrupt means "to prevent something, especially a system, process, or event, from continuing as usual or as expected". Thus, disruption is usually perceived as a negative occurrence triggered by outside factors (Boucher et al. 2020). Schuelke-Leech (2018) makes a distinction based on the depth and scope of the disruption and classifies disruption as 1) first-order (local market disruptions, certain domains are the only ones experiencing change, while society as a whole is not affected;

ethical issues and values are domain specific); 2) second-order (systematic disruptions at societal scale, technologies' capacity to alter society and individuals). Accordingly, Hopster (2022) in turn divides technologies as disruptive based on their technological features or based on their societal impacts, creating different starting points for assessing ethical issues, but also bringing forth a different set of ethical concerns (Hopster 2022). Thus, according to Hopster (2022) there are two different ethical foci: (1) technology as an agent of social disruption, (2) technology entangled in social disruption. Table 1 below outlines the main differences between these two starting points.

Table 1. Two ethical foci according to Hopster (2022).

	Technology as agent of social disruption	Technology entangled in social disruption
Primary assessment	disruptive potential of technologies	technological disruptions in society
Starting point of ethical inquiry	features of a disruptive technology	technosocial disruptions
Conceptualisation of technologies	in terms of technological artifacts, or fields of R&D and their constitutive techniques	in terms of technological applications, or contexts of implementation
Focus	responsibility of innovators and disruptors	societal response to disruptions

For ethical analysis of disruptive technologies, the aforementioned deviation plays a crucial role, however, evaluating disruptive technologies in the context of education, the focus is usually on technology as an agent of disruption. Nevertheless, depending on the emerging technology that is implemented for learning and teaching may have already been used in other contexts, thus widening its scope, but also its set of ethical concerns.

2.2 Values of Disruptive Technologies

Innovation in technology needs to be based on the values of the intended result i.e., to make our lives better. Technology developers usually have some motives and promise certain values while balancing at the same time between expected values and ethical considerations. While not all emerging technologies will alter the target field or social landscape, some have the potential to significantly disrupt the status quo, reshape how people live and work. In recent years, values as well as ethics have gradually become part of the design process, building on methodologies, such as the value sensitive design approach, ethically aligned design, etc. (Kritikos 2018), which consider values as an important part and aspire to understand the values of the users, ensure that these values are carefully considered and implemented in the design of the technology (Knobel and Bowker 2011). However, there are many interpretations of how value is understood and what kind of values are in focus (be it an economic, human, social, value to the end-user, etc.) (Gilmore et al. 2008). Iversen et al. (2012) claim that "Values have a transcendental quality, guiding actions, attitudes, judgments and comparisons across specific objects and situations and beyond immediate goals to more long-term goals"

(p. 143) or as stated by Borning and Muller (2012) "human values are simply defined as "what a person or group of people consider important in life" (p. 1125). As disruptive technologies continue to progress, there is a need for an increasing set of different values that guide the development and use of technologies.

In general, technology can be used productively or destructively (Weinberg 2019). Incorporation of new technology without considering potential consequences can cause significant societal and cultural shifts and occasionally disrupt already established social and cultural norms (Kritikos 2018). Furthermore, it may challenge our traditional moral understandings and reshape our value assumptions and practices creating ambiguity around what is considered acceptable, normal and ethical behavior (Kritikos 2018). As a result, technology becomes a carrier and even a disruptor of values, compelling individuals and communities to adjust to technology rather than leveraging it to enhance human potential in accordance with societal objectives and customs (Weinberg 2019). Our decisions regarding technology, particularly when made without thoroughly considering their consequences, may contradict our fundamental goals, principles, and values. Media certainly plays its role here through its dominant messages as well as personal experiences with technologies that affect peoples' vision and understanding of the ethics and values of new emerging technologies. Consequently, as individuals, families, communities, and societies, we must contemplate how we create and utilize technological instruments (Weinberg 2019). Furthermore, to guarantee that individuals have capacity to make wise technical decisions and technology is employed in a way that promotes both individual and societal well-being, technological assessment is necessary at all levels of society. These decisions are an expression of social, cultural, economic, political, ethical, and spiritual values (Weinberg 2019). Thus, value-centered design approaches and value elicitation methods are important tools to evaluate value and ethical dimensions of emerging disruptive technologies.

