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taming educators' tech beliefs

Robin Schmidt

Forty years of empirical research on the use of ICT (Information and Communication Technologies) in schools has repeatedly shown that ICT is by no means "wild" and "threatening", but rather largely ineffective. Therefore, I argue that the "wildness" of ICT in schools is primarily a matter of impactful teachers' beliefs. I analyse some elements of these beliefs and suggest that its them that need "taming". On this basis I propose that they can be tamed by becoming closely familiar with their content and structures, by professionalising them based on research and thirdly by reframing the use of ICT in school as a question of enabling participation in a world that is changing through digital transformation.

Keywords: digital literacy education, ICT beliefs, teacher agency, teachers' beliefs

1. What is "wild" about educational technologies?

At the end of the 1970s, it became increasingly clear through learning psychology and classroom research that learning cannot be operationalised in causal terms. Systemically, pedagogy is subject to what Niklas Luhmann (in his ironic manner) called the "technology deficit of education" (Luhmann & Schorr, 1979) i.e., that no direct cause-effect relationships can be discerned in teaching-learning processes, but that they always take place under the condition of contingency, in contexts between teachers, students, and the school as an organisation, etc. that function neither accidentally nor coercively. Learning, education, and upbringing cannot be achieved causally, therefore there is no such thing as educational technology.

At almost the same time, it was becoming apparent that computers would, one day, be small and cheap enough to be used in the school context. Since then, they have been associated with the promise that they could make learning more efficient, more interesting, more personalised, more equitable, and so on. It was not only the OECD that was already promoting this in the early 1970s (Hof & Bürgi, 2021), even UNESCO was celebrating the potential of computers for shaping a more just world already in 1983 (UNESCO, 1983). Thus, since the 1980s, computers have broadly been offered as a solution to the "technology deficit of education" and, as such, have been readily accepted by many.

This can be exemplified by the large-scale laptop integration programmes of the 2000s around the world. The establishment of laptop classes was intended (so the full-bodied promise goes):

> "[…] to change the school's learning culture in such a way that independent, self-responsible and creative exploration and discovery by pupils is strengthened, cooperative learning and work is promoted and individualised and differentiated

> learning supported. In addition, the aim is to promote interdisciplinary learning. All this is intended to help the pupils to acquire more key qualifications that are independent of the subject, e.g., strategies for researching and processing information, communication and cooperation skills. […].” (Schaumburg et al., 2007, p. 10, original German, translation by the author)

Systematic evaluations of these laptop integration programmes are consistently reticent in identifying positive learning effects, even though the studies are mostly rhetorically concerned with highlighting the positive effects (cf. Schmidt, 2020, p. 33ff). A statistically significant increase in learning is only found – not surprisingly – in the area of computer skills (Herzig & Grafe, 2011, p. 76). This is also shown by international meta-studies (Hattie, 2015, p. 259; Tamim et al., 2011): the use of computers achieves an overall effect size of d= 0.37, which corresponds to average “school attendance effects”. What is particularly interesting in Hattie’s analyses is that no correlation between the effect sizes and the year of a study could be found, from which it can be concluded that the learning effects do not increase even with newer technology. Overall, these findings confirm the results of earlier studies (Zucker & Light, 2009) that learning with computers makes “no significant difference” (Petko, 2014, p. 104).

Where ICT (Information and Communication Technologies – a term used in the following to encompass the variety and confluence of today’s digital tools, networks and applications) has had positive effects on students’ subject learning, it is due to teachers use of ICT in the learning process (Gerick et al., 2014, p. 220). Slightly higher effects were measured, for example, if learning arrangements with ICT were designed in such a way that students could direct their own learning, if teachers used ICT to teach new learning strategies or to increase contact between teacher and students (Hattie, 2015, p. 262). Thus, learning is not improved by ICT per se, but it can improve learning outcomes in the context of professional subject-related didactic use, or in the context of learning-promoting interaction between media characteristics and learning prerequisites of the learners (Herzig & Grafe, 2011, p. 78). It is not the technology, but the quality of the classroom activities initiated by the teacher that are decisive for positive learning effects. These can neither be brought about by ICT itself nor are they conditionally dependent upon it.

In other words, forty years of empirical research shows again and again that ICT in schools is by no means “wild” and “threatening”, so that its impact needs to be “tamed”. Rather it appears to be largely without effect. In view of the empirical results, the greatest danger of ICT seems to be that a lot of valuable learning time is wasted because learning is expected to be improved by ICT use alone. Or as Luhmann would put it: intensive technology use in school replicates the “technology deficit of education”.

