Transforming education to prepare students to invent the future

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Abstract

Purpose – Human talent is rapidly becoming the most important asset for individuals, communities and nations. As the world changes rapidly due to globalization and technological innovation new opportunities and challenges arise for individuals, communities and nations. This paper aims to explore transforming education to prepare students to invent the future.

Design/methodology/approach – This essay draws on an evaluation of the impact of an entrepreneurship education program on a sample of youth in Saudi Arabia and integrates the core findings and ideas of literature relevant to the topic of education for the 21st century, including several books by the author.

Findings – This paper highlights five principles guide a series of curriculum resources to advance dispositions and skills for student empowerment and civic participation: start with the end in mind to design curriculum; leverage improvement networks to design curriculum; learn by doing; the power of problem-based education; and the power of collaboration in diverse teams.

Originality/value – Klaus Schwab, the founder of the World Economic Forum, predicts that the Fourth Industrial Revolution, resulting from increased and ubiquitous automation and the development of artificial intelligence, will eliminate many of the jobs currently available. Together with neurotechnological and genetic developments, these changes will create new opportunities and serious challenges, which require a heightened commitment to putting humans at the center, and empowerment as a goal (Schwab, 2017). These developments create a new urgency to examine whether children and youth are being prepared to be effective and productive citizens and workers, and to not just understand the future but to invent it. There is an emerging consensus that the skills students will need to invent the future must include cognitive, interpersonal and intrapersonal skills (Pellegrino and Hilton, 2012). The growing awareness that the adequate development of these requires deliberate efforts to cultivate them is also stimulating questions and innovations about the kind of educational experiences which can cultivate those skills.

Keywords Fourth Industrial Revolution, Global education, 21st century skills, Transforming education

Paper type Conceptual paper

Human talent is rapidly becoming the most important asset for individuals, communities and nations [1]. As the world changes rapidly because of globalization and technological innovation, new opportunities and challenges arise for individuals, communities and Transforming education

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The Global Education Innovation Initiative I lead at Harvard University is a research and practice collaborative focused on understanding how public education systems are changing to address these new demands of the 21st century. We pursue that goal conducting applied research, constructing opportunities for research to inform education policymaking and practice and developing resources, tools and protocols which can support education practitioners in empowering students. In a recent study, researchers from the initiative found that governments around the world are broadening curricular goals and aligning them with this multipronged view of competencies that include not only cognition but also self-knowledge and the capacity to collaborate, or what is often also termed cognitive and socio-emotional development (Reimers and Chung, 2016). Another recent study comparatively examined programs of teacher professional development that aimed at supporting teachers with capacities to educate students holistically in the cognitive, intrapersonal and interpersonal domains. The study found that the majority of those programs involved public private partnerships in which organizations external to the school worked with networks of schools supporting teachers in multipronged ways to support innovative pedagogies that fostered the development of the whole child (Reimers and Chung, 2018). That study, and a report of an expert convening of the Global Education Innovation Initiative, identified the problem of scale as a critical challenge of the transformation of education to empower students with the necessary competencies in a changing world (Reimers, 2017).

This preoccupation with aligning the education system with the rapidly changing demands caused by the Fourth Industrial Revolution applies to the Arab World as well. Over the past few decades, the Arab world has gone through a dramatic demographic transition which has resulted in a surge of the region's youth population, and most nations have not been able to create enough jobs to provide this youth meaningful opportunities that allow them to transition successfully into adult roles.

While the Arab world has made significant progress regarding educational attainment and Arab Governments have initiated repeated efforts at the reform of educational systems, the region's reforms have not generated significant changes in the relevance and quality of education delivered to the region's youth. Rote memorization and teacher-centered instruction remain the core mode of educational delivery across much of the region. Instruction offen focuses on the dissemination (and memorization) of facts, rather than the application of such knowledge to analysis, to the solution of problems or to collaborative problem-solving. Little focus is placed on the development of creative thinking or soft skills such as leadership, teamwork and written and oral communication. This is reinforced by the nature of assessment in much of the region: comprehensive examinations favor transparently assessable multiple

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choice questions rather than essays and application of knowledge, meaning that schools are further incentivized to teach to the test and thus favor rote learning methods. As a result, youth in the region score poorly in internationally comparable examinations which measure the ability to solve problems such as the Trends in International Mathematics and Sciences Study (TIMSS) and Programme for International Student Assessment (PISA). In 2007, eight graders in Algeria, Bahrain, Egypt, Jordan, Kuwait, Lebanon, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Syria, Tunisia and the United Arab Emirates performed below the average scores in math and science of all participating countries in TIMSS [2]. More than a decade later, the results of the 2018 Programme for International Student Assessment showed 15-year-old students in Lebanon, Jordan, Morocco, Qatar, Saudi Arabia and the United Arab Emirates among the bottom third of all 79 countries participating in the assessment of reading, math and science skills [3].

