Human Capital and Innovations in Education

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Does public investment in educational innovations makes sense? Is there a tangible return on investment in innovations, either public or private? We know for certain that investments in expanding the existing modes of education do pay off (Becker 2009). But does it make sense to invest in innovation? This chapter will consider available evidence on impact of educational innovation, primarily at K-12 level. It will also demonstrate the need to conceptualize the impact of innovation. Work conducted within the next generation of educational reform should look very different from what we have done so far.

8.1 The Apparent Failure to Change

Do innovations in education work? The answer depends on what one means by "working." Let us consider the most obvious meaning: the impact of innovations on measurable learning outcomes, on how much, how well, and how fast students are able to learn. In higher education, we have very limited objective measures of academic learning, which is why I will concentrate on the K-12 level. In most developed countries, national systems of standardized testing provide sufficient data on learning outcomes at secondary level. Besides, we can use the international comparative studies such as PISA. Let us consider some of the most visible and most discussed directions of innovation in K-12 education.

The elusive benefit of information technology adoption is but the latest example of unfulfilled promises of educational innovation. Studies of various technologies'

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efficacy are not only exceedingly rare; there are few incentives to conduct any at all (Blumenstyk 2016). Neither manufacturers of educational technology nor their institutional customers are eager to find out that one or another expensive thing may not make any difference in the end. We simply do not know if one or another technological innovation in education works or does not work to increase efficiency of learning, and no one seems to want to find out. Large-scale public and private expenditures on hardware and software are fueled almost exclusively by unproven assumptions. Besides the lack of incentives, there is the inherent difficulty of conducting a true causal design study in education. One thing we know for sure: no one can detect any correlation between when and how fast a country has introduced computers and Internet into classrooms and changes in its educational achievement as measured by international comparative studies. In other words, if there was a large impact, we would have seen it at least in some countries. Andreas Schleicher (2015) stated, more or less, just that, using extensive data sets compiled by the Organization for Economic Development and Cooperation (OECD). Karasavvidis and Kollias in this volume present a very compelling and sophisticated analysis of the possible reasons for the information technology's failure to impact outcomes, highlighting differences in the practice of teaching and learning. I find their argumentation very convincing, but for now, it is enough to establish the fact of failure, without considering its causes.

Another relatively recent innovation is the introduction of consumer choice and provider competition into elementary and secondary education. The idea is attributed to Milton Friedman (Friedman and Friedman 1990) and is dated back to a 1950s–era proposal for school vouchers. The idea is not new, and in the Netherlands, for example, it has been practiced since about 1917 (Ritzen et al. 1997). However, in the USA, it was first piloted in late 1990s and then widely introduced in a somewhat more constrained version of school choice under the name of charter schools. Similar institutions exist in the UK as "free schools" and in other countries under various names. This was not a technological but rather an economic innovation, with all the promises of a great, well-founded idea. After all, stimulating competition has been shown to incentivize productivity growth in many other industries. The hope was that schools competing for students will become more innovative and, ultimately, more efficient and effective. Evidence from the large-scale Chilean experiment (Carnoy and McEwan 2003) seems to suggest that it did not happen. There is little evidence that other forms of school choice have shown significantly higher levels of effectiveness and/or efficiency. A meta-analysis of 195 meta-analytical studies of charter school effectiveness has shown a mean effect size of only $d = 0.07$ (Hattie et al. 2015)—a meager result by all accounts. It is a positive result, but not nearly as sizable effect as Milton and his followers, no doubt, had in mind.

Finally, the most visible example of a managerial innovation, the test-based accountability reform, is remarkably little studied. The lack of research is surprising when one considers the scale of the investment in this particular kind of reforms. The research we do have seems to show mixed results. For example, a recent paper (Deming et al. 2016) demonstrated that designating a Texas school

"low performing" created enough pressure to increase graduation rates and test scores but only modestly. Disappointingly, the impact of accountability on life outcomes (such as college attainment or salary) seems to disappear over time. Moreover, schools tend to game the system by classifying more students as special education eligible, and actually harming their life outcomes, while simultaneously raising the average test scores. Ravitch and Mathis (2010) asses the literature on the question "Does Accountability Work?" as mixed "with some studies showing modest test-score gains and others showing null or negative effects" (p. 15).

