

A Sociocultural Perspective on Creativity and Technology

New Synergies for Education

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Key Take-Aways

- Creativity and technology are both essential to educational futures. A synergistic, sociocultural perspective provides an integrative framework with transformative implications for teaching and learning.
- We advocate for understanding these issues in education settings based on Glaveanu's 5 A's model, which moves away from the traditional 4P's of creativity (person, product, process, and press) toward the language of actor, action, artifact, audience, and affordances.
- The 5 A's model allows for a language and understanding of creativity based on the interrelation or interaction between its elements rather than the elements themselves.
- Technologies as tools to think, work, and create with are part of the social-material world and have different creative affordances (real and perceived). The advent of the internet in particular has unleashed ground-up creativity, which is in contrast to the traditional structures and boundaries of schooling.
- Digital devices in general (and the internet in particular) allow for dramatic creative shifts in society and new implications for how we think about teaching and learning.

Education is all about preparing students for the future, and since the future is inherently unpredictable, creativity must be an integral part of the process. This need for creativity has become even more significant given the rapidly changing world we live in. Although change is a constant of human existence, the heightened pace and scale of the changes we face today are qualitatively and quantitatively different. The COVID pandemic is just one of many “planet-sized” (Gidley, 2016) global disruptions, which will stress our already inefficient political, economic, and cultural institutions. The accelerating influx of information and technology, in a volatile, uncertain, complex, and ambiguous (VUCA; Cousins, 2018) environment further underscores the important role of creativity in education, since unexpected and unanticipated situations require creative solutions.

Incorporating creativity into education requires that we have an accurate understanding and articulation of the construct. Too often, creativity in classroom contexts is framed in ways that have not kept up with changes in the field. This is not surprising, since much of the existing thinking about creativity in psychology has viewed it from an internal/cognitive, socially decontextualized perspective with an inordinate focus on creative individuals (Glăveanu, 2013). In contrast, more recent work in the field, based on advances in social and cultural psychology, expands and complicates the frame to account for the interconnected and contextual nature of creativity. Such perspectives recognize that creativity is a dynamic process where social, cultural, psychological, and material elements mesh together and that the creative force occurs as a result of *interactions* between elements, and is not inherent in the elements themselves. If creativity is to find roots in education, it must build on this new understanding and framing.

One of the significant drivers of change in our world is technology. If the COVID crisis and its impact on education has demonstrated anything, it is that technology (particularly the internet) has an important role to play in educational futures. It can be argued that access to the internet may be the single biggest equity issue facing education through the pandemic and beyond. During the pandemic, families and communities that had reliable access to the internet, and the devices to access it, could at least hope for consistent opportunities for learning. Those that did not have this access suffered. That said, schools and educational institutions did not necessarily consider the remote learning thrust on them by the pandemic as an opportunity to rethink how teaching and learning happen. For the most part, schools and other educational institutions have typically molded technology to fit existing educational practices, rather than taking advantage of the affordances of the technology to reimagine what education could be. While there are examples of creative uses of technology, they are often limited by preconceived structures of classrooms

and the curriculum. For instance, during the COVID-19 crisis, when schools moved remote, individual educators demonstrated creativity (technologically and pedagogically) to connect with their students and continue their learning. However, it was not clear that any fundamental assumptions about education had changed, and there has been limited, if any, discussion of technology and its potential role in advancing creativity in learning contexts.

The lack of emphasis on creativity (and the role of technology in fostering it in classrooms) is in sharp contrast to what is happening outside the educational context. The advent of the internet has unleashed a tidal wave of ground-up creativity, with youth across the globe engaging in highly polished, socially savvy, technologically mediated creative behaviors (through tools such as TikTok, Twitter, and Instagram) on their own initiative. While technology use in schools lags behind, both in quantitative terms (access and time spent) and qualitatively (what is done with the technology), learners have taken up new tools as opportunities to create, share, explore, construct, inquire, communicate, and express themselves – all of which are universally recognized as being good learning behaviors.

We argue that if we are to foreground creativity within educational systems and take advantage of the affordances of the technology, we must better understand both creativity and the inherent propensities of the technology to support and enhance it. We believe that there are organic synergies between this new sociocultural, distributed view of creativity and the affordances of digital technologies to change how we think of both creativity *and* technology in educational situations. At the heart of these synergies is a rejection of wholly individualized and internal psychological perspectives (Henriksen, 2019), given the deeply social nature of learning. We suggest that education would benefit from a rethinking of technology and creativity from a sociocultural perspective.

