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Creative Learning in Digital and Virtual Environments During COVID-19 and Beyond

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The importance of digital and virtual environments for both creativity and learning has been recognised for a number of years (e.g., Craft, 2010; Green-how, Eppler, & Solomou, 2011; Hsiao, Chang, Lin, & Hu, 2014). However, the scale at which teaching and learning have been taking place online or remotely during the current COVID-19 pandemic is unprecedented. From a luxury reserved for the very few or the distant future, digital and virtual environments in education became a necessity and an everyday reality for millions of people around the world. And nobody is expecting for things to go back to "normal" any time soon – the fact that students and teachers alike now see technology-mediated education as real rather than possible will certainly encourage many to continue exploring it long after the pandemic has (hopefully) ended. In this context, it is important to ask ourselves: what are the challenges and the opportunities associated with creative learning in digital and virtual worlds?

The present set of chapters focused on different aspects of creativity and learning, and several of them referred to how these phenomena are mediated by the use of various technologies. In this final chapter, authors engage in a conversation specifically about digital and virtual environments and use some of the findings reported in this book, results from their previous research, as well as their general expertise, to shed a new light on this complex topic. The conversation format, we believe, adds a dialogical and emerging element to what is nowadays a highly debated topic. In this way, we offer in what follows an overview of the main topics covered in this book and add to them, conceptually and practically. The focus is twofold: on the one hand, on theoretical notions that help us understand the current situation and, on the other, on practical advice that can guide those interested in technology-enhanced learning and creativity, now and in the future.

Vlad P. Glăveanu

As a sociocultural psychologist, I am concerned first and foremost with how cultural tools and signs mediate human thinking and action. Technological tools, including those that enable digital and virtual environments, are a fundamental part of today's culture across spheres of activity, from home and school to industry and organisations. Sociocultural theory also has considerable insights to offer creativity and learning scholars (see, for example, Vygotsky, 1967/2004; Lave & Wenger, 1991), in particular concerning the role of other people and social interaction in the way we acquire and create new objects and meanings. Taken together, these points of focus raise the question of how technological means impact processes of creative learning. Do they only shape the kind of contents people learn from and create with? Or, at a more fundamental level, do they change how we create and learn in the 21st century?

These questions don't have a simple answer (for a discussion of how the Internet changes creative expression, see Literat & Glăveanu, 2016), and the chapters included in this book bring evidence of both types of influence. My own sociocultural approach to learning and creativity considers these phenomena in terms of differences of position and dialogues of perspective resulting from these

positions (for more details, see Glăveanu, Johanne Ness, Wasson, & Lubart, 2019). What digital and virtual technologies afford, in this context, is adopting completely new positions – in terms of avatars, tasks, situations, and their affordances – and, therefore, developing a set of original perspectives on what we do, including on the way we learn, express our creativity, and envision education. Being a technology user is not an extra role or position for today's teachers and learners, it is a common reality that changes, often radically, what we consider as possible in the classroom, offline and online, with both positive and negative consequences.

Giovanni Emanuele Corazza

I could say that my point of view on the issues raised by Vlad Glăveanu comes from a threefold position: as a telecommunications engineer, I deal with the design of the tools and infrastructure that afford the world of online experiences; as a professor at the University of Bologna, I had to go through the rapid transition from teaching in presence to remote classes; finally, as the founder of the Marconi Institute for Creativity, I am specifically concerned with how this process is affected by and affects creative potential, in the multiple possible nuances of meaning discussed in the chapter by Corazza and Glăveanu (Chapter 7, this volume).

Starting from the first perspective, it is a source of pride to see how the telecommunications infrastructure and the Internet that runs on top of it has today become such an integral part of our lives, and in these times of crisis, most of our social interactions would effectively be halted if these technological means weren't in place. The digital alphabetisation of large sectors of the population underwent a sharp acceleration, so significant that it would have probably taken the span of a generation to obtain the same results in normal circumstances. This form of "learning technology by doing" has also led to a deluge of creative audio-visual expressions over social networks, chats and forums of many kinds. It's a triumph of everyday creativity, clearly with a highly variable quality level. On the other hand, this fast transition has also exacerbated the criticalities of the Internet as we know it today in terms of privacy and security, but also of alienation, and much work needs to be done here not only from a technological point of view, but also psychological, social, normative, and ethical.