2.3   Value Elicitation Methods

Eliciting values and ethical dimensions of technological disruption, various methods (value scenarios, in-depth interviews, workshops, etc.) have been utilised, each of them with their own advantages and disadvantages. The most common and widespread approach is using cards (Mora et al. 2017). Eliciting values and ethical dimensions of disruptive technologies, cards can facilitate conversation, stimulate the creative exploration of the design space, help the participants to reframe technical problems (Friedman and Hendry 2012), provoke reflective thinking, help participants to initiate and be focused in brainstorming sessions (Fedosov et al. 2019). Another method for eliciting values and considering ethical dimensions of potential activities with the disruptive technologies is to provide scenarios or design fictions (Cheon and Su 2018). Scenarios and design fictions provide a speculative space that helps to envision ways of using disruptive technologies and potential emerging value and ethical issues. They can help to focus attention on value tensions, and longer-term societal implications that might otherwise go unnoticed (Czeskis et al. 2010), support participants to understand the implicit future ethical and sustainability consequences of technology (Blythe 2017). In the context of the e-DIPLOMA project, the value cards were combined with the short description of learning and teaching scenarios supported by particular disruptive technologies.

2.4 e-DIPLOMA Project

e-DIPLOMA (Electronic, Didactive and Innovative Platform based on Multimedia Assets) is a Horizon Europe project (HORIZON-CL2-2021-TRANSFORMATIONS-01) that will examine the current e-learning ecosystems by analysing the usefulness of disruptive technologies (Virtual Reality, Augmented Reality, Artificial Intelligence or Chatbots) to support education and training systems, specifically in practical distance learning; co-create methodology to determine which technologies are the most suitable for dealing with different types of educational methodologies; develop online platform that will integrate artificial intelligence, virtual and augmented reality, interactive technologies and gamification techniques. The project consortium consists of 9 partners, 14 associated partners from 8 different European countries. This project will overcome the weaknesses of the current e-learning by exploring the potential of disruptive technologies applied to the e-learning. It will go a step forward of the current state of art creating high quality content focused on experiential e-learning, an engaged learning process whereby students "learn by doing". The project is mainly addressed to tertiary education or post-secondary education. It is based on experiential learning activities that raise the employability of the students.

3 Method

3.1 Value Elicitation Workshop in the Context of the e-DIPLOMA Project

For evaluating values of disruptive technologies from an ethical and sustainability point of view a value-elicitation method together with the learning scenarios with disruptive technologies was developed. The value - elicitation method is a type of workshop with group interviews, which lasts usually around 2,5 h. The aim of the method is to elicit ethical values and sustainability aspects of disruptive technologies through different learning scenarios and assess potential benefits and vulnerabilities, which might arise from the use of disruptive technologies for learning and teaching. To support and direct workshop participants' thinking and conceptualisation of learning scenarios with new disruptive technologies, value-elicitation cards were created (Mora et al. 2017). Every card has one value with its description. For instance, *Privacy - The state of an agent, asset or system where it regulates its level of openness to external disturbances and relations to minimal* or *Productivity - The quality of agents or systems to efficiently transform inputs into useful outputs.* The chosen set of values was drawn from the literature related to the use of disruptive technologies. A total of 45 value cards were created. Combining value cards with learning scenarios with disruptive technologies brings in the process playfulness and creativity (Lucero et al. 2016) to spark discussion, to expand participants' minds about the existing values and give vocabulary for them to think and talk about ethics and sustainability aspects related to the particular learning scenario and technology. Learning scenarios were presented as short stories consisting of disruptive technology description, objectives and explanations of learning tasks with the particular technology (Fig. 1). For better understanding some visuals and pictures were added. Although fictional, the scenarios were grounded in actual products and learning events derived from and modified from different research studies in the field. For the e-DIPLOMA workshops following scenarios were presented to the workshop participants: 1. Virtual reality

for the fire extinguisher training; 2. Supporting learning progress with AI in physics; 3. Cooking class in zoom with the augmented reality elements; 4. Telepresence robot in foreign language course. An example of the scenario is seen in Fig. 1.

