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COLUMN: RETHINKING CREATIVITY AND TECHNOLOGY IN EDUCATION

A Decade of Rethinking Creativity, Technology and Learning: Reflections with the Deep-Play Research Group

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The method of our time is to use not a single but multiple models for exploration

– Marshall McLuhan
One good conversation can shift the direction of change forever.
– Linda Lambert
For every static world what you and I impose
Upon the real one must crack at times and new
Patterns from old disorders
Open like a rose
And old assumptions yield to new sensation.
– Louis MacNeice

Introduction

10 years ago, we, the *Deep-Play Research Group (DPRG)*, were invited to write a series for this journal around the broad and intersecting themes of reimagining creativity, technology, and learning. This series has covered a lot of ground over the past decade, allowing us to explore these ideas from a variety of perspectives. In the first three years or so we discussed issues related to defining and measuring creativity, teaching creatively with technology, and a subseries on transdisciplinary creativity. In 2016 we began a new phase, where each article focused on renowned creativity scholars with the goal of making their work more accessible to the *TechTrends* readership, as well as to connect their work to the broader themes that underlie this series. Thus, over the past 6-plus years we have had the pleasure of speaking with some of the most interesting and insightful thinkers and researchers in the field. Our aim, through this process, has been to capture the richness and diversity of approaches to understanding creativity and its relationship to learning and technology. In doing so we have, through these conversations, explored a range of perspectives on these issues: from psychology to neuroscience; from design to social justice; from organizational behavior to mindfulness. These conversations have brought home to us how deeply creativity is connected with our humanity, and how a coherent set of ideas and themes play out at multiple levels and contexts: micro and macro; personal and societal; disciplinary and interdisciplinary.

To celebrate 10 years of this series in *TechTrends,* we decided to do something different for our next two columns. Through this decade-long series, the individual members of the DPRG have remained somewhat in the background. Though our names go in the authorship, and clearly our individual tastes and perspectives are revealed through the topics we have chosen to focus on, we have always spoken as a

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collective. In this first anniversary piece, we decided to go a slightly different route. In this column, the first of two, we revisited these interviews, and asked each current member of the group to pick three (or four) of these interviews that connected with them, personally, and for once, foreground the individuals who make up the group.

Carmen Richardson goes first, setting the foundation, focusing on some of the most important creativity scholars that we have had the privilege to interview. She is followed by Melissa Warr, who focuses on interviews that, according to her, allow us to question or even bust some standard myths about creativity. Our interviewees did not just speak about what we currently know about creativity, they also pushed at the boundaries of this line of research, providing new approaches to studying creativity—which is the focus of Rohit Mehta's selections. In addition, many of our interviewees saw creativity as a tool or mechanism for liberation or for providing social value, which Sarah Keenan-Lechel focuses on. Creativity is often a critically important part of the process of design; the process of going from standard to "preferred states" (Simon, 1969). Danah Henriksen focuses on three design theorists and their perspectives on creativity while Natalie Gruber, expands the lens to see the role that creativity can have in creating a better life. Finally, Punya Mishra closes out the piece, looking to the past, the present and future of creativity and imagination. Though we do not cover all 35 of the interviews we conducted, we believe the syntheses that follow provide both a personal look at these ideas, and in their collective, provide a broader story and set of themes that this series has explored over the past 6-plus years.

Personal Synthesis

Carmen Richardson: Setting the Foundation

Internationally known experts Ronald Beghetto, James C. Kaufman, Jonathan Plucker, and Mark Runco have made fundamental contributions to the field. Interestingly, there were three key areas where these experts held common beliefs about creativity: defining creativity, the impact of technology on creativity, and supporting creativity in education.

All of these experts shared that creativity scholars have often published work on creativity without defining the very concept they are studying and so an imperative requirement for future creativity work must be to define the term. Dr. Beghetto believes it is necessary to embrace a certain level of ambiguity if we are interested in creativity, but it is only after we have defined creativity that we can understand and operationalize it. Mark Runco co-authored what is commonly known as the standard definition of creativity (Runco & Jaeger, 2012), articulating the importance of novelty and usefulness. Dr. Runco explained that when a definition only contains these two components many types of creativity can be overlooked. Dr. Beghetto emphasized the importance of context, self-belief, and recognition of one's own creativity. Dr. Kaufman highlighted the importance of task appropriateness. A focus on context or task is integral because creativity can manifest differently across different content areas and situations. Dr. Plucker also agreed that there needs to be a component in any definition that highlights the sociocultural elements and grounds the discussion or research in context. The social context is fundamental to being able to explore creativity in complex ways, especially when studying creativity in educational contexts.