This fast transition impacted also large academic institutions, such as for example the University of Bologna with its nearly 90,000 students. In the space of but a week, teaching was transformed from in-class to online, with surprisingly few technical problems notwithstanding the huge load on the network. In general, students' reactions and feedback to this experience were largely positive, so much so that it is already clear that even when the immediate emergency will be over, the world will not return to its former state. We will have to collect and exploit the many lessons learned, also in terms of making our teaching more creative in the way we keep the students' attention and we involve them, irrespective of the virtual experience. One element that has turned out to be extremely effective is the introduction of game-based approaches. Introducing even very simple forms of games has the effect of completely turning around the mood of a class, stirring participation and serious amusement, with arguably very positive effects on long-term retention of the subject material. However, not everything is positive in remote teaching experiences; for example, monitoring of the students' attention level and tiredness might not be immediate, and examinations might not be as effective as they would be in person.

Finally, from the more theoretical standpoint of creativity studies, the question is to establish what the impact of these virtual world experiences on the creative potential of individuals, teams, and society in general is. As Vlad Glăveanu already mentioned, we cannot draw any simple conclusions and hope for any monotonic effect, be it positive or negative. Indeed, living in a situation of social confinement, characterised by online communications and multiple virtual worlds, each one with its

own means of communication, should altogether be considered as a wholly new experience in a novel socio-cultural milieu, in which some of the past affordances are missing, while new ones are born. While this topic is definitely worth a much deeper reflection, let's only give two simple examples here. The extension of our minds provided by information technology should enlarge our creative potential by greatly reducing the existing inter-disciplinary subdivisions. Specialisation will give way to flexibility. On the other hand, continuous interruptions and reduced attention spans should reduce our creative potential, mainly due to effects of early closure of our creativity episodes as well as to a feeling of being lost in an ocean of uncontrolled information exchange.

In conclusion, I believe that we are dealing with a profoundly different world, one for which simple extension of past knowledge will not be sufficient. Much work is in front of us!

Ingunn Johanne Ness

This book is reflecting on creative learning in digital and virtual environments and, having a PhD in Education from the Faculty of Psychology and leading the Cluster on "Creativity, Learning, and Technology" at the University of Bergen, I have focused on the subject for a number of years. How can technological tools support creative learning? Due to the COVID-19 pandemic we face an urgent need to include various digital tools in teaching since all teaching activities must happen remotely. From the sociocultural perspective I adopt on knowledge development, similar to the one mentioned by Vlad Glăveanu before, I am interested in how people co-construct meaning and learn together in collaboration. From a sociocultural view, this kind of co-construction is often seen in the context of an active and dynamic relationship between the social and the individual. Humans exist and develop in intellectual interdependence and social interaction, and they co-construct their knowledge through this interaction (Linell, 2009; Valsiner & van der Veer, 2000). This takes place both in workplaces and in educational institutions.

In the chapter on "Polyphonic Imagination" (Ness & Dysthe, Chapter 3, this volume) we see how interdisciplinary team members that engaged with innovative idea generation became more creative when they were introduced to other perspectives and other ways of understanding something. Different technological tools were used to support the creative learning processes and functioned as a mediating tool. Vygotsky states that human action, on both individual and social planes, is mediated by tools and signs (Vygotsky, 1981, p. 137). The group members learned from each other and, together, they could imagine new solutions and innovative ideas.

Such skills, creativity, and the ability to collaborate with others are seen as important skills for the 21st century in order to cope with the changing society and global challenges. Students need to learn the value of bringing together knowledge from different fields and how to co-construct new knowledge in interdisciplinary and creative collaboration, as Giovanni Emanuele Corazza mentioned. They should learn the benefits from meeting other views, to see this as a resource for their own thinking and imagination. Using different digital technological tools can be a good way for teachers to facilitate discussions and collaborative assignments in order to stimulate students' imagination and to open up different perspectives (see also Glăveanu, Ness, Wasson, & Lubart, 2019). This can be done through posing open questions. The benefits of such questions are that they are open to discussion and a variety of perspectives which again will stimulate the Polyphonic Imagination among the students. This is a Vygotskian view on imagination (John-Steiner, 2000; Vygotsky, 1930/2004) describing how many voices co-construct knowledge together in supportive collaboration and goes against the more traditional individual approach.