Fig. 1. Example of the learning scenario with disruptive technology.

The research participants were divided into groups of 4–5 people. It was recommended that participants with different backgrounds (students, lecturers, educational technologists) form a group. The reason for these mixed groups is the different perspectives the specific target groups have regarding learning and teaching with disruptive technologies. In the workshop, each group received one learning scenario and a set of cards, read the scenario, sorted through cards, and then selected up to 8 cards that represent values in the technology presented in the learning scenario they were analyzing or should be there, but were missing. There are various ways for groups to approach the task, such as working collaboratively, which involves discussing all cards together, or working cooperatively, which entails dividing the cards among group members. Collaboration format was left for the groups to decide. At the end of this part of the workshop, participants had a selection of values that they thought should be / were present in the learning scenario. Next, groups filled in the worksheet for value descriptions. In each worksheet, the group formulated one selected value and 3–5 sentences how this value relates with the scenario (e.g. with interactions of people, interaction between people and the system, with algorithms, data, at society level). Teams submitted their responses about each selected value separately. Finally, reflective feedback between groups was carried out. Every team introduced orally within 5 min the scenario and explained how the values relate with this scenario. If some new value aspect emerged in the discussion, the team added it to the value analysis (in the worksheet).

3.2 Data Collection and Analysis

7 countries (Spain, Netherlands, Italy, Hungary, Cyprus, Bulgaria, Estonia), the partners of the e-DIPLOMA project, organised their own workshops following the same guidelines and format as described above. The guidelines, value cards and learning scenarios were translated into local languages. Data from the partners was collected according to the learning scenarios, chosen value cards by the groups and group explanations related to the selected value card. All the value explanations were translated back to English for joint data analysis. For analysis, simple descriptive statistics as well as first-stage thematic analysis was used.

4 Preliminary Results of the International Value-Elicitation Workshops

A total of 187 entries were created, of them 58 different values were presented (either from the pre-prepared value cards or new ones added by the participants) and discussed in different groups related to the four learning scenarios with disruptive technologies. According to the learning scenarios, more or less the same number of different cards were chosen, except for one scenario - *Virtual reality* (*VR*) *for fire extinguisher training* - which received 58 entries, the others between 41 and 46. Some trends of mentioning some values more often in specific countries could be observed with the values of *Coercion, Accuracy* and *Accessibility*, but due to the small sample size in the dataset we could not confirm country-specific differences in the values. The most often chosen value was *Accessibility*, selected 13 times for the three learning scenarios except for *Supporting learning progress with AI in physics.* The other more popular values with 7 entries were *Accuracy, Flexibility, Responsibility, Surveillance, Sustainability, Trust,* with 6 entries were *Adaptability, Autonomy, Coercion, Connectivity* and with 5 entries were *Confidentiality, Consensus, Productivity, Satisfaction, Vulnerability.* The rest of the values were selected less often by the participating groups. There was only one value - *Flexibility* - chosen by the participating groups, which seemed to be relevant for all the four learning scenarios. The value dimensions that occurred in at least three scenarios (*Accessibility, Connectivity, Vulnerability, Trust, Involvement, Autonomy, Control, Surveillance, Challenging, effectiveness, Productivity, Accuracy, Sustainability,* and *Satisfaction*) indicate the value perspectives that meant most to people when they saw the learning scenarios with disruptive technologies. A comprehensive birds-eye view on the selected values related to the learning scenarios are demonstrated in Fig. 2.