I limit myself to these three most prominent and likely most expensive innovations in education: technology, school choice, and accountability. These three are not, however, exceptions. In the most comprehensive up-to-date meta-analysis of meta-analyses, John Hattie (2009) establishes the average impact of educational innovations on academic outcomes at 0.4 standard deviations (Hattie 2009, p. 12). Measured by impact on student test scores, educational innovations are, at best, not significantly impactful. This is a sobering realization, and we should try to understand why.

The evidence may compel policy makers to question the wisdom of continuous funding of educational reforms and innovations. Why should taxpayers and private philanthropists keep pouring money into reforming educational institutions that quite visibly refuse to change? The worry might be premature, for there is no evidence yet that policy makers' and philanthropists' appetite for education reform and innovation is wearing thin. Sooner or later, however, the public will be disappointed with the repeated cycle of promise and failure. That is unless we can provide another compelling rationale for continuing to invest in innovations.

8.2 Labor in Education

Let us consider educational innovation in terms of labor economics, according to which both students and teachers are considered to be laborers. This is a departure from Gary Becker's (2009) version of the human capital theory. He states:

> Instead of assuming that time can be allocated only between market labor force activity and nonmarket consumption activity, I now introduce a third category, investment in human capital [. . .] Each person produces his own human capital by using some of his time and goods to attend "school," receive on-the-job training, etc. (p. 63)

For Becker, student efforts to learn are neither labor nor leisure but something else. I won't delve into the reasons why I find this new categorization unconvincing (see Sidorkin 2007). For the sake of argument, let us assume that the school-related efforts to learn are a kind of labor. It may be unwaged labor for students, but then there are other kinds of unpaid labor (volunteerism, military service, domestic work of women, etc.), and the lack of wages does not prevent us from considering them to be labor.

The productivity of student and teacher labor has not changed much over the last century; at least no one can provide evidence of such a change. The Baumol's "cost disease" continues to reign supreme in education as it does in the performing arts. The phenomenon Baumol and Bowen (1966) described suggests that while productivity of labor in some industries does not change, salaries do increase to compete for labor with other industries. Performing arts have experienced many innovations in lighting and sound technologies, stage design, and the way they advertise and sell tickets. Yet the fundamental economics of theater—live human performance—has not become any more productive than it was in Shakespeare's times. The innovations tend to occur at the economic margins of stage theater, and in fact, they tend to make production even more expensive. Technical innovations enhance viewer experience but do not reduce labor expenditures by play wrights, directors, musicians, and actors.

Similarly, education has seen many innovations at its margins, including the ways of seeking, presenting, and distributing knowledge. However, similarly, the rising cost of education has not budged. We have not been able to either reduce the labor expenditures or make student and teacher labor more productive. Just like in stage theater, non-automated and non-scalable labor is at the core of our business.

With regard to student labor of learning, we may be pushing against a simple intrinsic limit on productivity growth: Student effort is directly proportionate to learning outcomes. Neither automation nor division of labor—the two usual engines of productivity gains—is relevant here. In other words, learning has to stay inefficient; otherwise it will not be effective. Automating or otherwise alleviating student labor would be as pointless as making body builder' dumbbells lighter to facilitate exercise. Many educational utopianists have held that learning could be made pleasurable, but they have been saying it for hundreds of years, and yet learning still requires an effort (see, for instance, Flunger et al. 2015; Matsuoka et al. 2015). The obvious fact that some learning could be made fun and joyful does not necessitate that all learning could be made that way. In general, the simple logical fallacy of implied scalability of successful exceptions is amazingly persistent among educationalist thinkers.

The division of labor in learning has similar limitations that are not difficult to imagine: the learning outcomes must belong to one person, and not to a team. There are many ways in which people can learn in group projects, with situational division of labor. But any teacher knows that once the different roles become persistent, it diminishes the quality of education. One of the group members always organizes, the second always presents, the third always does the math, and the fourth always makes it all look pretty. And that is all they learn; their learning becomes limited, too narrow for the purposes of general education. What is normal in the adult world of productive labor cannot become the norm in the world of education. Unless we work in exactly the same groups as we go to school, the division of labor among different members of a learning group can only be seen as a tool of limited utility.