Another area that was important to each of these experts was the support of creativity in educational settings. Dr. Beghetto mentioned the need for students to participate in open experiences where they have choice. In his research Dr. Plucker supports educators by offering professional learning around how to increase the support of creativity through small changes in practice. All four experts acknowledged that it can be a challenge to support creativity when educational systems are set up to reward conformity, not risk taking. According to Dr. Runco, this also leads to unfair experiences because those teachers that value creativity will find ways to support it.

All four experts believe that technology has done much to support creativity but are concerned about possible negative impacts. Dr. Beghetto shared how integral various technology tools can be towards augmenting creative expression in beautiful and powerful ways. Dr. Kaufman highlighted the importance of creation vs. consumption. All four experts mentioned the ability of technology to help creators bypass gatekeepers who may have prevented work from being seen in the past, allowing creators to find audiences for their work. Dr. Kaufman discussed the importance of collaboration via technology while Dr. Plucker cautioned against a technologically induced echo chamber effect that diminishes creativity. All the experts mentioned the negative impact of social media sites, specifically discussing the social pressures to conform rather than stand out that is common practice online.

Melissa Warr: Creative Myth Busting

I love myth-busting: I like to challenge common cultural beliefs, particularly when they get in the way of productive action and dialogue. I selected three articles to review that might address a common myth about creativity: that creativity is all inspiration and idea generation. Some people are creative and find new ideas in moments of inspiration, and some people just can't do that, this myth says. Each of the articles I reviewed pushed against this myth in

different ways. Michèle Root-Bernstein emphasizes engaging in active processes for developing creativity. Tatiana Chemi describes creativity as hard work and highlights how professional artists collect ideas throughout their life that later support creative connections. Finally, Chris Bilton discusses "uncreativity": the hard work that comes before and after a new idea.

Dr. Root-Bernstein pushes against using creativity as a noun. Instead, she tries "to keep it adjectival" (Keenan et al., 2016, p. 201) using it as a descriptor: creative behavior or creative processes. Dr. Root-Bernstein explains that creative genius is not inspired by new ideas appearing from thin air; rather, creativity stems from practice and knowledge across multiple fields that can be connected to address a problem. She commented that "we think when people are problem-oriented, and they're connecting all of these things [disciplines] with their hobbies, personal interests, there's more likely to be movement of thinking across and within each area" (Keenan et al., 2016, p. 201).

Dr. Chemi also emphasizes the active side of creativity. Her research shows that instead of waiting for inspiration to appear or intentionally ideating to find new ideas, professional artists draw upon their ideas and experiences and "the creative process becomes more about making connections and doing the work to bring those connections to life" (Richardson et al., 2019, p. 247). Constantly collecting and observing knowledge and experiences prepares the mind to make new and novel connections between ideas, supporting the creative process. This continual work takes the place of ideation-focused processes.

Finally, Dr. Bilton describes the hard work of creativity by giving it its own term: "uncreativity." Uncreativity is what happens before and after some creative act. "… It's not all about being this kind of inspired, full-on, always-on genius. It is about crossing over and switching between mental states, and even sometimes being in a trough of despair can actually be quite a good place from a creative point of view" (Cain et al., 2017, p. 103). Creative acts require the "uncreative" work of developing domain knowledge and practice that can lead to break-through thinking, which is the "exciting bit" but is "preceded and followed by this quite boring stuff" (Cain et al., 2017, p. 104). Although many creative models emphasize ideation or brainstorming, Dr. Bilton claimed that "brainstorming does not really generate better ideas. It generates more ideas but not necessarily better ideas. The framing that happens before and after that process is what really works" (Cain et al., 2017, p. 104).

These three scholars have pushed against the myth of creativity as a flash of inspiration or even deliberate process of ideation. Rather, creative individuals work, study, and practice across multiple disciplines, preparing the mind to make novel connections. After connections are made, the hard work continues through the refining and development of ideas.