Our articulation of this sociocultural approach toward creativity, technology, and education is driven by Glăveanu’s (2013) 5 A’s framework for creativity (see also Glăveanu’s Hot Topic 1 in this volume). The next section focuses on describing the 5 A framework in greater detail. We follow this with a section that “unpacks” the idea of technology with a particular focus on the unique affordances of networked digital technologies. Finally, we explore the implications of this sociocultural view of creativity and technology for education.

“Rewriting” the Language of Creativity

Glăveanu (2013) notes that much existing thinking about creativity in psychology has viewed it from an internal/cognitive, socially decontextualized

perspective focused on creative individuals. This approach does not recognize the interconnected and contextual nature of creativity. Moreover, it is inconsistent with current social theories of cognition (e.g., distributed theory of mind) and research in social and cultural psychology. He proposes a rethinking of the 4P's model first proposed by Rhodes (1961) – probably the most extensively used model in creativity studies. In Rhodes' 4P's framework of creative expression, person, process, product, and press constitute the broader components of creativity:

The word creativity is a noun naming the phenomenon in which a person communicates a new concept (which is the product). Mental activity (or mental process) is implicit in the definition, and of course no one could conceive of a person living or operating in a vacuum, so the term press is also implicit.

(Rhodes, 1961, p. 305)

Glăveanu (2013) argues that the 4P's framework decontextualizes creativity by focusing on elements in isolation without recognizing the role played by social and cultural norms. He suggests a new frame and new language which recognize creativity as a dynamic process where social, cultural, material, and psychological elements mesh and the creative force occurs as a result of their interactions. Thus, the 5 A's framework suggests a set of linguistic moves: from person to *actor*, from process to *action*, from product to *artifact*, and from press to both *audience* and *affordances*.

Because language drives not only our understandings, but our beliefs and behaviors, this change involves more than words. Rather, it is a change in dynamic, meaning, and epistemic position. Conceptualizing creativity as being about actors, actions, artifacts, audiences, and affordances is a different proposition than emphasizing aptitudes, processes, products, and the environment. Whereas the creative "person" can be studied as a discrete creator, the "actor" exists only in the presence of an audience. While "process" is often an internal psychological mechanism of thought, "action" cannot occur outside interactions with the social and material world. Although "products" can be examined for features or judged independently, "artifacts" embody the cultural traditions of their communities. While "press" can be looked at as external conditions and variables that promote, determine, and evaluate creativity, both "audiences" and "affordances" are integrated with the creator in a social/material world. The audience for creative work is not a passive receiver, but a dialectic participant and active user affecting the work; and affordances drive the possibilities that shape the thinking and efforts of the creator.

Thus, creativity can be conceptualized as being "concerned with the action of an actor or group of actors, in its constant interaction with multiple audiences and the affordances of the material world, leading to the generation of new and useful artifacts" (p. 76). This has implications for the socially constructed dynamics of creativity and technology, particularly in the ecological settings of schools or classrooms. The 5 A's go beyond a focus on isolated components, considering the interrelation or interaction between elements rather than the elements themselves. Technologies are tools to think, work, and create with. They are part of the social-material world that people act within, and have different affordances (real and perceived). These affordances are more than descriptors, they give technologies agency in the creative process. In the next section, we dive into conceptualizing how technology fits into this process. In particular, we address the affordances provided by digital and networking technologies.

Rethinking Technology for Creativity and Education

Different Tools Reflect Different Affordances

For most of human history, the technological tools available to creators were often physical technologies (e.g., pencil, paper, hammer, ruler – any tool that extended human thinking beyond intrinsic/physical capacities) or analog technologies (e.g., vinyl records or clocks with hands/faces – devices that operate using electrical signals, but do not break everything up into binary code). The advent of digital technologies (e.g., computers, or other devices that use signals where information is translated into the binary code format of 0 or 1) created dramatic shifts in the history of science and technology, with new potentialities and challenges for creative learning. This is not to argue that different forms of technologies offer "better or worse" propositions for learning – but their properties suggest different "affordances" or possibilities for use, what has been called the "zone of possibility" of a given technology (Dirkin & Mishra, 2010).

The term "affordances" speaks to properties of designed objects which reveal to users what they can do with them. For instance, a button can be designed to look as if it needs to be turned or pushed, and a pencil has affordances for writing with the graphite tip. These affordances are not fixed and static. For instance, a pencil can be used to scratch one's back – clearly not what it was designed for, but something that its shape does afford.