The story of teacher labor as opposed to student labor is different and more complicated, although I will show, and also limited in the prospects of radical improvement. One way to tell it is through a thought experiment. We can be certain

that technological advances will eventually compensate for the weaknesses of teacher's memory, which remains one of the main hindrances in productivity of teaching. Teachers at all levels simply fail to remember the strengths and weaknesses of each of their students, which material and to what degree they have mastered it and what else needs to be done. The advances in learning analytics, in adaptive learning, and in artificial intelligence are now concrete enough to imagine a future *Ultimate Tutor*, a machine that would be endlessly patient with and infinitely attuned to each student's learning path. The Ultimate Tutor is capable of providing each student with an individualized stream of tasks, explanations, videos, and other learning experiences. The machine would assess every action a student makes, every problem she or he solves, and every essay or email the student writes and use the feedback to further fine-tune his or her experience. The Ultimate Tutor could eliminate an unknown quantity of student's life wasted on listening to what is too difficult to comprehend or too easy to pay attention to and on completing exercises and problems that are too hard or too easy. Delivery of the right kind of educational content "just in time" could make a difference.

And yet, what we know about education undermines the utopia. The reasons for the slow spread of innovations in education are not limited to the special characteristics of student and teacher labor. A more profound feature of education is that it deals with work motivation. The Ultimate Tutor can make learning more efficient and one may say more intensive, but it won't compel anyone to learn. In fact, the opposite is likely to happen: If you are a student working one on one with the Ultimate Tutor, your wasted time (read: rest time) is reduced, and you have to apply significant effort all the time. The machine knows exactly what you can and cannot do and what the appropriate level of effort for your stretch zone (*zone of proximal development*) is. You may want to just turn the damned thing off. This may strike one as paradoxical but only at first: students and teachers resist real innovations in education because most make their labor more, not less intensive. Therefore, the resistance may be actually built in, because of human propensity to avoid working today more than yesterday. And please note—the Ultimate Tutor stands in not just for technological innovation but also for any innovation, economic, or managerial, which would increase the efficiency of learning labor.

Learning is a profoundly social activity, not only because of the social dimensions of cognition but also because social groups and institutions generate motivation to work. One may say that schools may undermine rather than generate motivation. Yes in this case some other social relation generated the motive in the first place. The relational canvas of learning is absolutely essential for the vast majority of people. One needs relationships with peers and with teachers to become interested, to apply effort, and to establish self-discipline. That much has been known in theory for a long time, since Vygotsky (1980), and for a long time in practice of teaching and learning. The most recent wave of experimentation with MOOCs has demonstrated the need for relational dimension of learning one more time: only a small minority of people, usually already well educated, can force themselves to learn something alone. For most of the population, lack of learning motivation is an unsurmountable obstacle unless they are placed in a social

situation that encourages learning. If we turn MOOCs into something hundred times smarter, it is unlikely that we will motivate learners. Motivation is a social construct, and we cannot yet foresee any technology that is capable of providing an equivalent of human relations without actual humans at both ends.

One common objection to such an assertion is the example of video games, which without any human interference can motivate a teenager to spend hours on seemingly unnatural activity. Many people believe learning curriculum can be made as addictive as learning moves in video games. I find the logic flawed and have seen no evidence yet to support it. In fact, the gaming industry has made significant efforts to develop the edutainment model, based on the exact assumption. Curriculum as we know it does not fit the intrinsic logic of the game. Playing is clearly entertainment, and learning in the managed, curriculum-limited sense remains mostly in the realm of work. And the motivation to work needs relations.

I am not saying that a relation-replacing or relation-enhancing technology is impossible; it is just that we don't have any prototype or even a theory of relational technology yet. Teaching at its core is relational labor. This much becomes more and more obvious as we are able to unbundle teacher labor and replace some of it with information technologies. When we peel off the thin layers of teacher labor replaceable by machines, what remains is the soft and fragile core of manual relation building, which is both poorly understood and hard to measure. We just now begin to fully appreciate the centrality of the relational dimension of education.

The low impact of educational innovations on student test scores is not an accident; it is such not because we have done it wrong in the past or because educators are somehow especially incompetent or change resistant. No, there is something deeply embedded in the nature of education or in the historically evolved organizational forms thereof. The sort of labor that is at the core of education resists becoming more efficient in the traditional economic sense of the word. The evidence for my claim may look a bit circular, but it does exist: education has been one of the most heavily reformed social spheres over the last half a century, and yet we have very little proof that student or teacher labor productivity has improved.

