



# Unlocking Creativity: Dr. Anna Abraham on Interdisciplinarity, AI, and Human Innovation

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A part of what we ignore when we use words like cognitive, process and product, when speaking of creativity, is the world of feeling. —*Anna Abraham*.

Nothing is more satisfying to the human soul than creating something new. —*Irene Claremont de Castillejo*.

## Introduction

This article series explores the relationship between technology, learning, and creativity, and has recently focused on Generative AI (GenAI). With its ability to generate human-like text, images, and other content, GenAI has already challenged our understanding of creativity, though separating its true impact from hype is difficult. What is undeniable though, is that the creative capabilities of this technology have raised profound questions about the similarities and differences between human and machine creativity. Since 2023, we have interviewed a series of thought leaders whose work can inform our understanding of GenAI, creativity, and education. Our past discussions have emphasized varied issues, like the critical examination of AI's emergence (Warr et al., 2023), the value of integrating GenAI across education (Henriksen et al., 2023), how AI is informing writing, pedagogy, and technology (Woo et al., 2023), and

more. In this article, we focus on the psychological and neuroscientific aspects of creativity by speaking with Dr. Anna Abraham, an accomplished neuroscientist and psychologist with expertise in creativity and imagination.

Dr. Abraham holds the E. Paul Torrance Professorship in Creativity and Gifted Education at the University of Georgia. Her research spans multiple domains, including cognitive neuroscience, cognitive psychology, and clinical neuroscience. She holds a Ph.D. in Neuroscience from the Ruhr University Bochum in Germany, with extensive post-doctoral research at institutions like the Max Planck Institute for Human Cognitive and Brain Sciences.

Dr. Abraham's interdisciplinary research bridges psychology, neuroscience, education, and the arts, and she has authored influential books like *The Neuroscience of Creativity* (2018) and *The Creative Brain: Myths & Truths* (2024). Her studies often use neuroimaging to explore brain activity during creative tasks, and some ongoing projects examine the role of mental illness in creativity, the impact of aging on creative capacities, and AI's potential to augment creative processes. By integrating insights across disciplines, Dr. Abraham offers a comprehensive understanding of creativity, encompassing cognitive processes and broader social and educational contexts.

Our conversation covered a broad range of topics including how we define creativity, the importance of interdisciplinarity, the internal aspects of creativity, and the struggles and frustration inherent to the process as well as the fulfillment it can bring. Further, we discussed the role of technology, especially GenAI, in both supporting and possibly undermining human creativity.

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## Redefining Creativity

While traditional definitions of creativity focus on how the originality and effectiveness of products are externally judged (Runco & Jaeger, 2012), some scholars have also sought to offer more complete or representative definitions. Dr. Abraham proposes a different definition of creativity, based on her research, going beyond the standard definitional criteria of a creative idea as being novel and useful. In contrast, she suggests that we need to distinguish between two critical frames of reference when considering creativity. The first is an internal perspective, which belongs to the creator, maker, or explorer, i.e., the viewpoint of the individual generating the creative idea. The second is the external perspective, encompassing the viewpoint of the audience, recipient, or field representing how the creative idea is perceived and evaluated by others. The standard definition of creativity has focused on the latter—the product of the creative process and how it is received or understood by others. Dr. Abraham contends that this is inherently limiting since it misses something critical about creativity, its deeply personal nature. She argues that recognizing and differentiating between these distinct frames of reference is necessary for a comprehensive understanding and evaluation of creativity. In other words, she suggests that creativity cannot be fully appreciated without considering both the internal process of creation and the external reception of the creative output (Abraham, 2023).

The current focus on cognitive processes and measurable outcomes, she argues, often neglects the role of feelings and internal satisfaction in the creative process. She says that “a part of what we ignore when we use words like *cognitive*, *process* and *product*, when speaking of creativity is the world of *feeling*.” Acknowledging that this internal frame of reference is more subjective, and thus more challenging to assess, she asserts that it is essential for truly capturing the phenomenon of creativity, since relying solely on external evaluations may miss the core of creative experience. According to Dr. Abraham, internal frames of reference provide insights into the feelings and emotions of creators, with a focus on the experience of satisfaction resulting from overcoming struggles:

My redefinition of creativity can apply to both the internal and external frames of reference, but they are separable and different. There is an internal and emotional side that we are not capturing. When you’ve got something, it is an internal feeling. We enjoy what can be a struggle because there is a sense of fulfilment at its culmination.