The foundationally different nature of analog versus digital tools means that technologies have different affordances and effects on how we think, work

or create. For instance, an analog watch tells the time with hands that move around a dial, and the position of the hands is a measurement of the time. How much the hands move is in direct relationship to what the time is (i.e., if the hour hand moves two segments of the dial, twice as much time has passed compared to one segment movement). Thus, the movement around the dial is a means of *representing* time passing. But a representation of time is different from time itself – it is a time analogy. Something similar holds true for more basic physical tools such as a ruler. If one measures the length of one's finger using the surface of a wooden ruler and marks it, that measurement is the same length as the finger (Woodford, 2020). There is a one-to-one analogical mapping between the phenomenon and its representation. This does not necessarily hold true of digital technologies.

Digital devices do not store pictures, words, or sounds as representations on things like plastic film or magnetic tape or mark them with physical tools. They convert any information they work with into numbers (digits) and display or store the numbers instead. This makes it easier to store, manipulate, combine, change, recreate, remix, and share information across people and places. Thus, digital information can be played, edited, manipulated, remixed, and shared (individually or at scale) very easily. Transmitting or broadcasting information at scale in the physical world is challenging and costly, whereas basic digital technologies like e-mail, websites, YouTube, and others give anyone easy access to edit, create, and broadcast information with powerful and widely accessible tools. This has implications for how people create, and how they share what they create. Digital media have made it incredibly easy to take existing media and create remixes through a process that includes material steps like splicing, cutting, pasting, merging, and editing, and more important conceptual steps such as reinterpreting, reimagining, redesigning, parodying, and more. This, combined with the power of the network, allows users to share their creations with the wider world, and brings the community/audience into the creative process. Thus, networked digitality allows unique affordances for manipulation, access, and sharing that are different from prior tools.

That said, discussions about the constraints and affordances of technologies sometimes assumes a predetermined impact – wherein a doorknob affords turning, a pencil affords writing, a video affords watching, and so on. Yet this is not guaranteed, since a doorknob will not be turned if a person does not want to enter, a pencil will not write if a person has nothing to say, and technology will not influence learning unless its use supports or aligns with intended (creative) outcomes (Toth, 2014). Further, affordances are not inherent in the design of the artifact. A wooden box can be used as storage, or quite literally as a soap-box to pontificate from; a sweater casually draped over the back of a chair can be used as a marker of possession (e.g., “this seat is taken”).

These meanings are culturally created, shared, and deeply embedded within the sociocultural matrix of the communities we inhabit.

Yet educational technology is too often integrated without reflection on its function or its interaction with all the other social-cultural elements in an environment (e.g., the students, the content, the goals, the classroom space or culture, the activity, etc.) Technologies are not neutral – they have intention and agency built into their designs and affordances (both real and perceived), which emerge and interact with the immediate and broader environment they exist within. To illustrate, we consider this type of agency in a particular technology – viewing the internet itself as a technological construct that has reshaped how we think, act, learn, behave, create – and potentially how we educate.

Rethinking the Internet in the Intersection of Creativity, Technology, and Education

The internet, the most significant digital technological development of the late 20th century, has grown exponentially to encompass nearly all aspects of human life. From an initial network of computers came the World Wide Web, which then spawned social media platforms such as Facebook and Twitter, which have changed almost every aspect of human life – social, political, economic, and cultural. There are now professions – such as social influencers, SEO managers and Uber drivers – that did not exist a decade ago. Financial ideas such as blockchain currencies (e.g., Bitcoin) now trade in billions of dollars. Social and political movements have gained great power, reshaping our elections and political landscapes, and fracturing societies. There are issues around invasions of privacy, and opportunities for governments or corporations to intrude into human affairs and monitor people at scales not possible before. None of these things, for better or worse, would be possible without the networked and creative affordances of the internet.

The largest social networks dwarf all the world's largest nations in numbers as Facebook, WhatsApp, and YouTube have monthly user bases larger than the world's two largest countries, China and India (Hu, 2018). The COVID-19 pandemic further accelerated the rates of growth of internet technologies and social media, as it brought much of the world, from toddlers to grandparents, into networked communications and communities. One essential component of the current internet is the idea of a sharing networks – i.e., peer-to-peer technologies that have created spaces where people are encouraged to share “content” (files, material and intellectual property, opinions, ideas, “likes,” products, knowledge, and more).