Chronis Kynigos

As an educational design researcher, I look for ways in which interventions in current educational practice may become a lever for transformation, in this case, enhancement and recognition of little-c (abundant, everyday creativity in all of us, Kaufmann & Beghetto, 2009) in the ways we learn and design for others to learn (Gruber, 1988). In our chapter (Kynigos, Essonnier, & Trgalová, Chapter 2, this volume), we try to shed light on how diverse teams of actors collaboratively design and develop digital resources with which students can creatively engage in learning mathematics. We connected a socio-cultural point of view in the way Vlad Glăveanu has articulated (Glăveanu, 2011) to a socio-constructionist activity where learning and creativity becomes part of collective design and discourse over the design (Kynigos, 2015). To study this, we perceived teachers as designers (Laurillard, 2012) and creativity within socio-technical environments (Fischer, 2001) involving complex interactions shaping both knowledge and digital objects under co-construction (Nardi, 1996). We looked for creativity emerging from diversity and the need for each individual to cross boundaries and understand the others' point of view about the building of a digital learning object. These objects thus became cultural artefacts and signs around the design of which many unexpected creative ideas emerged (Akkerman & Bakker, 2011). These kinds of processes are likely to be very common in education as we move beyond the pandemic, and they should be studied further, across domains, disciplines, and levels of study.

Nataly Essonnier and Jana Trgalová

As mathematics education researchers interested in the use of technologies for teaching and learning mathematics (Aldon & Trgalová, 2019), we see teachers mostly as users and sometimes co-designers of digital tools, but also as designers of (digital and non-digital) resources they use in their classes with their students, as noted by Chronis Kynigos.

Referring to Rabardel's (2002) instrumental approach, we consider a digital tool as an artefact that needs to be transformed into an instrument. This approach enriches the Vygotskian one evoked by Vlad Glăveanu and Ingunn Johanne Ness in this chapter, by stressing not only the mediation function of tools, called instrumentation by Rabardel, but also the transformation of tools by the user in the process of instrumentalisation. Instrumental genesis, that involves these two interrelated processes and that results in an instrument likely to foster creative processes, is a long-term process. During the design process of digital resources, tensions occurring between the intended and the effective design choices may be interpreted as consequences of instrumentation. For example, during the collaborative design of one of the c-books within the MC Squared project, we observed designers struggling with creating activities in the socio-constructivist perspective because of technical limitations of the digital tools; instead, the designed activities were very much guided, thus relating to behaviourism. Indeed, it appeared difficult to create a rich digital environment enabling personalised feedback depending on students' actions, allowing them to build knowledge themselves (Essonnier & Trgalová, 2018) or to foster some dimensions of creative mathematical thinking such as fluency, flexibility, or originality. On the other hand, instrumentalisation of the digital authoring environment manifested itself by integrating external widgets created by designers with advanced technological knowledge. Therefore, diversity in terms of complementary professional knowledge intertwining mathematics, pedagogy, and technology turned out to be a lever of the collective instrumental genesis and allowed to enhance social creativity, viewed as the generation of new, appropriate, and usable ideas among the designers (Essonnier, 2018).

Looking at the pandemic situation from an educational point of view, the spread and acceleration of the use of digital technology among teachers, allowing them to keep teaching mathematics and doing so without any anticipation or preparation, has revealed a disparity of situations among teachers. They had to adapt their teaching very quickly to remote lessons, turning them more than ever into creative designers. Many teachers were not prepared to use technology for online teaching and lacked time

for the instrumentation of the digital tools. Collaboration has been a key element for the instrumental genesis of technology. For instance, during their first online classes, some of the teachers were concentrated on the technicalities of using a new web-conference tool and did not anticipate the lack of interactions and feedback from the students. Hence, being able to talk about it in group discussion or with colleagues helped them feel less isolated, and gave them a reflective position from which to think on how to create conditions for explicit student feedback during lessons. At times, team collaboration made it possible to test a tool with other colleagues before using it with students, or to build on the experience and practice of other teachers, which generated a kind of collective instrumentation. We also noticed that organising massive online examinations in a very short amount of time proved impossible. Some examinations, such as the final secondary evaluation in France, have been cancelled, some others postponed, yet some others were simply sent via a platform to students who were expected to send back their paper-pencil productions. Assessment thus appears as the most difficult teaching component to be creatively transformed through technological means, and very often is approached from a migratory rather than transformative perspective (Ripley, 2009). These observations and remarks are complementary with the perspectives proposed in this chapter and the experience of other colleagues.