Rohit Mehta: New (to us) Approaches To Studying Creativity

Our interview with Vlad Glăveanu helped open our collective understanding of creativity as a socioculturally situated process. Dr. Glăveanu understands that creativity "is not the product of a 'disconnection,' but of deeply rooted 'connections' between person and environment, self and others, creator and culture" (Glăveanu, 2010, p. 147). Dr. Glăveanu has been developing a thread of research involving the relationship between creativity and wonder, weaving in the idea of perspective-taking. In his description, wonder occurs in the present but is also an escape from the immediacy of the present. Wonder helps us escape the concrete bounds of 'what is' to either re-imagine what *was*, imagine what *is not*, or what *could be.* Building on nonwestern paradigms, Glaveanu's work pushes the field beyond cognitive and individualist views of creativity. Similar shift can be seen in the works of Pat Allen and Jonathan Schooler. All three of these scholars help us open up the field of creativity that has been dominated by western cognitive and individualist paradigms to consider social constructive and non-western epistemologies to guide new understandings.

Patricia (Pat) Allen is a noted art therapist who uses art and creativity toward mental, emotional, and spiritual wholeness. Dr. Allen believes the field of art therapy is at its best when focused on helping individuals connect to their inner creative source and the self-guiding wisdom available there. The sense of human interconnectedness and connections to the earth and life is also revered and celebrated by many indigenous cultures. Children can use this method to learn about and process their own feelings, emotions, and experiences—which is not only a valuable surviving skill but also a thriving skill. Dr. Allen sees how we might engage children's natural interests in technology, then extend this into activities that have them create. She advances a constructionist learning paradigm for creativity—which puts kids in the driver's seat of designing and creating with technology. Dr. Allen's groundbreaking methods directly relate to school-based contexts, offering students access to their own creative healing, freeing them up to engage in learning. Her work offers potential for change and societal healing, addressing the dysfunctions and traumas that societies suffer—by helping and healing the young people that will become the future of those societies.

Our interview with Jonathan Schooler went deeper into understanding the relationship between mindfulness and creativity, merging eastern and western epistemologies. Schooler's interest in the inner workings of the mind resonates with the concept of in-between states of consciousness.

Creativity has the potential to flourish in a liminal space between mindful attention and mind-wandering. While it is useful for the mind to be aware and focused it also benefits from wandering. A wandering mind can be a powerful tool for creativity and imagination, although it also can bring its own challenges to focus and performance. Mind-wandering can be detrimental when untethered. It is associated with distraction and a lack of discernment. Distractibility thrives in a digital landscape where apps are loaded with gimmicks from companies that profit from our attention: human attention is a tremendous commodity that can be harnessed for better or worse. Cultivating mindfulness with the intentionality of what you do with your attention can offer a kind of antidote to the challenges of a wandering mind, so long as we make space for the kind of curious "mind-wondering" noted by Dr. Schooler and his work. Mindfulness is the yin to the yang of mind-wandering. What Dr. Schooler called open mindfulness we might also call mindful wandering.

Sarah Keenan-Lechel: Creativity for Liberation

Shakuntala Banaji focuses on creativity as more than a cognitive set of skills or practices, thinking about more expansive forms of creativity that foreground independence, playfulness, and criticality. Dr. Banaji looks at creativity as practice for elevating student voice and implicates the systems that suppress this kind of engagement as contributing to the disproportionate oppression of students who fall outside of dominant norms and power structures. Without restructuring education in such a way that these creative practices can be taken up and students give space to engage with personally meaningful problems, Dr. Banaji presciently worried (during our 2016 conversation) that systems would force such a transactional and impersonal approach to knowledge to the detriment of mental health for both students and teachers. She saw this as reducing the space available for encouraging critical thinking and risk taking which would result in the spread of neoliberal national politics.

Edward Clapp understands creativity as a participatory pursuit – a distributed process that occurs across people, time, and space; therefore, he says, creativity cannot be analyzed from the unit of an individual. Studying creativity requires that we look at the interactions across actors and the artifacts that represent the changing and molding of creative ideas. This is the launching point for Dr. Clapp's study of *maker-centered learning* which "hinges on inclusive social environments that support learners exercise their agency through making" (Warr et al., 2022, p. 14) Here, Dr. Clapp and his colleagues seek to expand conceptions of what skills, knowledge, experiences, and tools are important in creating community needs. This participatory take on creativity not only pushes against traditional conceptions of what making means and looks like, but sets the stage for more inclusive pedagogical approaches.

