Failing to succeed: The value of failure in creativity

Edwin Creely
Monash University
Australia
Michael Henderson
Monash University
Australia
Danah Henriksen
Arizona State University
USA
edwin.creely@monash.edu
michael.henderson@monash.edu
danah.henriksen@asu.edu

Abstract: Creativity is often aligned, in the academic literature and in policy, with desired 21st century skills. Creativity is also positioned as a vital part of education for digital futures and for the technology-driven learning settings and work lives that students will inevitably face. However, often missing in the writing and the rhetorics about creativity is the link between creativity and failure. We contend that an affirmative view of failure within education, and the designing of learning environments that recognise productive failure, is vital. The affirmation of failure as a pedagogical principle is an integral part of not only fostering creativity in students but also preparing them for the sorts of adaptations and flexibility they need in an environment of technological change. Research and policy development about the affordances of failure in facilitating creativity within education are much neglected, especially in an educational climate of caution and standardisation. In this conceptual and position paper we critically examine and affirm the place of productive failure as a pedagogical principle for promoting creativity, with an eye to technology-rich environments and for developing 21st century skills. This pedagogical principle can be supported by four operational strategies: 1. Purposeful learning environments, 2. Assertive agency about mistakes, 3. Possibility thinking, and 4. Reflexivity following failure. We also offer possibilities of what a failure-textured and technological-oriented classroom might look like, including its design features. Finally, we suggest some possibilities for the generative and iterative uses of failure within classrooms, especially as failure is linked with reflexivity and innovative outcomes from uncertainty. This paper offers a conceptual framework about creativity and failure that needs to be tested and refined through reference to empirical data.

Key terms: Creativity, failure, reflexivity, design thinking, technologies, change, digital futures, 21st century skills, possibility thinking

Introduction

Creativity is a desirable graduate attribute for students of all ages, including pre-service teachers. It is valued as a 21st Century thinking skill (Dwyer, Hogan, & Stewart, 2014) and understood as vital to innovation and problem solving. It is for these reasons that creativity is often linked with digital technologies. Creativity involves a complex and poorly understood process of thinking. However, it is clear that the risk of failure is a fundamental component of any creative endeavour (Swanson & Collins, 2018). Indeed, risk taking is an essential trait in most conceptualisations of creativity and is understood to include a degree of uncertainty about unmet expectations or recognition that undesirable outcomes may occur (Hansson, 2011). In this context, failure is integral to creativity and therefore must be understood as educationally. Furthermore, in this paper we argue that, contrary to common misconceptions in education, failure can be conceived as generative in both the creative process and students' output within classroom settings. We further argue that such a view of failure can be a transformative pedagogical principle (Hay, 2016). It is transformative by opening up a space for creativity to emerge for students and teachers, especially as it is delivered within classrooms in which technologies are oriented to support both creativity and failure (Hall, 2012).

The context of creativity, digital futures and 21st century skills

In the last 30 years creativity has generated intense interest and significant debates for researchers, practitioners, policy makers and educators across a diverse set of contexts (Rhyammar & Brolin, 1999; Craft 2005; Harris & De Bruin, 2018). The vast literature in this field makes it clear that fostering creativity in education is highly desirable but, at the same time, there is a comparable lack of scholarly consensus to direct practitioners about what facilitates creativity in educational settings (Fasko, 2000-2001; Kaufman & Sternberg, 2010), particularly when it comes to using technologies (Henriksen et al., 2018). Nor is there much consideration for the role of failure, as to how creativity is enacted *in situ.*

One area of research and practice that has attended to creativity and failure is entrepreneurship within the scope of the business world (Ready, 2016; Acton, 2017). This points to emerging ways in which business views creativity and the role of failure as vital in forging new products, ideas and solutions. It also illuminates possibilities for the ways work and career may be enacted in the future, and that innovation, creativity and flexibility are essential capabilities.

This global interest in creativity has been especially centred on the use of technologies and online resources in response to the increasing digitisation of education (Al Nuaimi, 2016; Tække & Paulsen, 2017). The rhetoric has moved toward digital futures and what new online and virtual spaces for learning might mean for enacting creativity in the classrooms of the future. This suggests a substantive link between creativity, digital technologies and 21st century skills (Trilling & Fadel, 2009; Wrahatnolo & Munoto, 2018)—highlighting the need for more work that connects these topics in educational research and practice. One instance of this link are makerspaces that not only contain digital technologies but a range of informational and design resources (Fourien & Meyer, 2015).