2. Wild beliefs

Looking back on previous ICT integration programmes reveals the pervasiveness of the rhetoric that the digital technology currently available still has some minor flaws, which hamper its ability to reach its full potential but which the next generation of devices will be able to overcome. What is interesting here is that the time needed to empirically test these claims for their potential for learning – i.e., roughly the ten years for careful theoretical modelling, implementation in the classroom and empirical survey, evaluation, publication and reception – is pretty much the same timeframe in which the next generation of digital technologies becomes available. This we see from

the PC of the 1990s to the laptop of the 2000s, from these to the tablet and whiteboard of the 2010s and so, currently, to today's AI and VR technologies.

Given that the next "wild" technology will come along in each case, solid empirical research on the potential for learning improvement using current ICT technology always seems redundant by the time it is available. It is always only the next generation of technology that appears "wild", exciting and powerful enough to solve the fundamental problems of education. Apparently "wild" is the foremost belief in the quest to technically resolve the "technology deficit of education" through technological progress.

Initially, it was assumed that the lack of effectiveness of laptop integration programmes – besides inadequate equipment in schools – was due to inappropriate teachers' beliefs. As a group, their beliefs about ICT appeared to be the "final frontier" (Ertmer 2005) to successful ICT integration. Teachers were thought to carry outdated or overly instructivist beliefs about learning that were incompatible with the use of ICT in the classroom. Accordingly, these beliefs needed to be identified and changed through training and professional development.

Today, this research on teachers' ICT-related beliefs and attitudes forms a whole branch of expertise (Ottenbreit-Leftwich et al., 2018). Among many other findings, it has become clear that teachers' ICT beliefs cannot be changed intentionally towards a targeted use of ICT. Central and often overseen is the finding that the actual use of ICT in schools seems to be primarily determined by teachers' beliefs. It is their beliefs and attitudes towards ICT that largely determine current school ICT practices – but not professional knowledge (Schmidt, 2020, p. 128).

So, observed together, the belief of educators and stakeholders in the effectiveness of the next generation of ICT on the one hand, combined with teachers' beliefs about what school with ICT should look like on the other hand, appear to be very powerful. Together they can unleash enormous financial investments and shape the reality of ICT use in schools. Seen in this light, it is not ICT per se that is "wild", but rather educators' beliefs about ICT.

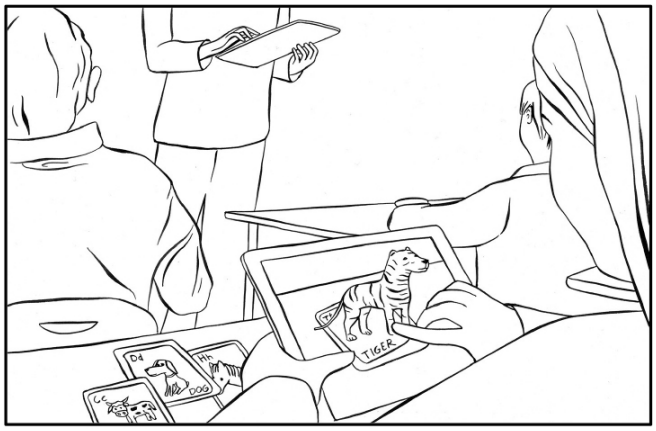
3. Taming educators' ICT-beliefs

Accordingly, it would be less a question of "taming" technology but rather of "taming" the technology beliefs of teachers and stakeholders. What can be done to tame educators' ICT beliefs? Firstly – as Saint-Exupéry's "Petit Prince" already knew – "taming" is about getting to know without intent. What really are the guiding beliefs of educators? What are the driving ideas and concepts in teachers' minds?

In a qualitative study, the ICT beliefs of more than 100 students who will be the next generation of teachers were investigated (Schmidt, 2020). The following typifying and simplifying illustrations depict the prevailing ICT-beliefs of pre-service teachers:

Type 1 imagines a conventional classroom in which the teacher takes the role of the "front" instructor and ICT adds to the organisation of the lesson or the illustration of content, but does not change its structures or content.

Type 2 imagines a conventionally organised classroom in which the use of contemporary ICT such as tablets is supposed to make lessons more interesting or modern. The presence of the teacher is attributed an important role because of the increased general use of ICT.



Type 3 orients the image of school to current pedagogical models such as inclusion or personalisation in teaching. ICT enables new forms of teaching such as learning landscapes, learning studios or flipped classrooms, whereby a coexistence and sequence of traditional and modern forms of learning with and without ICT are envisioned.

Type 4 replaces the current image of teaching in two directions: on the one hand, into a virtual learning environment (that virtually replicates the structure of traditional classrooms) and, on the other hand, learning coached by teachers in real and virtual learning landscapes.