The point here is not that innovation in education is impossible or undesirable. I am just suggesting that the kind of disruptive innovation that radically improves labor productivity in education is unlikely to happen in the foreseeable future. I am not particularly comfortable with this conclusion and imagine that very few people will be either. I may be a prisoner of the particular framework inspired by labor economics, but a productivity revolution in education seems to be highly unlikely. That is why I find chasing the dreams of techno utopia or managerial utopia equally irresponsible; they both distract us from instigating productive innovations in education. Education reformers cannot continue promising large gains in what economists call the "education production function" (Hanushek 1979) to the public, receive and spend public money, and then fail to deliver and continue to get away with that. The vicious cycle of innovational folly has to stop. One grows increasingly weary of the TED talk style of reasoning—which there is a breakthrough technology out there, just over the horizon and that it will inevitably revolutionize

education. There is nothing wrong with dreaming, but we cannot afford to have unlikely dreams affect public policy.

Instead, we should learn to value and eventually measure what could be called the spillover effect of innovation in education. It could also be called the not-yet-well-measured-but-real effects.

8.3 The Case for Investment in Innovations

In a postindustrial society, innovation becomes the most important driver of development. Therefore, the ability to innovate and the taste for change become important characteristics of human capital. Note that we are not only talking about the production side but also perhaps even more so about the consumption side of contemporary economies. The demand for novelty cannot be taken for granted and should be specifically fostered.

For both the production and the consumption sides of economy, quality of human capital comes to the forefront, because some of the developed nations have reached maximum quantities of human capital. It is not just the years of formal schooling but rather actual skills that become more and more important. The World Economic Forum's Human Capital Report (2016) concludes:

> While current education systems seek to develop cognitive skills, noncognitive skills that relate to an individual's capacity to collaborate, innovate, self-direct and problem-solve are increasingly important. (p. 28)

We do not yet have reliable instruments to measure such qualities objectively, while self-reporting is notoriously unreliable, but it is reasonable to suppose that having an experience of generating or adopting innovation in educational context will have positive impact on a person's further ability to innovate and embrace change. In other words, practicing innovative behavior is likely to produce innovativeness and openness to new experiences, just like practicing any other kind of behavior tends to increase skills needed for such behavior. Schools must produce innovators and innovation adopters.

Empirical evidence presented in this volume by Smirnov, Koroleva, and Khavenson supports the view that innovation at its core is the issue of quality of the innovators themselves, not necessarily of the quality of their ideas. Smirnov has shown that the strongest predictive factors of an innovative process have to do with who makes up the team as innovators and how determined they are to succeed. Khavenson and Koroleva show that innovators are motivated by values of social status and creative fulfilment. Those are unlikely to be fully innate, and are formed, at least in part, through educational settings. This is why, regardless of the traditionally understood effectiveness, turning schools into innovative organizations makes much economic sense.

Moreover, pegging student and teacher labor too closely to measurable learning outcomes may have the opposite effect. Preparing for high-stakes exams may

induce lower risk-taking behavior among both teachers and students and thus inhibit their ability to innovate (Sahlberg 2004). Therefore, the way we were trying to measure the impact of innovation on learning outcomes may be self-defeating, because of this possible confounding variable. The time taken for trying something new reduces time contributing to measurable outcomes.

Consider these findings by Rubera and Kirca (2012) on firm innovativeness and performance outcomes in their meta-analysis study: "the direct impact of innovativeness on firm value is stronger than its impact through market and financial positions" (p. 144). In other words, shareholders reward innovation in excess to its utilitarian value; they reward the innovative effort itself. Moreover, investors support managers of innovative, small firms in low-tech industries even if they show low revenues and profits (p. 144). One may argue that shareholders are mistaken, excessively hopeful, or irrational. However, the authors of the study believe that "innovativeness not only enables a firm to increase its revenues and market share but also leads to the development of internal capabilities" (Rubera and Kirca 2012, p. 144). They conclude:

> Finally, the innovation literature would benefit from taking a broader, multilevel perspective in understanding the effects of innovativeness on firm performance by focusing on broader outcomes than those simply associated with economic valuation (by shareholders, managers, or customers), such as sustainability or general social welfare. (p. 145)

I suggest that public management should adopt a similar attitude toward innovativeness in education. Rewarding innovation as such may not drive up the results of performance tests, but it may strengthen the capacity of the educational system and prevent its fossilization. We do not have a similar data to back up such a claim, because there is nothing like the firm value with respect to educational organizations. However, despite huge differences between schools and firms, one would be hard pressed to identify reasons why innovation would affect organizational cultures of schools in a negative way. One possible exception could be the phenomenon of completely manufactured innovations for the sake of bureaucratic advancement. Such fake innovative activities have been well documented under the pressure of government reforms. However, with genuine innovative practices, the organization culture impact remains very likely.