Given the rhetoric, one might assume that education systems both emphasize and support creativity in schools, or that teachers and learners are afforded opportunities in policy and practice to engage in creative work, and productive failure with and through technologies. However, the reality behind the rhetoric is not so simple, and the challenges are substantial. Existing research has shown that much educational policy falls short of supporting creativity or clarifying its relationship to technology in practice (Henriksen et al., 2018). Despite the common rhetorical positioning of creativity alongside digital technologies in discussions of 21st century thinking, there is a need to better integrate how these constructs connect in educational practice (Siegler, 1996; Page & Thorsteinsson, 2017).

We suggest that within the emerging possibilities for doing and thinking creatively, digital technologies embody a set of modalities for dealing positively with failure and allaying concerns about failure in outcome-centred educational systems. Technologies, including online digital tools, offer the possibility of enhancing adaptability and independent thinking skills, promoting novelty and 'trying out' ideas in safe spaces of thinking and doing—all of which are established by research as correlates of creative thinking (Prabhu, Sutton, & Sauser, 2008; Casminaty & Henderson, 2016).

The place of failure in creativity

In order to understand the relationship between creativity and failure, and to reposition failure as essential and productive, we offer an elaboration of what failure means for creative practices. Within the creative processes of classrooms, we suggest that failure often does not seem to fit the desired initial goal or outcome for students or teachers. Given the emphasis on quality productivity in classrooms, failure may seem incompatible with gatekeeping practices that steer students towards results.

Indeed, notions about the efficacy of failure within education may also contain negative attributions and may not position failure as essential. In a 1991 article, John Rich suggested that "Schools are haunted by failure. Failure haunts the hallways, grounds, and classrooms; it insinuates itself into the lives of the school's inhabitants." (Rich, 1991, p.4). What Rich points to is a school climate, and a policy setting, in which failure is viewed as a problem that needs to be solved, rather than an integral part of the creative process itself. Failure also signals that which is *deemed* 'failure' by those in authority to make judgements about the worth or success of a creative process or product in schools, and seeks to establish normalised practices which can include or exclude failure. In other

2

words, derogatory notions of failure can operate implicitly both within creative thinking and making practices in classrooms, and more systematically, including at the level of curriculum policy frameworks. This is problematic when we consider the importance of failure in the world outside of classrooms, as part of the process of productive or creative success. Promoting risk aversion, via avoidance of failure, seems the probable result of policy settings tuned to standardisation and metrics (Hartlaub & Schneider, 2012).

However, failure may also be seen as a point of recognition by students that a novel design or an emergent idea has not met expected outcomes and therefore should be modified for the sake of improvement. It is also possible that the initial labelling of a creative process or outcome as 'failed' might lead to the re-examination of initial goals. In this sense, failure can become productive and essential for creativity. Failure is thus at the core of creative processes and iterations toward success-building, and need not be feared, avoided or dismissed—but seen as generative when aimed at learning goals, and when mediated through digital technologies.

Mednick (1962) explored the associative basis of creativity. By this he meant the ways that individuals and groups draw together and associate disparate elements to form new creative wholes or develop innovative and divergent thinking (Benedek & Neubauer, 2013). While Mednick does not use the word 'failure', he implies that 'trying out' (and thus, often not succeeding) with these disparate associated elements is pivotal to creative productiveness. Thus, the forming of new wholes from associated elements within a situation necessarily contains within it failure. In sum, Mednick opens up the idea that mistake-making is intrinsic in paths to success-forming.