Samira Bourgeois-Bougrine

As an ergonomist, university teacher, and facilitator of human centred design (HCD) workshops, I consider that we face at least two challenges when it comes to the issue raised by Vlad Glăveanu, as well as by Nataly Essonnier and Jana Trgalová, about the teacher being a technology user: the usability of online teaching platforms and their affordances to promote a safe virtual environment for creative interaction with and between students. Similar to Giovanni Emanuele Corazza and many other teachers, I had to go through a rapid transition from teaching in situ to online classes during the corona-virus pandemic. This transition involved reviewing the pedagogical content to adapt it to the new media and learning how to use the software of distant learning provided by my university. Measuring the difficulty of learning how to use a system is a key indicator of a system's usability (Chorfi & Alhudhud, 2019). From the perspective of the user of any educational interactive software, usability is one of the most important aspects of the system as it determines the success of teaching and learning. Usability, which is defined in ISO[1] as the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use, is related to the clarity of the functions provided by the system, the expressiveness of the icons' roles, the easiness to perceive the interface components and to remember the hierarchy while navigating the deep menus in order to discover, to select, and use the right option, etc. (Ardito, et al., 2006; Chorfi & Al-hudhud, 2019). If the interface is too rigid, slow, and unpleasant, the teachers spend more time learning how to use the software rather than focusing on the didactic effectiveness, leading to an increase of both frustration and the probability of abandonment.

Beyond functional usability, as a facilitator of creativity workshops in HCD context, I consider that a major challenge would be to provide teachers with the ability to switch, in one click within the same platform interface, from passive distant delivery method (e.g., lecture-based instruction) to a Multi-User Virtual Environment (MUVE) such as Second Life or Unity. This would provide students with the opportunity to interact via their avatars and to express their creative potential (see Bourgeois-Bougrine, et al., Chapter 5, this volume) and help creativity teachers extend their pedagogical repertoire beyond "Sage-on-the-Stage" or "Guide-on-the-Side" to include a role of "Meddler-in-the-Middle" (McWilliam, 2009; Bourgeois-Bougrine, Buisine, Vandendriessche, Glăveanu, & Lubart, 2017). Blending my university distant teaching platform with Zoom, Jitsimeet, or Discord during this transition period allowed me to experience first-hand the several socio-cognitive mechanisms (Diehl & Stroebe, 1987), like the apprehension of evaluation (social inhibition) in face-to-face interactions with students whom I met for the first time this semester. By enabling the sharing of ideas

simultaneously amongst the participants while preserving anonymity, MUVEs offer a "liberating" atmosphere that would cognitively disinhibit participants and favour the expression of their creative potential (see Bourgeois-Bougrine, et al., Chapter 5, this volume).

Elvis Mazzoni and Martina Benvenuti

Traditionally, scholars have analysed creative processes by focusing primarily on individual characteristics or attributes to explain the observed process (Eysenck, 1993; Williams, 1980; Reilly, 2008; Kaufman & Baer, 2005). However, as underlined in the previous interventions of Glăveanu and Ness, a sociocultural perspective on knowledge development gives considerable insights on creativity processes, particularly on the mediation of tools (e.g., Internet applications) and signs (e.g., language). Based on this perspective, our contribution refers to two models of knowledge development: the zone of proximal development (Vygotskij, 1978) and the socio-cognitive conflict (Doise & Mugny, 1984; Butera & Darnon, 2010).