In the context of education, focusing just on the external output may lead teachers to misjudge and negatively impact student creativity, as she explained:

If you apply the standard definition of creativity, teachers in that context don’t think there is an internal world that they should be consulting for students. This is unfortunate because teachers are there to probe and ask questions; they don’t have to judge. It’s with judgment that problems happen because students come away thinking what they produce is not good enough, even though they have created something that is new or surprising for them. When we train teachers, we tell them to accommodate the students’ internal frames of reference and examine their growth over time.

This inclusion of the internal frame has another added advantage. It allows us to go beyond the outputs of the creative process, which may differ across contexts and cultures to aspects of creativity which, she argues, are deeply human.

### Creativity as a Fundamental Human Drive

Creativity has sometimes been historically mythologized as a rare or special trait, although contemporary notions have expanded to a more inclusive and researchable perspective (Cromptley, 2016). Dr. Abraham sees creativity in a democratized way—as a fundamental human drive within all people, challenging the notion that it is exclusive to artists, musicians, or writers, saying:

We think of creativity as exclusive to a few because we focus on extreme forms of creative achievement. But it starts from a basic, almost spontaneous process we are born with, which is to explore and make sense of the world.

By viewing creativity as a fundamental human drive, we can compare it to other inherent human tendencies. She noted that all humans have the ability to be creative. She suggested that this is, “just like we have all the capacity to move.” Going further, she said, “Not everyone is going to be a top 100-meter specialist, but that doesn’t mean we don’t move. We still get many benefits from attending to our physical fitness.” Extending this, Dr. Abraham reflected on how creativity stems from “capacities that we have as babies,” noting this makes it “something that is in our grasp. So, we’ve been mistaken about the way we think about talent.”

Furthermore, creativity does not only serve practical and instrumental purposes but also leads to enjoyment and meaning making. This lets us make sense of experiences, express inner thoughts and emotions, and connect with the world in meaningful ways (Abraham, 2018). Her broader understanding underscores its importance in everyday life

and its role in personal fulfillment (Kaufman, 2018). Dr. Abraham's belief in the inherent nature of creativity actually supports that it can be nurtured and developed. Everyone, she suggests, has the capacity to enhance their creative abilities with appropriate guidance and opportunities, pointing out that creativity is "very trainable at any age." While people tend to be dazzled by examples of extreme creativity or of individuals who are recognized for significant creativity early in life, this kind of focus is not especially valuable in education, as she noted:

Just because creative ability isn't immediately obvious, doesn't mean that those who don't show it as strongly are incapable. That's a false matching notion. We need to realize that with exposure, training, and guidance, people can understand that it's within their grasp and can do it... When we only focus on the most obvious or extreme demonstrations of creativity, we ignore 99% of the world—what we're capable of at any age. A person can take up a new creative practice at any point in life to get better at it, gain fulfillment, and more deeply understand themselves.

This democratization of creativity may help foster a more inclusive and diverse range of creative expressions, breaking down barriers that limit creative opportunities to a privileged few. From an educational perspective, it connects with existing research on embedding creative education or training within curricula (Beghetto, 2013). While schools often focus on acquiring content knowledge, Dr. Abraham noted that if we view creativity as a trainable skill, then it merits attention in education, just like the fundamentals, such as literacy or physical education:

With something like sports, we don't say, "Well, you can't play football at a professional level, or you can't play tennis, so, don't move." Physical education is important for everybody, so you need to do it. Whereas, for creativity, we have these strange standards that we'll only promote if you are naturally gifted at it... That's actually maladaptive and counterproductive.

She highlights the importance of paying attention to creativity in educational contexts based on its relevance to our unique humanity, pointing out, "There's very little in the world where you're doing something, where you can put your unique mark on it, and that's where creativity comes in. So we should be promoting it as a general ability."