Like the previous two researchers, Yong Zhao identifies oppressive structures in education that stifle creativity and discourage youth voice. Dr. Zhao conceptualizes creativity as part cognitive ability, part courage to create, and identifies the importance of creations having social value. Like Dr. Clapp, Dr. Zhao suggests that the very act of creating is knowledge-making, and that this requires a turn away from prescribed learning sequences, toward celebrating students' diverse talents and interests. Standardization is antithetical to Dr. Zhao's understanding about how creativity flourishes. He bridges the kind of individual and systems-level perspectives of creativity identified by Drs. Banaji and Clapp, though, makes it clear why the disruptions they both propose to our educational systems are necessary prerequisites for how he views creativity, too.

It is telling that all three of these creativity scholars approach creativity from different epistemological and methodological spaces but offer similar recommendations in service of supporting creativity in education. It is just as telling, I think, that the recommendations they offer are closely aligned with what culturally relevant and sustaining pedagogies ask: that students' lived experiences are centered in the learning / creating process, and that creation is geared toward a community-centric need. Students are well-positioned to develop solutions that address real-life inequities, which seems to me an empowering reason to champion the cause of creativity.

Danah Henriksen: Designing Creativity

Richard Buchanan and Paul Pangaro are design scholars and Keith Sawyer is an educational researcher. All are influenced by their own creative backgrounds and past experiences; Drs. Buchanan and Pangaro have worked in professional design capacities and Dr. Sawyer started his career as a pianist and professional jazz musician. The shared overlaps and differentiation across their perspectives has informed my thinking about design, creativity, and education.

While Dr. Sawyer is a creativity scholar and educational researcher, his views also connect to a design perspective. He views creative teaching as structured improvisation, likening it in some ways to the improvisational skills of an artist or musician. He noted that nothing is completely improvised—there is always an open, generative yet identifiable structure to improvise within. Designers, like artists or different disciplinary experts, often work within a general structure or situational constraints, and within those boundaries they make creative decisions that shape a design. Sawyer doesn't view creativity as something teachers teach, but as something teachers can *design* into a learning environment. He noted that:

> Teachers can design experiences, and by engaging in those, a learner might learn to become creative. But the phrase 'teaching for creativity' implies connotations of a personality trait…it becomes like a parallel with intelligence. It wouldn't make sense to talk about teaching someone to be intelligent" (Henriksen & Mishra, 2017, p. 15).

This view perceives design as a factor teachers' roles as designers of learning environments and experiences.

Dr. Buchanan, however, was clear that he believes creativity *is* teachable, and he aims to teach his design students to be more creative, and mold their capacity for perceiving new things and making new perceptions. As he put it, "Design thinking is a discipline…It means asking and answering good questions about every situation we run into…The ability to ask questions of the environment, to interrogate the environment, and to find the answers shows this great perceptive capacity" (Henriksen et al., 2018, p. 218). Using principles from early invention theory espoused by ancient Greeks and Romans, he noted how developing creativity involves learning practices that encourage asking good questions, breaking cognitive frames, and questioning categories. While this seems to diverge from Sawyer's view that creativity itself isn't taught, there are underlying similarities in the idea of arranging learner actions, tasks, or environments to help develop their creative possibilities.

Dr. Pangaro defined design creativity as an act of perceiving, using developed intuition and an ability to re-see something, or re-think what you see, toward new and effective ideas. His notion of breaking an existing mental frame or assumption to see something new connects with Buchanan's view of creativity as an act of perception (re-perceiving something in a new way). Pangaro emphasized the dialogic nature of design creativity; how designers move back and forth between the material world and their own cognition to create something, mediated by the process of design. Pangaro's emergent, yet bounded, dialog relates to Sawyers notion of a tension between structure and improvisation. Pangaro grounds design creativity within Simon's (1969) definition of design—as an action taken by anyone working "at changing existing situations into preferred ones" (Simon, 1969, p. 130). The broad applicability of this definition highlights the inherently interdisciplinary nature of creativity by all three scholars.