From a Vygotskian point of view, each person is characterised by a potential of the development determined by the difference between what he/she can do and what he/she might do if supported by an expert person. In online contexts, we may suppose the existence of a sort of mutual zone of proximal development that pushes persons toward objectives and goals otherwise impossible to obtain. However, interacting in online contexts means also considering many points of views and coping with possible conflicts, not only receiving or giving support and collaborating. From this point of view, divergent thinking represents one of the key factors that can activate creative processes in a group or in a network of persons (Gaggioli, Riva, Milani, & Mazzoni, 2013) because it requires one to consider many alternatives before making a decision on how to proceed. About that, studies on socio-cognitive conflict (Butera & Darnon, 2010; Mazzoni & Benvenuti, 2015), in which participants with divergent points of view must negotiate a collective decision or a collective solution to a problem, show that the final result is more creative than any solution generated by an individual, and is not simply a sum of the different expressed contributions but a new result coming from their progressive integration and accommodation.

Starting from the cultural-historical perspective of Vygotskij (1978) and Leont'ev (1978), Activity Theory (Greeno, 2006; Engeström, 2015) suggests that creative processes emerge not only from small groups (like those analysed in Chapter 4), but also from complex systems of people attempting to achieve specific results (e.g., a company or an association). Each activity system is characterised by a dynamic equilibrium (Gaggioli, et al., 2013; Mazzoni & Gaffuri, 2009), i.e., it is constantly evolving, but always finding a balance to ensure a good adaptation to achieve the result.

New needs arise in individuals (determined by trends, changes in society, career demands in those who work within a company, etc.), and new artefacts are produced to improve productivity. This creates what in Activity Theory is called a contradiction between elements of the system (Engeström & Sannino, 2011; Foot & Groleau, 2011). When contradictions require solutions that can easily be integrated within the existing system, the system recovers balance (Piaget could call it accommodation). However, when they cannot be solved using solutions previously adopted, the activity system should expand the vision beyond the limits of what has been done up to that point and find alternative solutions that have not yet been thought of or imagined. This is called "expansive learning" (Engeström & Sannino, 2011), which results from the need to resolve a contradiction never faced previously, and which requires a creative process that involves the entire system.

Considering this point of view, Internet applications during the COVID-19 pandemic can be seen as tools allowing an activity system (in education, in industry, in business, etc.) to go over the current

cultural limits (previous practices, behaviours, tools, ideas, solutions, etc.) and achieve innovative, creative, and more advanced solutions.

Andrea Gaggioli and Alice Chirico

Digital tools hold a significant potential to support creative learning. We agree with Samira Bourgeois-Bougrine that ensuring usability is a crucial requirement. However, we also contend that for this potential to be realised, the focus of analysis should be extended from the functional aspects of technology to the overall experience that results from interacting with it, which encompasses perceptual, cognitive, emotional, and motivational dimensions. According to Hassenzahl (2010), when a user interacts with a product, two broad categories of attributes are at stake: pragmatic and hedonic. Pragmatic quality refers to characteristics such as "easy", "predictable", or "clear": these features indicate the potential achievement of particular "do-goals" that an actor wants to complete, such as "watching a video lesson" or "doing an exercise online". In contrast, hedonic quality refers to the perceived ability of a product to support the fulfilment of "be-goals", such as "being autonomous", "being competent", "being admired", "being stimulated", "being related to others", etc. Pragmatic quality supports the achievement of "be-goals", but only indirectly; as such, the usability of a product is valuable insofar as it contributes to pursue more basic human needs. In this perspective, to design a good creative learning experience – be it virtual or conventional – involves fulfilling the be-goals that are implicated.

The theory of flow provides a meaningful framework to identify the positive experiential features that are relevant for designing virtual educational environments. According to Csikszentmihalyi (1975, 1990), flow is an optimal experience characterised by a perceived balance between high opportunities for action and skills/abilities to face these challenges. Further characteristics of this state include high concentration and involvement in the task at hand, a feeling of mastery, and a loss of reflective self-consciousness (Nakamura & Csikszentmihalyi, 2002). If this has been real for conventional educational practices based on positive psychology (Seligman, Ernst, Gillham, Reivich, & Linkins, 2009; Kristjánsson, 2012), why should it not be so also for advanced digital ones?