The importance of considering failure

Why is an affirmative view of failure so important? First, because such a view counters the problematic narrative of traditional classrooms and the limiting constraints of much educational policy, in which failure is punished rather than supported for meaningful learning or a necessary part of ultimate creative success (Kapur, 2016). Although failure is frequently associated with deficit thinking and used pejoratively in education, it is essential to ultimate success in creative innovation and in meaningful learning outcomes or findings. Arts practitioners have long known the place of failure as a path to success (Hay, 2016); and more recently the role of failure in productive design and learning has been touted in business and numerous other areas (Tahirsylaj, 2012). Smith and Henriksen (2016) assert that failure is essential to deep learning, noting specific examples that emerge through digital technologies in arts classrooms—in which failure contributes to stronger learning. Falling short of success in early iterations or failing to reach a goal can be an impetus towards understanding or learning what does not work, and compelling future or further achievement (Lewis, 2014; Povova, 2014).

According to Sarasvathy (2009), who has researched successful business entrepreneurs, failure, when oriented to inventive goal-setting and practical use of resources (including technological resources), is the basis for creative success. She terms this idea *effectuation* and she builds her case for innovative use of failure by considering what works in situations of uncertainty such as those facing new entrepreneurs. In effect, an affirmative view of failure is needed as a prior condition to working through uncertainty, and trialling ideas and processes on the way to success. More generally, psychology research has recognized that intellectual risk taking, openness, and willingness to fail are all related, as vital correlates of creativity (Nusbaum & Silvia, 2011)—which may vary among people but can also be expanded and developed through educational opportunities (Karwowski, 2014; Madrid & Patterson, 2016).

Furthermore, failure is the basis for deep learning, because meaningful learning is less likely in situations of predictability—because such situations do not have the urgency or the need to effect change. This deep learning occurs because of the necessity for reflexivity generated in the experimentation and failure process, which leads, by necessity to innovative discursive thinking (Emmanuel, 2016). According to Burleson (2005), failure is necessary for developing different and flexible perspectives. This in turn leads to more open-minded views that suspend judgement and allow different perspectives to flourish—as necessitated by creativity (Silvia, Nussbaum, Berg, Martin & O'Connor, 2009).

Finally, engagement with failure may foster resilience, flexibility and the ability to adapt to change, which are core to 21st century skills (Trilling & Fadel, 2009; Martin et al., 2012). This is important to the sorts of creative skills that current students need in order to be employable and productive in a technologically

evolving future with changing work practices. It is not uncommon for creativity to be described as being enabled by and through technologies—yet there is little understanding of how this happens, and even less attention to the place of failure. Adapting to failure is critical for accepting real-world ambiguity and complexity, or the idea that there is more than one right way.

Failure as a pedagogical principle in teaching for creativity

We propose in this paper, that in the fluid landscape of digitisation and the desire for creativity as a part of 21st century skills, an affirmative view of failure can be a productive process in creativity. Indeed, it can be considered an essential pedagogical principle (something that is actionable) for the emergence of creativity in classroom spaces (Atjonen, Korkeakoski, & Mehtäläinen, 2011; Arminio & Schrum, 2013; Hay, 2016). We suggest four operational strategies in terms of the actioning of this principle in classroom environments with the aim of creating sites in which failure is acceptable and doable. These are schematised in the Figure 1 below. These operational strategies are highly interactive and should be considered part of the unfolding processes that operate around creativity and failure. This conceptual framework is grounded in literature and is the basis of what we consider to be much needed future research.
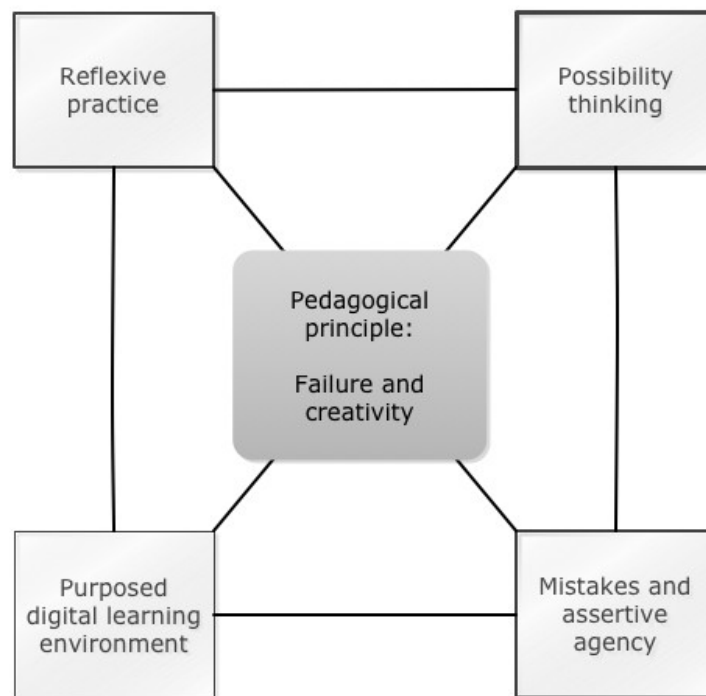