The heightened production of content can be seen in any popular social media venue. Twitter sees over 700,000 tweets per day on average, with up to 10,000 tweets sent per minute, and hundreds of billions of tweets per year coming from all around the world, and with most world leaders on the platform (Smith, 2020). Similarly, YouTube has a steady and worldwide trend of use by consumers and producers. There are over 2 billion active monthly users on the platform (Youtube for Press, n.d.), with 77 percent of people in the US aged 15–35 using it and over 500 hours video uploaded every minute. (Tankovska, 2021). Well-known YouTubers are more recognized by teenagers than traditional “A-list” movie stars (Dredge, 2016; Henriksen & Hoelting, 2016). Other digital forms of self-publishing – artwork, e-books, blogs, and others – are also expanding. The majority may never find a significant audience or put a dent in their genre, but this demonstrates a dramatic shift in the social-creative landscape. This represents a global thought and information sharing resource in constant production, opening barriers to creative production and paths to an audience.

The internet has also blurred the distinction between users and creators, as many internet users are not passive users of the tools. They are active creators, influencers, and participants, driving the evolution of the technology itself. A simple example would be the use of the hashtag or even the @ sign on Twitter. This was not created not by the company, but something that users developed which was integrated into the technology by the company. Content creators on most platforms receive, respond to, and change their creative action based on direct feedback from their audiences in ways and at a scale that was just not possible before.

Ropolyi (2018) argues that the internet is understood in different ways depending on what we focus on. Although he suggested four ways, for our purpose we will focus on three. The first is that the internet can be seen as a constructed *information technology system*, second, it can be seen as a *network for communication and development of communities*, and third, and most important, it can be seen as a *cultural medium* that is “created by the continuous activity of people ... systems, networks, and worlds penetrating each other are interwoven in it” (p. 45). Humans, he argues, are consumers and creators of this organism:

The indispensable vehicles are the net, built of physically connected computers, the web, stretching upon the links which connect the content of the websites into a virtual network, the human communities virtually present on the websites organized into social networks, the interlinked human things as well as the infinite variations of individual and social cultural entities and cultural universes penetrating each other.

(p. 45)

These aspects of the internet support, engender, and afford certain ways of making, thinking, doing, and being (creative actions). It has been argued (Eisenstein, 1980) that the effects of particular media technologies *prefigure* processes and structures (cognitive, social, and cultural) in unique ways. For instance, speaking of the advent of the book and print technologies, Mishra et al. (1996) argue that certain properties of the medium (such as the fact that ideas could be inscribed in books and “transported” without changing their essential nature) influenced how we think. As they observe, “initially it was the medium, this new fixed object, that was immutable. Then the idea of immutability passed on from the medium to the message, with attendant implications of accuracy, fixedness, and truthfulness” (p. 289). One of the consequences of this transfer of properties from the medium to the message was that it solidified the notion of ownership of ideas and the convention that arguments could be settled by invoking the appropriate text – ideas could be “owned.” This is in sharp contrast to prior oral culture, where meanings were deeply connected to speech, with no external arbitrator or authority.

The changes associated with the advent of the internet are other examples of this phenomenon. In many ways, social media, with affordances that emphasize virtuality, plurality, and fragmentation (Ropolyi, 2018), is more akin to an oral culture than one solely based on print. That said, there are also significant differences between an oral culture and the digital culture of the internet – in particular the fact of *traceability*. Data on the internet are always available and can be pinpointed and identified relatively precisely. At the same time, the ability to creatively remix these data to create new combinations with different meanings across contexts suggests that meanings are not immutable.

This perspective sees creativity (playing out within this technological matrix) as a dialogical process that occurs within the context of relationships. This relationship is between actor and action in a dialogical relationship with the audience and the (perceived and real) affordances to create physical and/or conceptual artifacts. This sociocultural view sees cognition as being distributed among technologies and tools, individuals, and communities, and is continually evolving as members of the audience become part of the creative community.

This description of creativity maps onto the conception of the internet we have developed – i.e., as being more than a network of computers, but rather a cultural medium providing “context, locus, and medium” (Lerat, 2018, p. 1168) for continuous activity. It is a tool with affordances that align with what we have come to understand as creative practice. On the internet, actors (or groups of actors) are in constant interaction with an array of audiences using the material and sociocultural affordances available to them to create new artifacts (physical, digital, conceptual).

It is not surprising, given the synergy between this emerging sociocultural view of creativity and the affordances provided by the internet, that we are seeing this overflow of individual and collective creativity. It has allowed users to engage and interact with their audiences, to perform and be performed at, to directly measure their impact and make changes based on immediate feedback. This is not to say that all the products are highly creative (or even good), but they *are* expressions of an ever-evolving cultural production system.