The implications of flow for learning are manifold. This experience is associated with positive emotions and deep engagement with the learning task. Furthermore, since the experience of flow is intrinsically rewarding, learners are motivated to further their efforts, which leads to increasing skills and leveraging their individual potential. Indeed, previous research has shown a positive relationship between flow and students' academic performance in both conventional and e-learning settings (Engeser & Rheinberg, 2008; Rodríguez-Ardura & Meseguer-Artola, 2017). Flow is also closely linked to creativity: not only do people commonly associate flow with a highly creative state (Csikszentmihalyi, 1996), but also it has been suggested that flow could lead to enhanced creative performance (MacDonald, Byrne, & Carlton, 2006; Landhäußer & Keller, 2012), although empirical evidence of a direct causal relationship is still limited. Whilst the original flow framework developed by Csikszentmihalyi focused on individual flow, more recent theorisations have proposed the existence of a shared optimal experience, termed "group flow" (Sawyer, 2007) or "networked flow" (Gaggioli, et al., 2013). The study of how flow emerges in both real and digital social networks could help defining novel principles to design distributed creative learning environments that support this optimal experience across different collaboration platforms (Koffka, 1935).

Claude Chaudet

As a professor of computer science, I have witnessed the rise of digital culture. Today, instructors and learners are, on average, more technology savvy and more eager to use virtual meeting rooms, pre-recorded videos, online exercises, and virtualised labs. This has been a life saver for online learning in these times of social isolation. Remote knowledge transmission had taken off with the rise of Massively Open Online Courses (MOOCs), which were envisioned to replace BOOKs. Artificial intelligence starts to be used to help detect missing knowledge and personalise the learning process. Gamification, as Corazza mentions, also brings a whole new perspective to learning without pain. Creative uses of technology have emerged from the opportunities offered and from new constraints, driven by the motivation of people willing to achieve the same result, as Mazzoni and Benvenuti explain, and catalysing the motivation of enthusiastic, self-learning, and inherently motivated students. Technology lets them choose the modality and the pace of their learning process, but they would find a way to achieve their goals under any circumstances.

Education is not only about these learners, though, but also about students who struggle to understand or to keep their motivation on the long run. For that population, the isolation period we are undergoing turns technology into a constraint, a requirement. Even if usability, as Bourgeois- Bougrine mentions, has improved, online sessions limit subtle interactions and implicit communication that even the most creative usages fail to replace. Such students will often behave like good soldiers, attending the sessions, turning in assignments in time, but will remain in a place where they feel safe or slowly vanish over time.

Education is also about certification through diploma, and this is why the number of integrity issues has exploded since the beginning of social isolation. Students have been suspected or reported to get help or fully out-source work to a friend, or in exchange for payment, but also to have other people impersonate them for oral exams, or to let other people control their screen through remote desktop utilities, while they act. We witness, in that domain, a certain malevolent creativity that is driven by pure interest.

Engaged students will benefit from the creative use of technology and often perform better than in class, as the social pressure vanishes. Malevolent students will initiate a cat-and-mouse game in which each player has to be more creative than its opponent, at the image of cybersecurity. In the middle lie the uncertain students, who lack confidence but have good intentions. Uncertainty creates fear to fail, which drives students to seek safety by avoiding risk, and therefore limits their creativity. Just like in the business world, processes, procedures, and fear of punishment lead employees in doing exactly what they are told to, no more, no less, so that nobody can tell them they did something wrong.

Olga Dysthe

I would like to ground my reflections in three examples from my long career as a teacher and researcher. The first one is from the early days of teaching with computers. I was a high school teacher in Tromsø, and my Norwegian class had just read a novel for young people on the tragic conflict in Northern Ireland between Catholics and Protestants, when I managed to establish contact with a high school class in Northern Ireland. At that historic time in the evolution of online teaching, I had to book the computer room as well as a data specialist to ensure the class was able to connect online. Thus, my students got first-hand accounts of the lives of the Irish youth and how this related to the characters in the book. It was obvious that for the participating students this was an "opening,

widening and deepening of dialogic space" as Wegerif (2013, 2020) expressed it. I witnessed how the ongoing conversation between the two classes, online and by emails, supported their participation in a global dialogue of culture and widened their perspectives, not only of the conflict in general, but first and foremost of the daily dilemmas students of their own age had to endure. This became manifest in the student book essays, which mirrored their deeper understanding of the conflict, but also of their own place in the world.