Figure 1. Operational strategies of the pedagogical principle of failure in creativity

The first strategy of the diagram involves purposefully averting the fear of making mistakes through the creation of learning environments geared to design, built technologically for experimentation and 'trying out,' and suffused with support safely making mistakes (Kapur & Bielaczyc, 2012). The goal is to manage open experimentation and play and then employ scaffolding of creativity to promote success-making out of initial failures. In this situation, ICTs can be employed as management and enhancement tools for risk as failures from experimentation unfold. The technologies then become instruments for knowledge management (Bhatt, 2001). ICTs can also facilitate individual and collaborative risk taking and can help students in two key ways: (a) to generate alternatives and new ideas, and (b) to keep their options/possibilities open for longer, sustaining them in periods of ambiguity which is a component of creative thinking (Casminaty & Henderson, 2016).

The second strategy is the recentering of classrooms to facilitate the development of agency for students, to promote a daring-to-be-wrong attitude or an overt openness to the possibility of failure in experimentation and play (Kusano, Wright, & Conger, 2016; Estabrooks & Couch, 2018). This subverts the hegemonic idea that failure must

be avoided, a notion that can be carried endemically within education systems. Jacob James echoes this idea when he wrote: "For the creative, doing the right thing all the time can be wrong. Does that sound strange?" (James, 2016). This focus on agency and creativity also relates to active learning and self-regulation (Boekaerts & Niemivirta, 2000). This agency might be expressed as a form of performance in which failure is part of a student's learning narratives (Hastrup, 2007). The aim of heightened emphasis on agency is capacity building around creativity through participation in processes that embrace failure. Importantly, digital technologies can offer opportunities to explore, create, share, and revise or iterate in the context of a positive view of failure.

The third strategy is possibility thinking in moving forward from failure (Cremlin et al., 2006). In other words, what might ensue out of instances of inventiveness that occasion failure. Possibility thinking is not causal or linear thinking but is recursive and orientated to the potentialities that can emerge out of failure. It underscores possibilities that would not have been possible if failure had not occurred. Possibility thinking is grounded in curiosity and imagination about what might be and what could emerge out of an idea or product not working out. Such an openness to new possibilities is a growth mindset (Hochanadel & Finamore, 2015) that we believe needs to be widely engendered in education. Practically, this idea of possibility thinking can be grounded in the interpersonal practices of teachers to students and students with each other. It can also be enacted through purposeful uses of ICT. Hunter (2015) suggests that technologies can unleash playful moments, boost creativity and offers opportunities for strong productive output geared to possibilities.

The final strategy involves employing reflexive practices to move failure toward design success. Reflexive practices are a set of purposeful processes which centre on personal and group reflectivity about actions and decisions. The aim is to build deep learning and enhance outcomes (Miettinen, 2000). Reflective practices centre on critical evaluation and design thinking as part of the collaborations within groups. It might also include teacher and student feedback about a creative outcome or process within reciprocal engagement (Gabelica et al., 2014). A crucial value within reflexive practices would be failure tolerance, in which instances of failure are framed as productive to learning, rather than diminishing. Lastly, reflexive practices allow for iterative processes such that there is a sense of developing towards and conceiving refined editions of a creative idea, process or product (Chan & Schunn, 2015). Notably, reflective practices are even more essential in the context of technology-rich settings (Kirk, & Pitches, 2013). In the ever-evolving landscape of technology teachers benefit from cultivating such practices to consider how technologies are interacting with their learning goals and classroom environment, and what new technological possibilities might also suit these.