This of course raises the question of what implications this intertwining of creativity and digital networking tools has for education and for learning in schools and classrooms. There are fundamental challenges that arise when we think of the insertion of creativity and technology (particularly the internet) into the classroom context. There are fears about the deliberate insertion of the uncontrolled internet into the lives of young people, despite the fact that youth are increasingly participating in these new technologies and cultures on their own. That said, it may be that this very lack of adult supervision in these spaces is a powerful driving force. Further challenges may involve access, cost, teacher knowledge, and more. But a fundamental stumbling block may actually be systems of schooling that value standardization and replicability within a predetermined curriculum above and beyond learning agency and creativity. If creativity is to play a strong role in the educational context, society must rethink the purposes of education. It is to this, that we turn next.

Rethinking Creativity as the 5-A's with Educational Technology

The 5 A's framework and the view of technology we have provided so far in this chapter give us a powerful lens to reimagine how creativity, technology, and education work together. In Figure 13.1, we aim to capture this shift from a static, individualistic, decontextualized approach (as captured by the 4P's approach) to a richer, sociocultural, networked, contextualized approach (as captured by the 5 A's framework). As is clear, the 4P's approach is typical of most current attempts at integrating technology in education. The 5 A's frame, we suggest, is transformative, not just for how technology is used, but in terms of changing the very matrix within which education, technology and creativity play out.

As follows, we dig deeper into the implication of the 5 A's model of creativity in classrooms (expanding on Figure 13.1). Specifically, we unpack the consequences of seeing creativity through a sociocultural lens, as specified in Figure 13.2. At the center is the triangular, and mutually constituting, relationship between *actors* (as individuals and groups) and *audiences* (often multiple) around the emerging new *artifact*. It is through this relationship that these elements *engage in creative action* that is situationally constrained and

The 4 P's of creativity		The 5 A's of creativity	
Focus on	Implications for educational uses of technology	Focus on	Implications for educational uses of technology
Person: Internal attributes of the person	Emphasize individual student's psychological attributes and celebrate individual successes. Technology used for individual students for creativity.	Actor Personal attributes in relation to a societal context	Emphasize the socially and culturally embedded nature of learners and creativity. Individual as embedded within a broader matrix. Technology use emphasizes connection and shared successes.
Process: Primarily cognitive mechanisms	Emphasize mental and internal aspects of the creative process, idea generation etc. Technology use supports cognitive goals of information gathering, ideation and construction of products.	Action Coordinated psychological and behavioral manifestation	Emphasize action, an integrated way of working, doing, and thinking that happens in tandem with the world. Technology used for collectively creating and sharing or evolving artifacts.
Product: Features of products or consensus around them	Emphasize creation of products that are evaluated on preexisting rubrics, typically by adults.	Artifact Cultural context of artifact production and evaluation	Emphasize understanding cultural/community sense-making and evaluation in the shared creation of creative artifacts. Digital and networking technologies used for remixing, sharing, and feedback.
Press: The social as an external set of variables conditioning creativity	The social as being external to the educational or creative process till learners are prepared. Little if any use of networked technologies.	Audience & Affordances The interdependence between creators and a social and material world	Emphasize the participation of the audience in the process of exploring and defining the affordances of the material/digital world. Digital and networking technologies used for remixing, sharing, and feedback.

Figure 13.1 Building on the 5 A framework with educational technology implications

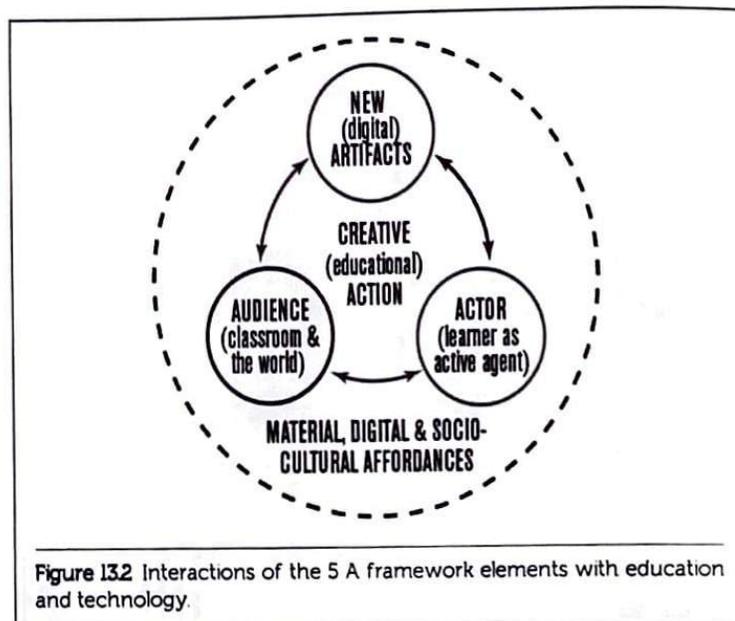


Figure 13.2 Interactions of the 5 A framework elements with education and technology.

