

“We can take this powerful mechanism and deliberately design it to learn”

Interview by [Sabine Gysi](#)
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Manu Kapur, Professor of Learning Sciences and Higher Education at ETH Zurich, explains his concept of “Productive Failure”. In the first part of our interview, he also discusses why teaching should be guided by the latest research on human cognition and learning.

Sabine Gysi: You developed the concept of Productive Failure. In this context, you once pointed out that seemingly successful learning is often superficial, and therefore unproductive. Does that mean teachers should just sit back and let their students solve problems by themselves?

Manu Kapur: No, that isn't quite the idea. The idea of Productive Failure (PF) is basically around initial learning. If you don't understand a concept, how do you come to understand it? What does the initial phase of learning look like, and how best to design for it? Typically, how people design for this initial phase in which you don't know a concept, is 'I will tell you.' 'I'll explain to you exactly what, how and why it is, you'll know the correct information and then you can use it to do other things, like solve problems and so on.'

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It's not that this doesn't work, it's just that it's not the optimal way. Whereas if you design *failure* in the initial learning, you'll still have to explain the correct concepts. But before you explain the correct concepts, if you've engaged learners in an activity that's designed for them to fail while solving the problem, then that failure helps them learn better from the subsequent explanation or instruction.

PF is about engaging students in carefully designed, constrained activities that lead to failure, but then, after that, helping them understand how they were thinking, where and why their thinking was correct and incorrect, misconceived or sub-optimal, and then consolidating their knowledge into the formalized, correct concepts. In short: we deliberately design for failure and then bootstrap that failure into something that's productive.

SG: *Can you give me an example?*

MK: We have examples from all walks of life. If you look at how children learn language at home, they don't go to a language class, you don't sit them down and say 'first, learn your grammar rules

and tenses and vocabulary and so on'; instead, you read to them, you talk with them. And these activities, from a complete novice standpoint, are *strange* activities; you are engaging the children in activities without them really knowing the language beforehand. The children will make errors – a lot of errors.

The idea is that language development, in part, then proceeds with learning something, inducting rules, over-generalising and correcting them; and where that feedback comes in is through the activity itself. There is no direct instruction to say that this is the way to use the language, children pick it up; there's over-generalisation, there's a failure, which is then corrected and the child learns to use it properly thereafter.

This happens naturally and it's a very powerful learning mechanism. Imagine *using* the same power; instead of waiting for it to happen, we design for it. We can take this powerful mechanism and deliberately design it to learn – not just language, but also mathematics or science concepts, just about anything.

SG: *Would you say it's important to maintain a playful approach to learning even at higher levels of schooling?*

MK: Absolutely, because play is an activity that naturally engages; and failure happens naturally in play, and that's what, in part, helps develop flexibility and adaptability which is very important for conceptual development and our ability to transfer what we learn to novel situations.

SG: *A teacher would be something like a moderator, then?*

MK: The teacher is both the designer and facilitator. If you want to use failure for initial learning, the teacher needs to know how to design for it. What are the principles based on which such a design works? Then, once you've engaged students in these failure-based experiences, how do you consolidate that experience to teach them the correct concept? On both levels, the teacher is extremely important.

SG: *So you're saying that we need to change the way we teach teachers.*

MK: The modern history of research on learning is maybe five to seven decades old and, especially in the last thirty years or so, there have been significant advances in how we understand learning. The problem of teaching and teacher education is not a lack of research, but that research is not tied to the practice. Much of teaching education remains dependent upon a lot of intuition, ideology and beliefs rather than the latest research on human cognition and learning.

Therefore, one of the principled ways to change teacher education is to take our understandings of human cognition and learning based on latest research, and use that to design teacher training programmes, both pre-service and in-service professional development. That would be a broad-scale principle upon which teacher training could be designed.

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SG: *When you develop Productive Failure designs, how and at what point do you involve students?*

MK: We involve students during the piloting process to find out how they interpret the PF activities we designed for them, how they understand it, and what they would do with it. When we design these failure-based experiences we want to connect with the students' intuitive experiences, too; it's not just about activating your formal knowledge you've learned at school but also your intuition and informal ways of thinking and reasoning which are very powerful. Students' thinking is very important and without that you can't design. It takes at least two to three iterations before we get to a PF task that works reasonably well.

SG: *What role does collective cognition play in learning?*

MK: In designing for PF as it is in play: You need a bunch of people to play, they bring in multiple perspectives. There's the need to communicate, develop shared understanding and representations, and give feedback. People who are good learners are able to self-critique and monitor, and we know that self-monitoring and regulation are very hard too, but in a collaborative setting the likelihood of group members providing some level of monitoring and regulation increases. For example, you may think you've explained everything to me clearly – but I still don't understand what you mean, I will give you that feedback which may lead you to revise your own thinking while you're explaining it.

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SG: *Since January 2017, you have held the Chair of Learning Sciences and Higher Education at ETH Zurich. What are your plans going forward?*

MK: Part of my work here is to continue to build a research programme on the learning sciences, to carry out fundamental research on human cognition and learning. Another part is to design interventions; taking our understandings of human cognition and learning – be it at the neural, cognitive level, embodied, or sociocultural levels – taking these understandings and designing interventions to work with the higher education faculty, to design and test these interventions in controlled as well as real settings, and to ultimately transform teaching and learning. That's broadly the mission of this professorship.

In the second part of our interview, Manu Kapur talks about recent global developments in education, such as the rise of technologies and artificial intelligence, and possible policy implications.

Manu Kapur is a full Professor at the Department of Humanities, Social and Political Sciences of ETH Zurich, Switzerland, and holds the [Chair of Learning Sciences and Higher Education](#).

Prior to joining ETH Zurich, he was a Professor of Psychological Studies at the Education University of Hong Kong (EduHK). Manu Kapur also worked as the Head of the Curriculum, Teaching and Learning Academic Group (CTL AG) as well as the Head of Learning Sciences Lab (LSL) at the National Institute of Education (NIE) of Singapore.

[Read more about Manu Kapur](#)

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