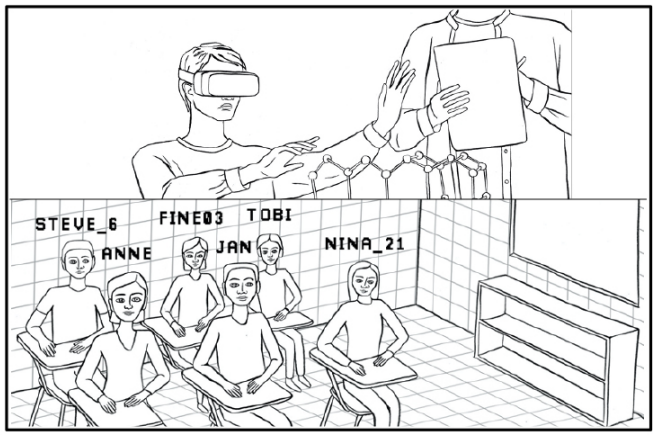


Fig.1: Types of Teachers' ICT Beliefs (Schmidt, 2020, pp. 214ff)

These are by no means illustrations of good or bad teaching. Rather, they represent the prevalent beliefs of pre-service teachers of what digital school is all about.

If such beliefs really are central in shaping the reality of ICT use in the classroom, a main task of teacher training must be to reflect and challenge them with educational science findings, subject didactic knowledge and standards of good teaching. What characterises good teaching and how are these standards met when teaching with ICT? How can specific goals of subject didactics be achieved through ICT? For example, the type 1 and 2 beliefs are mainly concerned with increasing the effectiveness of the teacher: ICT should reduce organisational work and/or achieve better learning results. Here, in teacher training it is important to learn how to shape the classroom use of ICT by pedagogical motives, for example through personalisation, student orientation or feedback culture. Types 2 and 3 call instead for a reflection based on subject didactics: in history didactics, for example, it would be necessary to reflect on whether and how ICT use contributes to the acquisition of a competence in accessing historical sources and representations and how the relevance, transparency, and performance of digital history teaching formats (Demantowsky, 2015) can be taken into account.

So, a second element in taming educators' ICT-beliefs is about ICT-professionalisation, how to find forms of teacher education and continuing professional development that challenge existing beliefs through reflection and research findings.

However, a third and even more central motive than the intention of improving learning through appropriate pedagogical and subject didactic use of ICT today, is probably the consideration of social change through digital transformation. School today takes place within and facing a society changed by digital transformation. The academic subjects on which school subjects are based have already fundamentally changed through digitalisation. Work life is facing major changes. Together with climate change, global migration and many other major challenges, the significance of digital transformation is now posed in radically changing surroundings, against which the significance of ICT in school must also be re-considered.

From this perspective, it will be increasingly important in future to develop and maintain conditions for access to and participation in a society that is shaped by digital transformation. Just as "literacy" includes reading and writing, being able to express oneself and being heard, and is thus a necessary condition for participation, the same applies today to participation in a digital society (Mioduser et al., 2008; Swertz & Fessler, 2010). Here, too, it is important to learn a secure and confident way of comprehending, orientating, and expressing oneself according to one's age and abilities. It is important to understand the roots and consequences of changes in professions and life, as well as to be able to learn and work with digital media, to be able to engage adequately in a subject or professional field and to be able to achieve one's own life goals. This means that for active participation in today's society, teachers as well as students should be able to achieve and constantly develop a "digital literacy".

In view of these intentions, the question of whether a teaching tool is digital or analogue is not really pivotal, nor whether current teaching can be somewhat improved by ICT. What is pivotal is "digital literacy education", i.e., whether it is possible to learn in school what is relevant for life in a society changed by digitalisation and whether students are thereby enabled to make their own original contribution to shaping this world.

Therefore, a third element of taming educators' technology beliefs is to reframe the whole intention of technology in schools as a question of school in the conditions of a society transforming through digital technology. The question for educators here is how they acquire *agency in digital literacy*

education (Albion & Tondeur, 2018; Priestley et al., 2017).

Starting from the premise that ICT use in schools is largely ineffective in terms of its influence on learning outcomes, and that even the most advanced digital technologies cannot resolve the "technology deficit of education", we have argued that the "wildness" of ICT is mainly to be found in the beliefs of stakeholders and educators. It is their tech beliefs that need to be tamed. This taming, we suggest, can be undertaken firstly by becoming familiar with the driving ICT beliefs, secondly by professionalising them through reflection and confrontation with educational research findings, and thirdly and most importantly, by reframing the question of ICT in school as one of *digital literacy education,* i.e. to contribute to ensuring conditions for participation in a world that has begun to be fundamentally and lastingly changed by digital transformation.

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