supported by broader *material and sociocultural affordances*. Figure 13.2 emphasizes the manner in which technology transforms each of these elements and, more importantly, their relationships. We will now consider each in turn, with implications for education and educational technology.

Actor–Audience–Artifact

The term *actor* implies a person acting creatively, but goes beyond an individual unto themselves. An actor is a person connected in the web of social relations that exist within communities or societies. Describing people as creative “actors” acknowledges the social selves shaped by cultures or contexts and acting from within them. Creative actors are not disparate individuals (even if they happen to be working alone) because creativity is always tied to and emergent from systemic and cultural elements that are connected to others. This also implies that creators must be active and responsible for promoting their creations – similar to examples of real-world creativity, where artists, musicians, actors, entrepreneurs, scholars, and others actively share and disseminate their work and learn from audience response and feedback. So, while creativity does rely on individuals, Markus and Hamedani (2007) point out that “individuals are also ineluctably social and cultural phenomena” (p. 5).

This sense of performance and promotion always involves an *audience*. Using the notion of an audience rather than a “press” offers a more concrete and socialized way to rethink the abstract notion of an evaluative body assessing creative products, to instead see a “vivid image of multiple others assisting, contributing, judging, criticizing, or using the creative act and/or resulting artifact(s)” (Glăveanu, 2013, p. 74). Audiences can range in scope from collaborators, friends, family members, rivals, colleagues, funding bodies, review boards, critics, or professional associations to the broader public who may consume, observe, adopt, or reject the creation. Creators interact with an assortment of people and groups in performing or making, and these people are directly or indirectly involved in the emergence, interpretation, and ongoing evolution of artifacts.

Actors and audiences are collectively engaged in the creation of creative *artifacts*. The word “artifacts” has a cultured connotation that emerges from human groups and societies. Artifacts, unlike products, cannot be studied in isolation without symbolic/cultural associations. Adopting a sociocultural lens on artifactual creativity, Weiner (2000) notes that “each creation comes into being, is understood, and is valued as part of a larger web of relations of people, things, institutions, and beliefs beyond that particular creation” (p. 254). Societies and communities accumulate artifacts, and how we use and live with them demonstrates a mediated cultural quality. In addition to a physical presence, they carry meaning, and people engage in meaning-making activities surrounding them.

Implications for Educational Technology of Actor–Audience–Artifacts

The emphasis on the dialogic relationship between actors, audiences, and the evolving artifact has implications for creativity in education. The current educational system is based on a small subset of adults determining what students should learn and serving as judges of the value of what students do. In contrast, a perspective that appraises this dynamic dialogical relationship and emphasizes the social and cultural aspects of learning will lead to very different educational structures and possibilities. It implies a need for students’ agency – seeing them not as passive individuals working and learning independently on projects devised by the teachers, but as active, responsible agents who create new artifacts (material, digital, conceptual) for possible audiences. The audience in this context is not passive (giving a grade only at the end), but rather, is actively involved in the performance of the learning, and its evolution. For instance, involving learners in co-creating tools and rubrics for evaluating or assessing the work they do can be a powerful strategy to provide

agency to students. Thus, learners become part of the process of design, shifting between creators and co-creators of the creative artifact.

A shift of this nature cannot happen within many restrictive school structures. Here, the inherent affordances of new technologies and the internet might be brought to play, to create contexts where students engage with real problems that are of value to the world, not just creating solutions, but engaging in the acts of performance and persuasion around their ideas. New technologies that open up the classroom to the world, and the world to the classroom, allow for creation, sharing, and immediate feedback to further enhance these educational moves. Although project-based learning has become part of the educational process in many schools, projects are often limited in scope. The inclusion of the internet allows learners to expand the reach of the kinds of projects they engage in and the data they can collect, as well as the possibility to engage with experts as part of their research, share prototypes for feedback, and through that process engage in genuine creativity. The technology allows for immediate and specific data-driven feedback, and the learners can change course, or make subtle changes to what they do, on the fly to improve their creations. This provides a vision of what the world of learning and creativity can look like when it recognizes the social and cultural embeddedness of actors, audiences, and evolving artifacts.