That being said, even in acknowledging creativity as a universal trait, Dr. Abraham is quick to point out that individuals have unique points of variability. Individual people differ across many dimensions, whether it be talent or other psychological or physical factors. In her work, she

has emphasized not talent, but other psychological factors that play a critical role in creative success. For instance, she noted that among the "Big Five" personality traits, creativity has been tightly linked and correlated to the trait of openness to experience. However, openness often receives the least attention of the traits, with studies and interventions focusing on helping people develop traits such as conscientiousness (Javaraš et al., 2019), or decrease traits like neuroticism (Armstrong & Rimes, 2016). In contrast, little attention has been paid to increasing our capacity for openness, even though she suggests the trait might be expanded by offering or exposing people to a broader range of experiences and ideas. Given this, Dr. Abraham poses key questions for education:

What kind of experiences do we offer to kids? Are some people not open because they've never had those opportunities to have varied experiences? The more you try something, the more it pushes you to try other things... Even a small amount of trainability matters, if it gives you more or deeper awareness of the world or even yourself.

In short, she presents a compelling case for fostering creativity across the lifespan and varied contexts for all people. In that, embracing creativity is essential since it touches on a range of contexts and subjects, driving human progress across disciplines.

## Interdisciplinary Approaches to Studying Creativity

Dr. Abraham's approach to creativity is inherently interdisciplinary, and stresses that it cannot be understood via a single disciplinary lens. She suggests that integrating insights from various fields, such as psychology, neuroscience, philosophy, biology, education, and the arts, provides a more comprehensive and nuanced understanding of creativity:

I'm interested in seeing as many different viewpoints as possible on the same question. It's something that naturally drives me, so I don't even see it as explicitly "interdisciplinary." I care what philosophers say or how creativity is conceived of in the biological world. ... By taking a wider lens, I'm exposed to people with very different backgrounds and interests and understand why they view creativity the way they do.

This interdisciplinarity has deepened her understanding of creativity across the field. For instance, psychological studies on creativity often focus on cognitive processes and individual differences, while neuroscientific research explores the

brain's mechanisms underlying creative thinking. Philosophical inquiries, on the other hand, might delve into the nature of creativity and its ethical implications. In fact, Dr. Abraham makes a strong case for listening to practitioners as well as researchers, to reduce our disciplinary biases. As she says:

You could be in a local art exhibition, and talk to the artist, and they will say the strangest things. This is their world, so we have to understand it. I can't just say, "well, I don't think that's true." They're the artist, and they point out things that may not even be in our vision. This can reveal that we have been ignoring another perspective, because we've been so focused on our narrow definition.

She pointed out that by combining different approaches, researchers might build a more holistic picture of how creativity works and how it can be nurtured. In this way, her approach differs from more siloed aspects of traditional academic research, as she noted:

There's very little crossover between disciplines on a topic that is actually easy to discuss in interdisciplinary ways. For example, you won't often find people in education speaking to therapists or those in AI talking to neuroscientists. There's a disciplinary bubble in creativity linked to how it has always been studied. Emerging from intelligence testing research, it was first applied in education and has remained tethered to that tradition for a long time.

Dr. Abraham argues that developing an integrated understanding requires being open to different disciplinary languages and jargon, as even a "simple word like 'cognitive' is used differently in education compared to neuroscience," which means there should be more dialogue and compromise to devise agreed-upon terms and concepts. These kinds of collaborations, while rare, often help people resist groupthink by expanding the frame:

When interdisciplinary work is going well, there is an infusion of ideas from everyone, which keeps us from staying in a bubble. Studying creativity is complicated, and anything we study could be broken down into simpler pieces—but interdisciplinary events reveal how much we still need to understand.

Her dedication to interdisciplinary collaboration broadens the understanding of creativity but also highlights different disciplinary, linguistic, and institutional challenges that get in the way. Navigating these differences in perspective and approach can be frustrating, requiring perseverance. This mirrors the creative process itself—specifically, the significant role of struggle and frustration in the creative journey.

## Role of Struggle in Creativity

Dr. Abraham believes that struggles or challenges are not only inevitable, but also essential for fostering true creativity and personal growth. In her revised definition of creativity, which considers whether products are perceived to be satisfying by both recipients and creators, she described *satisfaction* as a powerful internal feeling, indicating to creators that "they have it," "this is good," or "this is where I want to stop." *Satisfaction* can be a manifestation of a sense of accomplishment stemming from the struggle to exercise creativity (Sacchetti & Tortia, 2013). However, while the outcomes and enjoyment of creative work can provide satisfaction—struggle and frustration are also valuable and integral to creative learning. Unfortunately, as she notes, elements like struggle and frustration are rarely given space in formal education, and this hampers creativity:

Struggle is valuable, and frustration is important. That's what makes it all worth it. If all of our learning is based on our sense of what students get right quickly, it's no wonder everyone turns to technologies that are fast and reasonably accurate. What they don't cater to is exploring what students can do uniquely.