In a comprehensive review of public sector innovation theory, Gow states, "Everyone wants to have results on innovations measured, but there is not agreement about what should be included in these results, nor about the criteria of success" (Gow 2014, p. 17). Mark Warford in this volume has made a great case for complicating the traditional diffusion of innovation models and for recognizing the complex agency of teachers. Indeed, we cannot describe innovation in education as a simple process consisting of individual decisions: "adopt or ignore." Perhaps we can de-emphasize the diffusion aspect of innovation and consider a non-diffusional model of innovation. The traditional assumption I wish to question is this: it only makes sense when the best new practices spread throughout the industry. This is why

Rogers' model of diffusion is so influential. Indeed, what is the point of an innovation if it is not adopted by others?

In case of education, a reverse assumption is not out of the question. At a very basic level, adopting someone else's innovation prevents one from trying to innovate in exactly the same area. In this sense, innovation adoption competes with innovation generation. If every teacher thinks of herself as an author of innovation, there is little incentive to become an adopter, a follower. It is not clear that encouraging the latter role is better than the former. Paradoxically, in education we may be better off with more innovators and fewer adopters. If the process of innovation is more important than the practical result of it, we may as well incentivize what is more valuable.

In education, we may be better off giving up on the direct impact of innovations on measurable outcomes but instead invest in innovation for the spillover effects. The most important shift I advocate for researchers is to revise the diffusion agenda. What is diffused is not the innovation itself and not new products or models or methods of teaching and learning. Rather, the very process of innovation should be seen as the phenomenon to be diffused.

Hattie (2009) notes, "most of the successful effects come from innovations, and these effects from innovations may not be the same as the effects of teachers in regular classrooms—the mere involvement in asking questions about the effectiveness of any innovation may lead to an inflation of the effects" (p. 6). We cannot yet measure what I would call the universal innovation effect—neither impact on learning outcomes nor impact on propensity to innovate. It is significant to postulate its existence. The very engagement in innovation activities makes teaching more impactful. If more teachers would engage in innovation, the overall impact would increase.

What Rogers (2003) called "relative advantage" cannot be understood narrowly as a boost in the test scores. Rather, the relative advantage is in infusing the sense of newness in the teaching and learning process. It is, if you will, a way of increasing the entertainment value of learning without compromising the measurable outcomes. In other words, innovation makes both teaching and learning more fun, and fun has great economic value.

Recall the relational nature of teaching and learning. Some educational relations are direct, but most are mediated by an activity. To build enduring relations, people need each other for some purpose. In schools, such purposes are hard to find (see more detailed argument in Sidorkin 2002, Chap. 8). However, engagement in a common innovative practice can be such a purpose. To learn something is an individualistic aim. To try to figure out a new way to learn is a collective project, a vehicle for strengthening the relational underpinnings of teaching and learning.

In Rogers' footsteps, characteristics of innovators have been studied for a long time and have continued (see, for example, the chapter by Koroleva and Khavenson in this volume). We have little understanding of how the ability and propensity to innovate can be fostered in an educational setting. Chell and Athayde's study (Chell and Athayde 2009) identifies precursor skills: creativity (imagination, connecting ideas, tackling and solving problems, curiosity), self-efficacy (self-belief, self-

assurance, self-awareness, feelings of empowerment, social confidence), energy (drive, enthusiasm, motivation, hard work, persistence, and commitment), risk propensity (a combination of risk tolerance and the ability to take calculated risks), and leadership (vision and the ability to mobilize commitment). The study shows that particular features of curriculum extracurricular activities, teaching style, and other components of school life can foster innovation skills. The authors created a self-report tool, which is better than nothing, but is still very far from a dependable performance instrument. Working on such an instrument remains the highest priority for the study of innovation in education.