Action

Creative “process” in creativity scholarship has typically been conceived of as the mental and internal goings on related to creative workings in the mind of an individual. Reconceiving of it as action means that it is much more dynamic and provides an integrated way of working, doing, and thinking that necessarily happens in tandem with the world. Action involves both the psyche and the physical world – i.e., it is both internal and external, directed at goals both symbolic or meaningful. Importantly, action cannot occur in a vacuum. While prior work has often described the creative process in ways that can feel somewhat universalized or reliant on set traits, creative action places the focus on not only the characteristics of the creator, but also the domain, the other participants, and other situational factors. It rejects the artificial distinction between “ideation, divergent thought, and insight on the one hand and execution, implementation, and performance on the other” (Sawyer, 1998, p. 11). The ease of use of the tools available today to create, share, and to receive feedback bring a performative quality to the action.

Implications for Educational Technology of Action

This vision of action as opposed to process implies that learning is integrated between the internal and external mediational in-between spaces.

Action is not about operating within one’s own mind or the bounds of the classroom, but about performative engagement with the world. In an educational context, this suggests that educators and learners need to go beyond the local ideation and the construction of ideas toward seeing how they can be actually made actionable in the world. Seeing creativity as including both cognitive moves (e.g., ideation, divergent thinking, and insight) and active ones (e.g., execution, implementation, and performance) opens up the learning environment in powerful ways. Students no longer perform for the teacher, but rather seek to engage with the world – perhaps thinking of their work as a performance that can move others. These opportunities for engagement with the world should be included in the classroom dynamic as a fundamental element for learning. If students are not encouraged to actively interact with real-life people in real-life situations, there always will be a disconnect between the what (specific content) and the how/why (application of the acquired knowledge and the reasons why it is even important to learn that specific content).

Technologies have a significant role to play in the power they bring to creative action by connecting students to knowledge, people, and spaces that extend beyond the bounds of their immediate classroom. New technologies open the classroom to the world, and the world to the classroom. The ability to create, share, and to receive immediate feedback give immediacy and power to these educational moves. Through online connections and communication, creativity has universal scope. Creative ideas drawn from the work of individuals and groups, and across different disciplines, can be made visible, promoted, shared, and enacted through online forums, including social media and platforms for “showing” (e.g., a blog, a podcast, a YouTube video/channel, or many other venues).

Affordances

From a sociocultural perspective, affordances are directly tied to technologies and tools, giving them some agency in the creative process. Tools, technologies, and other material objects are inherently an extension of human thinking and doing into the world. Tools, technologies, and other material objects both constrain and support creative action in an ongoing dialogical manner. Thus, design theorists such as Donald Schön (1984) referred to how designers are always in dialogue with their materials – every move made with certain materials “talks back” to the designer, suggesting, supporting, or changing the next move in a kind of dialectic and cumulative creativity.

Implications for Educational Technology of Affordances

There are consequences for “action” based on affordances. Teachers should be aware of and prepared to think about technologies as more than neutral

tools – considering the potential agencies embedded within any tool based on its characteristics, what it can do, and how it is being used. Understanding the concept of affordances (particularly toward enacting creativity) is critical for teachers to make informed decisions about what they choose to employ for creative purposes. Every tool (whether a crayon or photo editing software) affords different possibilities and ways of thinking and creating – some intended, some repurposed. There is no set of unchanging definitions we could provide to state which technologies map onto which affordances. However, teachers could be empowered with an evaluative lens to consider what they want to do and what the tools at hand might support.

Certain creative mindsets can be seen in the affordances of some digital tools. For instance, communication and design tools can be used by students (individually or in groups) to play, explore ideas, or manipulate virtual objects that correspond to real-world material objects. Online tools provide cross-platform common working grounds and enable students to collaborate with others in real time (Creely & Henriksen, 2019). Creativity is inherently associated with open-mindedness toward the new, or intellectual risk-taking. While this can pose a sense of discomfort or risk for many students, digital technologies may provide a safe space for trialing ideas. The ability to easily undo certain actions or play in a virtual space offer ways of experiencing managed risk-taking and enacting constructive failure to try out ideas in safe, non-destructive digital and virtual environments. For some anxious or introverted students, a virtual environment may offer opportunities for oral/visual presentations in a safe environment where they can choose an avatar, change their names or appearance, while still taking an active role in learning.