Education systems, she argues, have not "incentivized frustration," and sometimes function as "factory systems" that focus on narrowly training students—thus dis-equipping them from finding their passion and developing personal connections with the world (Deresiewicz, 2014).

Creative processes inherently involve trial and iteration, and, most importantly, *productive struggle* and *failure*. These struggles and failures are productive because they push us to not just engage with unfamiliar concepts but also to reflect on them, giving us the much-needed confidence to take risks (Kapur, 2008). Dr. Abraham provided an example of how teachers can guide students through writing processes, which requires them to "drudge" through the iterative processes of contemplating, generating, and reflecting. There is no shortcut to creativity, which is problematic, given that the availability of GenAI tools can remove this essential frustration from the process. The use of these tools may detract from learners' confidence and lead them to expect creative processes to be smooth and easy.

A key concern she expressed is how this reduction in skill development "pushes away their sense of confidence," a sense of self-belief that is intimately tied to creative potential (Homayoun & Henriksen, 2018). Over time, productive failures/struggles lead students to experience



satisfaction as they extensively practice expressing their “own ways of thinking and writing.” This is essential to developing creative confidence and supporting strong cognitive skills, which may already be suffering if the hard work is outsourced to technology, as she notes:

You can only become a good writer through practice. There is nothing else you can do except practice, practice, and practice. Another part of it is finding the way you uniquely express yourself. I think that’s really worth fighting for.

The advent and accessibility of GenAI tools complicate this process—providing easy ways of side-stepping an important step—the step of struggling to get your ideas articulated in ways that are true and honest. These new tools have also raised bigger and deeper questions about the nature of creativity itself.

## Implications of AI for Education and Creativity

GenAI technologies have raised questions about the nature of human creativity and how we can distinguish it from something generated by a software program, with some seeing it as a threat to human creativity across a range of disciplines. Dr. Abraham diverges strongly from this, arguing that humans perceive AI as being more than it is. Humans, she argues, have a natural tendency to ascribe intentionality to AI systems, much like we do with other complex phenomena (Mishra et al., 2023, 2024). Drawing on Daniel Dennett’s work, she argues that humans apply three stances to understand events: physical, design, and intentional. When confronted with GenAI—which uses language, interacts with us, and generates seemingly original content—we often default to an intentional stance, attributing human-like internal processes and agency to AI, even though it possesses neither (Mishra et al., 2023). In other words, she suggests that when AI produces outputs similar to human creations, we mistakenly assume the underlying processes must be similar as well. This confounds the distinction between process and product since the internal processes of these large language models are fundamentally different from human cognitive and emotional processes involved in creative acts.

Dr. Abraham gave the example of AlphaGo, an AI system, which made innovative moves in the game that surprised even the experts, seemingly defying conventional strategies. However, AlphaGo lacked internal states valuing moves or motivation beyond its programming. The system’s “creativity” emerged from its ability to process vast amounts of data and identify patterns, rather than from

human-like intentionality or understanding. Thus, what AlphaGo and other AI systems demonstrate is not true creativity. Rather it could be a form of what Runco (2023) noted is “a particular kind of pseudo-creativity” (p. 2). Thus, what appears as creativity is not, given the lack of an internal frame of reference or essential human creativity elements, like intentionality, emotional engagement, judgment, or internal sense of satisfaction or “rightness” that creators experience. By failing to distinguish between the product and the process, and not recognizing the unique context of human creativity, we risk misinterpreting AI’s capabilities and misunderstanding the true nature of creativity. Dr. Abraham notes about AI:

It doesn’t have a sense of what’s satisfying or beautiful. It just knows that this is what people tend to like. We also, at present, can’t tell what percentage of what we’re seeing is purely generated by the AI, and how much of it is informed by human design.