We also noticed that in the scenarios of *Telepresence robots in foreign language course* and *Supporting learning progress with AI in physics* were more concern-related values, such as *Trust, Vulnerability, Equity, Fairness,* and *Autonomy*. However, the negatively connotated values such as *Confidentiality, Privacy, Coercion, Control* and *Surveillance* were also perceived in regards to scenarios with augmented reality (AR) *Cooking class in zoom with the augmented reality elements* and virtual reality (VR) *Virtual reality for the fire extinguisher training*, and not only with the scenario with AI *Supporting learning progress with AI in physics.* The participants' explanations and rationale for selected values varied. For instance, *Disruption*, usually evaluated as a negative occurrence, was
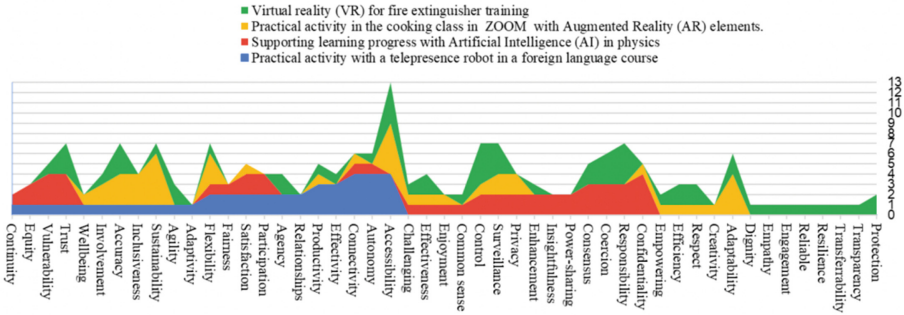
■ Virtual reality (VR) for fire extinguisher training
■ Practical activity in the cooking class in ZOOM with Augmented Reality (AR) elements.
■ Supporting learning progress with Artificial Intelligence (AI) in physics
■ Practical activity with a telepresence robot in a foreign language course

Fig. 2. Example of the learning scenario with disruptive technology.

perceived also as a positive or driving forward value or with a negative connotation. For example, the most often selected value *Accessibility* was seen as a hindrance for students i.e. in the learning scenario "Cooking class in zoom with the augmented reality elements" one of the groups explained that "*students are less accessible to teachers, making it harder to identify struggling students*" or as a beneficial aspect, which is explained by one of the groups "*It allows access to educational resources regardless of geographic distance and economic resources*". Yet another example is related to the value *Confidentiality*, which is often perceived as a threat with regard to disruptive technologies. The main argument is that "*One cannot be sure who has access to the digital data in the system*". On the other hand, in the case of *Supporting learning progress with AI (artificial intelligence) in physics* learning scenario, one of the groups has presented it as a promising aspect "*GoTrack data will only be displayed to the teacher via the teacher dashboard. The confidentiality of the discussion is guaranteed because it is available to the teacher.* Thus, based on the provided examples, the value elicitation method allows to bring out participants' critical perspectives of certain values and contradict them to the positive ones.

The preliminary thematic analysis of participants' explanations for every value resulted in themes as follows: risk, spatial quality, group, learning process, learner intrapersonal qualities, learning management, health/bodily reactions, cognitive effects, system's capability, beneficial qualities of the environment, resources. The most often the participants pointed out Group related aspects (such as enabling collaboration, participation, connectedness, peer interaction, social learning, role distribution, etc.) as mainly positive features and potentially emerging Risks (such as control, personal data, reliability and monitoring issues, unwanted exposure, unsuitable for older learners, etc.) as negative consequences of the learning scenarios with disruptive technologies.

5   Conclusions

Disruptive technologies bring along the need to take a deeper look at the ethical and value dimensions in order to make wise technical decisions and employ technology in a way that promotes both individual and societal well-being. We have presented a technique with some preliminary results to better and more efficiently elicit values and

ethical dimensions related to disruptive technologies in educational settings. The method, combining value cards and learning scenarios with disruptive technologies, facilitates conversation, widens one's thinking space and helps the participants to verbalize their perceived concerns as well as possibilities regarding the ethical and value dimensions of disruptive technologies in educational settings. The results point out the most important values and potential value spaces of different disruptive technologies perceived by different target groups, and provide a list of themes that occurred related to the selected values. Our next step is to look deeper into the value spaces of the disruptive technologies and look for patterns and connections of values and disruptive technologies. The outcome would help the developers, designers and policymakers to understand potentials and threats of disruptive technologies in educational settings.

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