8.4 The New Generation of Education Reform

If the emphasis shifts from the direct effect of innovation to the process of engaging students, our understanding of educational reform must also change. Education policy makers must embrace the next generation of educational reforms aimed at creating a climate conducive to emergence of authentic local innovations that may or may not spread. They may not be effective in terms of measurable learning outcomes (just as the old reforms are), but they will be effective as means of preparing students for the life of innovation and change.

It is difficult to imagine that the new generation of reform aimed at creating innovative ecosystems in education would be more expensive than the accountability, school choice, or technology reforms. Moreover, we do not necessarily have to abandon the three big changes; we just need to modify them. For example, instead of buying big technology systems, we need to make purchases of smaller, more agile apps and systems easier so that more and more educators would be able to tweak their practices. We need to expand accountability by learning to measure the ability to innovate and tolerance to change, among other skills. We should probably tolerate a little more school choice while still trying to control for the tendency to separate students by class and race. We must recognize innovative learning environments as the main and independent aim of the next generation of education reform. More specifically, I recommend the following:

1. Top-down reform as a change strategy has shown very little efficacy and may actually counteract the authentic innovations. It should be replaced with the creation of innovative learning environments. Let us de-emphasize the "what works" approach and instead encourage teachers to engage in collective problem solving on their own. We need to limit the role of canned comprehensive programs of improvement that promise immediate solutions. In fact, every solution and every program should be evaluated by its ability to generate the authentic innovation in schools and other educational organizations.
2. Shifting emphasis from innovation by teachers to innovation by students. Just as teachers often feel shut out of the conversation about the merits of innovations, so may students. However, when they are a part of the team that designs, pilots, and evaluates a new way of learning, students will learn something valuable

about innovations in general. They will acquire personal experience as members of an innovation team.

3. Investing specifically in technologies that target the relational, affective side of teaching and learning. In every developed country, there is an ecosystem to support start-ups, and some projects even support specifically start-ups in education. An overwhelming majority of proposals are related to the use of technologies in learning, itself, in knowledge acquisition. Yet the major bottlenecks in education have nothing to do with learning; they are related to learning motivation, and that, ultimately, is a relational phenomenon.

These are not particularly large investments. Most of the suggestions listed above can be achieved with a particular variation of targeted deregulation. For example, placing emphasis on teacher innovation on par with his or her students' test score gains is cheap, but it can boost the pseudo-market of reputational competition. Such a market already exists; the most innovative teachers and schools enjoy the benefits of media exposure, often prizes and other benefits. These kinds of nonmonetary competition structures can be very helpful in instigating the small-scale authentic innovations. We have to be careful formalizing and measuring teacher innovation, because of the negative effects of Campbell's Law (Campbell 1976). Once a certain measure is used with significant consequences, people learn to game the system. For example, if we formally evaluate teachers by the number of innovations produced, they will respond with a flood of fake innovative projects. Strong incentives tend to corrupt the very activity we are trying to improve. Yet weaker, less tangible incentives can nudge the teaching profession into generating more small-scale authentic innovations. As I said before, such innovations are unlikely to diffuse or to have impact on student test scores but are definitely worth encouraging for the presumed impact on students' ability to generate and tolerate innovation.

The major thrusts for innovation we tried in the recent past (technology, school choice, accountability) have not produced expected results, cost much, and cannot continue indefinitely. We need to change course. I am calling for the new generation reforms in education that are aimed at mass production of authentic innovations. In other words, we have to create organizational ecosystems that encourage many specific, local, authentic innovations. By authenticity I mean simply that change of practices is born by the specific, personal circumstances and is motivated by a personal decision of an educator and students to try so something new. We have to get away from both the top-down reform, with emphasis on fidelity of implementation, and from the techno-utopian attempts to disrupt educational practices.

The alternative is to do nothing and to let the educational system to its own devices. That alternative does not look appealing for a number of reasons. One is political: the public in many developed countries have developed an expectation of school reforms. Even Finland that remains on top of PISA charts feels compelled to introduce a school reform, while everyone around the world is trying to emulate it. Another is economic: even though we cannot be sure that innovation in education

definitely improves the quality of human capital, it would be foolish to wait for an iron proof. As in many areas of public policy, evidence-based yields to plausibility-based decisionmaking.

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