Despite these limitations, Dr. Abraham suggests that there could be productive ways of using AI to aid the creative process—artists have mentioned to her that they sometimes use it to spur imagination. This, however, requires a shift in framing, from seeing it as an all-powerful, creative tool to viewing it as a partner, involving a form of human-AI co-creativity, where humans and AI interact and influence each other while working on shared creative tasks (Wingström et al., 2024).

However, as AI usage becomes ubiquitous and embedded in education, she emphasizes the importance of remaining critical of the opaque processes of AI and assumptions about AI creativity and intelligence. Additionally, she notes that students must continue to have ample opportunities to overcome struggles as they engage in creative processes, to develop the skills and experiences to “gain the most” from AI. The lack of struggle that emerges from the easy availability of AI concerns Dr. Abraham. There is the distinct potential for negative cognitive effects of becoming dependent on this tool. As she said:

Cognitively, deskilling [by outsourcing one’s efforts to AI] is pretty insidious. The more you outsource, the less you’re able to do and know what you would say. That is the big danger. There is a lot that education is embracing without even the slightest reflection.

The worry about deskilling learners is quite real, and teachers, she suggests, need to be prepared to use AI in “very intentional, well thought out” ways that leverage its strengths, such as “cultivating interest” and “keeping informed about the latest in the world.” This can equip students with competencies to meaningfully interact with AI.

Teacher education has a critical role to play here, though it may require a reimagining of the role of teachers in classrooms. For this reason, Dr. Abraham advocates for the teacher education curriculum to prepare pre-service teachers to become “mentors.” Teachers, she says, will need...

...more social and emotional skills and more mentorship models, as opposed to factory models. Maybe we can return to more of a mentor model where you’re in the business of getting students to be highly intellectually skilled and confident and have the ability to do whatever they need to do.

This implies that teachers need training that embeds the knowledge and experiences to model, listen, and counsel students in ways that holistically develop their academic and psychosocial selves. GenAI and other technological tools might help in this regard, by providing personalized exercises, prompts, and recommendations that scale one-on-one mentoring (Mullen & Klimaitis, 2021).

Despite her concerns, Dr. Abraham remains open about the potential of AI to fill gaps in the field of education and provide new experiences for learners. She sees it as a “potentially wonderful tool,” but one that must be approached intentionally when used in educational contexts. She believes that a critical role here will be played by teachers, and emphasized the need for tools that will improve the experiences of teachers and educators—who continue to encounter job-related stress, depression, and burnout or consider leaving their jobs (Steiner et al., 2022). She explained that if done correctly, AI could even increase teacher agency. She said that:

We can incentivize technology to create tools that will help them, in terms of tracking student performance and providing interesting ways to look at very complicated subjects. They might then be able to do more of their own thing in class.

Finally, considering the interdisciplinary nature of creativity and AI, Dr. Abraham emphasized that the processes of creating AI tools must involve stakeholders from different disciplines “having conversations” and “compromising.” For instance, neuroscientists like Dr. Abraham can support the design of tools that strengthen students’ creative cognitive abilities (e.g., overriding constraints imposed by prior knowledge and expanding conceptual structures to make novel associations) (Abraham, 2014), while educators could bring in a more applied sense of pedagogical uses and needs.

Lastly, she noted concerns about the advancement and proliferation of AI, with a focus on the potentially harmful impact on educational equity and skill development. Foremost, she stated that policies should ensure a “consistent level of instruction and standards across all schools, to address huge differences and disparities” in access to AI technologies and technology training.

## Conclusion

Our conversation with Dr. Abraham highlighted how an interdisciplinary and grounded approach can support a comprehensive understanding of creative processes. Her insights on the fundamental humanity of creativity, the value of interdisciplinary dialogue, and the role of struggle and frustration in fostering creativity can help us understand the construct more thoroughly and frame it within human society and a rapidly changing world. As AI integrates into education and creativity, she highlights the need for thoughtful application, ensuring that human creativity remains central. By seeing creativity as a fundamental human drive, we might better nurture it at any age and create more inclusive educational environments. In that sense, Dr. Abraham’s advocacy for maintaining the human elements of creativity, while being intentional about the affordances of AI, could open new avenues for innovative learning and fostering human creativity.

## Declarations

**Competing Interests** The authors declare that they have no conflicts of interest or competing interests related to this work.

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