Beyond such technological *material* affordances, sociocultural affordances are critical for education. For instance, we might aim to humanize the curriculum and bring families and cultural contexts into the classroom. Instead of schools being sterile spaces where children are treated as all the same or blank slates, sans history, culture, and context, the affordances provided by new digital networked technologies may allow more connection with the community, family, and broader cultural matrix in which learners live. Examples could include virtual tours or trips, digital and virtual places of creation, collaboration, critique, and sharing where knowledge creation, creative expression, and learning are not centralized in institutions, but built around interest groups and communities.

Conclusions

We have emphasized the critical and interconnected roles creativity and technology play within the sociocultural world – across societies, communities,

classrooms, and other learning spaces. Glăveanu's 5 A's model represents a sociocultural shift in how we view and discuss creativity. The five elements require each other (particularly in social spaces like classrooms) and cannot be understood in isolation. Moreover, there is a temporal aspect that needs to be recognized as well. The 5 A's (actor, audience, artifact, action, and affordance) work together in dynamic ways, forming a complex web of interconnections that evolve and grow, organically, over time.

It is important to acknowledge that the function of technology to affect thinking, learning, or creativity did not originate with computers and digital media. Pea's (1987) definition of cognitive technologies as "any medium that helps transcend the limitations of the mind (e.g., attention to goals, short-term memory span) in thinking, learning, and problem-solving activities" (p. 91) includes systems of written language or mathematical notation. He acknowledges that every new technology, whether oral/written language, pencil and paper, or computer, has transformed education. Thus, we do not assert that digital technologies are the only or the best path to creativity in education. Rather, digital technologies are central to the world we inhabit, and more importantly, the world our learners inhabit, since these technologies provide powerful affordances for inquiry, information access, creating, editing, remixing, and sharing. However, these affordances offer little unless they are aligned with learning goals, creative purposes, student needs, or the cultural geography of the classroom.

It is important for teachers to be aware of affordances and consider what the available (digital or non-digital) resources or tools have to offer. In a socio-cultural context, tools of all kinds have uses that can also be rethought or repurposed based on the variables at hand. In some school settings, digital tools or internet connectivity are limited, and while this is a major equity concern, it is also a reality that many must work within. In a sociocultural frame, technological tools involve a system of knowledge, skills, and organization, not just connectivity or gadgets. Thus, an instructor who can think flexibly about any particular type of tool could also consider other types of tools (whether analog, digital or simple physical objects – e.g., a bag of beans for a mathematical counting game versus Unifix Cubes versus a digital math game).

Koehler et al. (2011, pp. 150–151) discuss the repurposing of technology, or the need to repurpose new technologies for instructional use (since few are designed with an educational purpose as primary function):

Most technologies teachers use have typically not been designed for educational purposes ... teachers must repurpose them for use in educational contexts. This is a process of *melioration*, or the "competence to borrow a concept from a field of

knowledge supposedly far removed from his or her domain, and adopt it to a pressing challenge in an area of personal knowledge or interest" (Passig, 2007). Melioration acknowledges the importance and necessity of the cognitive skill of drawing on knowledge from varying domains and combining them in unique and effective ways. Such repurposing is at the heart of melioration and is possible only when the teacher knows the rules of the game, and is *fluent* enough to know which rules to bend, which to break, and which to leave alone.

This suggests that a technology's purpose, while shaped by affordances and properties, is not pre-defined. Rather, the inextricable interactions of objects, environment, and human psyche determine its potential and significance. Thereby, an instructor who can evaluate a tool and envision how to use it creatively and to mediate cognitive, motivational, or social creativity or change could do so with any number of tools (Toth, 2014), digital or otherwise. Despite the obvious potentialities and dramatic shifts wrought by digital technologies, it is still educators' evaluative ability and creative use of objects that is key. Digital tools and connectivity are central as part of our world, so having an ability to evaluate their affordances, power and opportunities is useful in opening more paths to creativity – but there are, of course, any number of other possible paths.

The 5 A's framework suggests that technologies or tools of any type have a role to play across elements of the creative process. The distributed and interconnected nature of creativity and the role technologies play in either supporting or inhibiting it suggests there is value in using a frame that speaks to these synergies of creativity, technology, and education. As tools to think with, technologies operate across the sociocultural landscape – having *affordances* that affect the *action* the *actor* can take, and thereby the *artifacts* produced and what the *audience* receives.

Recommendations for Additional Resources

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