The second example is from UCSD where for half a year I observed two "Fifth Dimension" sites, where 6–12 year olds were voluntarily engaged in computer-mediated activities focusing on games and telecommunication. This project, which lasted for more than ten years and was exported to many countries, among them Sweden, was initiated by Michael Cole and other researchers. Undergraduates from UCSD worked as organisers, facilitators, dialogue partners, and as "the Wizard's assistants", helping the children develop their capacities for problem solving (Cole, 1996, pp. 289–326). While the boys preferred games, the girls favoured telecommunication with children in Mexico. I observed a two-faceted dialogic interaction, on the one hand the important role of the undergraduates in their involved dialogues with the children, and on the other hand the increasingly intense online conversations and discussions between the American and Mexican children.

My third example is from a study I made with Sølvi Lillejord of a part time distant education Master Programme, organised by the University of Bergen, where digital, peer feedback was one of the cornerstones (Dysthe & Lillejord, 2012). Crucial factors in the building of a productive writing community were the intersections between academic leadership, study design, and students' participation in online writing communities. Interestingly, the concept of "community" has a historical grounding in the European Humboldtian university tradition that goes to the core of how academic knowledge is produced and developed. It is therefore equally relevant in all disciplines. Basic to modern universities is the assumption that because nobody owns the "truth", academics have to discuss and test various knowledge claims in scientific communities. A major trait of this tradition is that writing is not a decontextualised learnable skill, but training in learning to think through being confronted by other voices. The German writing researcher Otto Kruse has documented how students at the time of Humboldt got feedback on their writing and their presentation of content, both orally through discussions at the seminar and in writing from two peer opponents (Kruse, 2006, p. 342). Our study shows a modern version of this in a digital networked design, which resulted in students' creative thinking around their own texts. In the web-based master, peer feedback was a key to establish the collaborative dependencies referred to by Dirckinck- Holmfeldt, Jones, and Lindstrøm (2009, p. 7).

What do these examples have in common, and how do they relate to the chapter on Polyphonic Imagination and the theme of this book? The obvious answer is the third dimension in our findings earlier: the Bakhtinian concept of dialogue and creative potential of divergent voices. The students in my three examples vary greatly in age, from basic school in the US to Norwegian high school students and adults in mid-career seeking to widen their professional basis. All three show, however, how technology expands the dialogic space of the students involved by exposing them to divergent and foreign voices, and thus trigger new ways of thinking. In the first two cases, students confronted cultural differences between their home country and Northern Ireland and Mexico, respectively, while the adults' understanding of their master thesis topic was confronted by readers with different professional and intellectual experiences. Bakhtin has underlined that our encounter with a foreign culture is a two-way affair, as we seek answers to what seem strange to us: "We raise new questions for a foreign culture, ones that it did not raise itself; we seek answers to our own questions in it; and the foreign culture responds to us by revealing to us its new aspects and new semantic depths"

(Bakhtin, 1986, p. 7). This is equally relevant whether the "foreign culture" is real or metaphorically interpreted.

Ronald A. Beghetto

As an educational psychologist, my work has increasingly focused on the role uncertainty plays in creative thought and action in educational settings. This includes considering how uncertainty serves as a catalyst and condition for creative learning. More specifically, I'm interested in situations whereby uncertainty not only serves as a signifier that new thought and action is needed, but also under what conditions people view uncertainty as actionable. Indeed, as has been discussed elsewhere (Beghetto, in press, 2018), not all encounters with uncertainty prompt a creative response or result in creative learning outcomes that contribute to new ways of understanding and behaviour for oneself and others.

It is not difficult to understate the levels of profound uncertainty the COVID-19 pandemic prompted across the globe and in almost all aspects of life. With respect to teaching and learning, a key uncertainty pertained to whether and how formal schooling could continue in a time where many other aspects of life were put on indefinite hold.

To the extent that digital and virtual platforms were available and accessible, the uncertainty surrounding the continuation of formal educational efforts afforded a creative response in the form of a massive and rapid change in how people thought about and engaged in teaching and learning. This has also resulted in almost incalculable amounts of time spent in virtual rather than material learning environments. Indeed, somewhat early on in the COVID-19 response, my university reported that in one month and two days (March through 2 April) members of our university community logged nearly 150,000 Zoom sessions on the university platform, accounting for a staggering "60 million minutes worth of interactions" which they estimated equates to "roughly 115 years of Zoom" (ASU, 2020).