What a failure-textured, technological-oriented classroom might look like

In this paper we have taken a conceptual look at creativity and the possibilities inherent in failure to enhance creativity and promote learning. We have suggested that productive failure is a positive pedagogical principle for incorporating failure into the teaching and learning practices in classrooms, with and through technology. This paper is also a position statement in regard to grounded empirical research we have embarked upon in classrooms about the role of failure in creativity and the ways that technology connects with this.

In order to more clearly reflect this in the reality of classroom possibilities, this section of the paper is an imaginative excursus into a conceivable exemplar of a classroom geared to an affirmative view of failure. We position this classroom as being one that is failure-textured, meaning that failure is not seen as diminishing success but as a set of growth pathways to success and part of imaginative play. The classroom is also therefore technologically-oriented in conceiving new (and old) technologies as opening spaces in which failure can be positioned as central to creativity.

Jane Smith is a teacher of a Year 8 STEM class. She also has an interest in drama and using drama as a pedagogical practice in her classroom, so she embraces transdisciplinary thinking and practice. The classroom has been purposefully designed by Jane and her students to allow everyone to play, experiment and try-things-out. It has four work corners and a central forum space. Students mostly work in groups and often rotate around each corner, depending on the task or activity. The whole class meet from time to time in the forum space to show, discuss and perform their work.

In one corner she has developed a space where students can chat, plan and trial ideas. She designed this space in consultation with her students. It has a digital whiteboard, space for students' devises, and a large screen

where students can work collaboratively with each other. Her students are encouraged to actively share and take ownership of their ideas. They are also encouraged to think and create daringly, no matter how silly the idea might seem.

In another corner of the room is laboratory equipment that enables a variety experiments to take place. Each group is scheduled to do some work in the laboratory space and then report back to the whole group. In a third corner, Jane has a play area in which various hands-on material are offered, including playdough, crayons and paper and building blocks. Students are allowed to experiment and play unfettered in this space. Finally, there is a makerspace corner which contains video equipment, robots linked to control device and computers and augmented reality (AR) devices, among a range of modalities. Here students can work on various projects, imagine worlds, use STEM-related AR, as well as program the robots.

The class is working on the big ideas of how we can reduce or eliminate plastics in the world's oceans and developing a propulsion system to get to Mars quickly. The focus of each of the activity corners is on this big idea. As we enter the room, the whole class is gathered in the forum space. A group of students has just presented a play about the impact of plastics on the ecosystem of oceans and what can be done about it. Some students disagree with the ideas in the play and say that what is being presented will not work. Another group is now demonstrating a biodegradable plastic substitute made from cellulose. Unfortunately, it tends to break apart in water and the whole group is figuring out why it is not working and problem solving for alternatives. The final group is showing the class their digital animation of a new propulsion system using Animaker. One student is heard saying that she loves the idea but wonders how all the materials to make it would get up into space. Another student then says that the solution is to mine the moon.

In this imaginative scenario, failure and trying-out of ideas are core to the pedagogy, and so is design thinking as students use the spaces to construct and form new ideas. Student agency is openly affirmed and so is reflexivity as students engage with each other about the what lies behind the success and failure of their ideas. Out of all the trialling and working with ideas, possibility thinking about the healthy ecology of the oceans and the dream of inter-planetary travel are front-and-centre. The aim of the class is not only to explore STEM ideas and STEM thinking (Reeve, 2015) but to produce students that can engage with problems that impinge on their future, using technology alongside creativity and potential iterations of failure—aimed at learning, success and growth.

Conclusion: conceptualising failure as generative and productively useful

In this paper we have positioned failure as generative and productive, and as a potential part of the path to success, learning and innovation. This is presented in a conceptual framework in which failure is an actionable principle built on four strategies: student agency and freedom, well-designed technological classrooms, possibility thinking, and reflexivity and deep engagement in groups. Productive failure can also be seen as essential for developing 21st century skills and equipping students with the positive entrepreneurial mindset they need to be successful in study and work life. Finally, we have argued that digital technologies can support each of these strategies and offer substantial possibilities in allowing failure to be contained and managed within the limitations of standardised system in which teachers work and students learn. Our imaginative scenario of the classroom of Jane, built around creativity, design thinking and failure, highlights the potential of using a range of technologies for exploring ideas and embracing mistake-making. Clearly, empirical research in classrooms is needed in order to understand the efficacy of failure as an actionable principle.

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8

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