Natalie Gruber: Creativity and the Better Life

Dancing, cooking, surgery, playing music, and recess. Each of the three articles cover at least one of these fundamentally human, and creative, activities. The scholars featured in these interviews are all grounded in neuroscience and have highly practical wisdom to share on the nature and benefits of creativity accessible to us all. Their work sheds insights on shaping education, essential to preparing forthcoming generations to live, work, survive, and thrive.

Both Rex Jung and Charles Limb assert that creativity can be trained and developed in anyone. Paula Thompson and Victoria Jaque also emphasize that it is important to recognize creativity as a basic human ability and an essential component to fulfillment: "it is just as critical to recognize the value in creative experience and action as something that is integral to our humanness, and to our sense of purpose, wellness, and ability to thrive in the world" (Warr et al., 2019, p. 106).

Given the centrality of creativity to humanity, it is important to better understand *what creativity is and what it is for*. Dr. Limb emphasizes that creativity is more about novelty than for usefulness, and more about process than for product. Dr. Jung, on the other hand, emphasizes that both novelty and usefulness are of equal value: "it is important to find a sweet spot of creativity where you have a balance between novelty and usefulness" (Mehta & Mishra, 2016, p. 529). This is counter to the transactional mindset we sometimes have around creativity being a tool for innovation for commercial benefit, although the outcome of creative output is often of great practical use. Dr. Limb suggests that practical use is important and creativity is a fundamental aspect of human thought, essential for our survival and evolution as a species. Dr. Thompson and Dr. Jaque add that creativity does not always mean creating something new. Sometimes creativity involves interpreting an original creation, such as a ballet or musical score. Interpretation and enactment are creative processes.

Flow – a phrase coined by Csikszentmihalyi (1997) – is often a companion to the creative process. Dr. Thompson and Dr. Jaque research the experience of flow within the autonomic nervous system. They explain that engaging in the creative process leads to "heightened awareness, vividness, and positive feelings of a flow experience (which) may come from the combination of an active sympathetic nervous system and dampened anxiety response" (Warr et al., 2019, p. 104). Dr. Limb explains, flow "really feel like you're alive and you love something" (Warr et al., 2018, p. 139).

If creativity can help us feel more enlivened, solve problems, and is a universal part of the human experience, it seems as though we need to draw on our creative capacities now more than ever. Why, then, aren't opportunities to develop creativity more celebrated within education? Dr. Jung emphasizes that the creative process requires a phase called incubation where ideas "flow and bump into each other" (Mehta & Mishra, 2016, p. 530). This incubation time is also essential to learning. Jung refers to recess as the most important time of the day, as it allows for downregulation, giving the mind a break to allow for new knowledge to be integrated. Making the arts extra or optional in schools, as

Limb says, "takes away one of the best options for people to learn how to develop their creative minds…if we want people to solve the problems of tomorrow, we need to start this process of practicing creativity" (Warr et al., 2018, p. 140).

Punya Mishra: Creativity, Past, Present, and Future

The movie *2001 A Space Odyssey* has one of the greatest jump-cuts in the history of film. An ape, out of sheer excitement of having defeated another tribe of apes, throws a bone into the sky. The scene is simple, just the image of a bone rotating, in slow motion, against the blue sky. Then, without preamble, the shot cuts to a spaceship somewhat similar in shape to the bone, turning silently in the darkness of space. In this cut, Kubrick captures, powerfully and silently, the entire history of human civilization and the creativity and ingenuity that makes us who we are. That cut, leaping across millions of years of history, connects our past to our emergent future. The three pieces I selected follow a similar trajectory – albeit in a less visually powerful manner.

Our journey begins with Peter Gray, a psychologist who builds on his expertise in evolutionary psychology and interest in how humans (and other mammals) learn with a focus on the role of curiosity and social play in learning. He explains, "By playing together and being curious, children pick up language, learn and hone new skills, acquire knowledge, and gain confidence to be in the world by interacting directly with it" (Mehta et. al. 2020, p. 685). Though curiosity and play are often seen as being individualistic drives, Dr. Gray argues that they are actually social in nature. Further, he suggests that imagination is the crucial mediator that connects play with creativity, allowing learners to explore new possibilities, identities, and futures.