Although the massive migration to digital and virtual schooling has helped resolve some of the uncertainty surrounding the question of how formal education might continue in the midst of a pandemic, it has surfaced new and complex uncertainties. Indeed, as the commentators to this final chapter have noted, the move to digital and virtual schooling has raised numerous questions, uncertainties, and considerations regarding how technology might support or impede creativity and learning. These questions and uncertainties can and likely will prompt new programmes of research and further creative learning and practice.

One area of uncertainty that I have been thinking about is the role of physical spaces and materiality in creativity and learning. This area of uncertainty raises numerous questions for researchers to consider, including what has been gained and lost when a tool, like digital and virtual technologies, serves as the location for creative learning? What might happen to physical spaces that have become abandoned? What inequities and imbalances are caused by such a move? How might physical spaces be repurposed as a kind of third space – a space where people can step away from the first spaces of home and work and second spaces of virtual environments to learn and create? Could these spaces become a creative common where people come together to think and learn in different ways? Can the physical spaces of schools and universities serve as creative pop-up commons for people in the local community to engage in creative learning? The uncertainties surrounding questions like these can serve as a stimulus for new ways of conceptualising and experiencing creative learning.

Constance de Saint Laurent

Reading the contributions made to this chapter, I am struck by the commonalities between our local experiences of the effects of the pandemic on education: everywhere, we had to adapt extremely fast to a complex situation, moving a heavily presence-based education entirely online, learning to use preexisting tools in new ways. As Giovanni Emanuele Corazza is, I am amazed at how the technological progresses made over the past decades have allowed for a relatively smooth transition, given the conditions. However, as many have mentioned, this did not come without challenges, and although transitioning to online education has been a global effect of the pandemic, it has been declined into an infinity of specific situations. Beyond regional specificities that have affected both the strength of the measures taken and what has been expected of educators during this difficult period, the contributions made by Samira Bourgeois-Bougrine, Nataly Essonnier, and Jana Trgalová in this chapter highlight the importance of the tools made available to teachers and of how well they actually master them: while some universities and schools had already experimented with virtual environments and digital teaching resources, others have been slower to join the movement – either by lack of volition or lack of means – making the current transition only more difficult.

And indeed, as multiple authors in this chapter have discussed, the tools we use mediate how we learn and how we understand the world we live in, which is probably all the more the case when technology comes to mediate even the most basic student–teacher interactions. A smooth working online classroom, allowing participants to appropriate the space – for instance, by using avatars – will necessarily have different effects than a basic conference call style class with a limited Internet connection. That said, I think we can all agree that technology is not everything, even in this context: learning is not only mediated by tools, but also by others. For me, the real question is not so much what tools are available to teachers, but how well they can use them to "connect" with their students. In this regard, teachers around the world have had to adapt extremely fast, with huge disparities in terms of how comfortable they were with technology to begin with and how willing they have been to learn more. Once the emergency of the crisis has passed, it will be important to not assume that because we have all globally adapted quite well and because new technologies have raised to the challenge, it means it is enough: we will need to make sure that teachers are properly trained to use adapted technology in order to teach online, and to take stock of what aspects of learning have been facilitated or hindered by this digital migration.

Finally, I would like to go back to some of the points raised by Claude Chaudet about some students "slipping through the net". Education has always had the potential to both increase and decrease inequalities. Online teaching, however, raises new issues in this regard. On the one hand, students in difficult situations may more easily feel left behind and drop out, and it is harder for teachers to notice them outside of face-to-face interactions. Inequalities can take the form of uneven access to technology, but also of a lack of confidence, making it harder to intervene online, and which can easily be hidden behind a camera that has not been turned on. On the other hand, remote education makes new forms of cheating possible – from having others do assignments to abusing the leniency we have all felt towards our students in these times of crisis. While it is sometimes difficult in the current context to act against students abusing the system, ignoring them is unfair for the vast majority of students who have made the effort to play by the rules. In this area, as in many others, the pandemic has led to a major reorganisation of public life, which will have lasting consequences for our societies, both good and bad. While urgency has been the driving force in this transition, it will be important in the future to properly learn the lessons of this global experiment – with all of its successes and failures – and leverage it to transform education for the better.

Note

1. https://www.iso.org/obp/ui/#iso:std:iso:ts:20282:-2:ed-2:v1:en.

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