The next stop focuses on the here now, in a conversation with Ioana Literat, a sociologist who studies the social nature of online creativity among youth. Her work is grounded in the idea of distributed creativity, a theory focused on the social, material, and temporal dimensions of creativity. The emphasis on sociability, play and creative agency connects well with Peter Gray's ideas—except that they are transplanted into new networked media. Of particular importance to her is the idea of civic imagination which she sees as being "the first step towards having an improved future" (Keenan-Lechel et al., 2021, p. 142).

And finally, our conversation with Ed Finn looks to the future, seeking to harness our sense of play and imagination to create better futures for all of us. His self-described goal is to prepare young people to survive the coming century—a century that will be increasingly dependent on complex algorithms and creative technologies. Creativity for Dr. Finn is "an applied form of imagination" that is "key to envisioning possible futures" (Evans et al., 2019, p. 362).

These three pieces also highlight another aspect of this series: its eclectic yet integrative nature. The three scholars I selected come from different intellectual traditions, differing in the methodologies they bring to the phenomena they seek to understand, and yet are linked by a consistent set of themes—creativity, play, and imagination—and through that capture some essential qualities of what it means to be human. And these three pieces, in their eclecticism *and* their thematic coherence, capture why this series has been deeply meaningful to me.

Conclusion

A decade is a significant chunk of time to devote to a series of articles, and we believe it is an achievement worth celebrating. Over the past 10 years, our team has evolved, influenced by changes in lives and careers. Some have stayed while others have moved on, with a few individuals joining us for just an article or two. There have been significant transitions over these years, as is to be expected, with people graduating, moving across the country to take on new challenges. There have been many personal accomplishments: promotions, weddings, child births and more. And through all these changes, one thing has stayed constant. We have, every two months (with just a couple of exceptions) submitted an article to be published in this journal. It has become a part of the rhythm of our lives. And it has changed us, individually and collectively. In the final section, we provide a few personal thoughts on how this series came to be and what it has meant to each of us.

This series started from an inchoate idea in Punya's head—writing a column-series, where one could explore a cluster of ideas over time. As he says, "I pitched these ideas to many people but the first (and only) person to take it seriously was Abbie Brown, then editor of *TechTrends*. I truly can't believe we have been at it for 10 whole years!" Danah, who was just starting her post-PhD career, has been a co-leader from day one. As she puts it, "I couldn't have imagined what an important facet of my work it would be over a decade. The series has given us all the opportunity to explore creativity as an interdisciplinary phenomenon."

Rohit, Sarah and Carmen, started as doctoral students at *Michigan State University* and have continued through graduation and beyond. Rohit recognizes that this series allowed us to, collectively, "peel at the layers of creativity through the interview series which shed light on emerging patterns and themes." Carmen, in turn, explains her interest in creativity as coming from an involvement with the arts from a young age, a lens she brings to her work and analysis of these interviews, explaining "I believe all children deserve creativity supporting experiences as part of their education." Sarah saw this series as helping her draw

connections across multiple issues she cares about, saying, "Interviewing so many different researchers and getting to talk with them about the lenses through which they study this common phenomenon was a useful exercise not only for talking about my own interests, but for appreciating the ways in which layering a critical perspective on creativity helps center pedagogical approaches that value the experiences of all students." Along the way Melissa and Natalie, doctoral students at *Arizona State University*, came on board, adding to and learning from the experience. Melissa points to a shift "in how I think about creativity and learning, forming a foundation for future work" while Natalie, describing a shift in her practice since joining the group said, "I have been fascinated by the intersections of creativity, psychology, education, and mental health and have seen firsthand the healing benefits of creativity through my clinical work incorporating art therapy methodology."

We are collectively and individually grateful for the opportunities this series has offered us to explore issues of creativity, technology, and education and appreciate the readership who has followed along. We thank the editors of *TechTrends,* starting with Abbie Brown who first said yes, and then continuing through Dan Surry and Charles Hodges, for their support. And finally, thanks to the scholars who have so generously shared their expertise and time with us. They have given a human face to the scholarship on creativity, and through that enriched our understanding of the complex and rich relationship between technology, education and creativity.

Author Contribution Sarah Keenan-Lechel led the writing and organization of the article.

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