The occupational consequences of such deficient educational preparation are evident. Youth lacks the competitive edge needed to secure gainful employment in a tight labor market. The region faces the highest rate of youth unemployment in the world, 30% on average, more than double the world average. Five million workers enter the labor market each year in the Middle East and job creation is in short supply (Stratford Youth Unemployment, 2018). In 2016, unemployment of youth aged 15–24 in the Arab World stood at 30% on average, compared to 14% on average for the world [4].

The burdens of poor labor market outcomes in the Arab world are particularly challenging for young women, who average low market participation rates at 21% compared with young male participation rates of 52%. Those women who are engaged in the labor market are particularly vulnerable to unemployment. On average, the unemployment rate among young women in the region is nearly 38%, or twice that of young men.

Students and employers concur in identifying the gaps between the performance of the education systems and the demands of the labor market. According to the Arab Human Capital Challenge, only 54% of interviewed chief executive officer (CEOs) across the region feel that the educational system provides graduates with adequate skills, whereas less than half consider that there are enough graduates with those skills to fill needed positions (Mohammed bin Rashid Al Maktoum Foundation, 2009). In particular, these CEOs voice concerns about the weaknesses of graduates in regard to soft skills such as communication, teamwork and leadership. Employers are more interested in skills that enable workers to be self-motivated, flexible and innovative in the workplace than in any particular basis of knowledge, and stress that these are the areas in which the educational system is weakest [5].

Saudi Arabia partakes in the challenges I have described. The country continues to struggle with efforts to diversify the economy beyond oil, which accounts for nearly 52% of gross domestic product (GDP). The country is reliant on large numbers of foreign workers, both unskilled and highly skilled, to sustain its industrial and service economy. Most of Saudi work for the public sector, while most expatriates work for the private sector.

Perceived self-efficacy of Saudi students

In a recent survey to secondary school students [6], I asked them to rate to what extent they considered themselves capable of performing a series of tasks. The results are presented in Table 1 which summarizes the percentage of those students who felt capable of doing them to a great extent – Values 4 and 5 in the five-point scale. Less than half of the students see a connection between their education and the real world. While most students feel prepared to working in teams, which 80% feel prepared to do, or adapt to new situations, which 70%

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PRR 4,2	feel prepared to do, or solve problems (73%), the percentage of those who feel capable of various social activities is smaller, only about half feel they can make a presentation to a group of peers (56%) or of adults (55%), or resolve differences within a group (70%), only 62% think they would solve community problems, or persuade others (64%), or negotiate conflict in a peaceful way (73%) or lead a team (62%).
84	Adapt Adapt to new situations.
	Present heers Present a tobic to a group of classmates
	Present adult Present a topic to a group of adults.
	Resolve diff Resolve differences within a group to reach a solution satisfactory to most.
	Commproblem Solve community problems.
	Persuade Persuade a group of people about an idea.
	Neg conflict Negotiate personal conflicts in a peaceful way.
	Compete job Be competitive in securing a good job.
	Start business Start and run your own business someday.
	Role business Understand the role of business owners in our economy.
	Lead team Lead the members of a group to meet a deadline in producing a result.
	Research Research the potential market for a company.
	Learn real world To what extent is there a clear connection between what you are learning in school and the real world?

The survey also explored students' attitudes toward entrepreneurship in Saudi Arabia, finding that a significant percentage of them had dispositions not aligned with the support of entrepreneurship. The results are presented in Table 2. For instance, just over half of the students thought that people in Saudi Arabia can get ahead because of hard work. Over 60% think that entrepreneurs only think about their own gain. Only about 60% think that women can play an important role in the success of a business. A low 21% think that most people can be trusted. Only about half think that it is possible for entrepreneurs to succeed

Table 1.Perception of self- efficacy of secondary	Attitude	Control Before (%)	Participant Before (%)
school students in Saudi Arabia in a group which participated in an entrepreneurship education program (before participation) and in a control group. (question: on a scale of 1–5, to what extent do you feel that you are able to. Table includes percentage who answer 4 or 5)	Teamwork Adapt Problemsolve Presentpeers Presentadult Resolvediff Purpose Commproblem Persuade Negconflict Competejob Startbusiness Rolebusiness Leadteam Research Learnrealworld	$\begin{array}{c} 82\\ 69\\ 73\\ 56\\ 55\\ 70\\ 81\\ 62\\ 64\\ 73\\ 90\\ 59\\ 43\\ 62\\ 57\\ 47\end{array}$	$\begin{array}{c} 79 \\ 72 \\ 72 \\ 61 \\ 63 \\ 66 \\ 72 \\ 58 \\ 61 \\ 65 \\ 83 \\ 69 \\ 49 \\ 66 \\ 59 \\ 48 \end{array}$

in Saudi Arabia. Only about a third think that entrepreneurs can create jobs for others or contribute to the economic development of the country. education

Hard work People in your country can get ahead by working hard.

Entrepreneurs selfish Entrepreneurs only think about their own gain.

Women lead Women can play an important role in the success of a business.

Trust Most people can be trusted.

Entrepreneurs succeed There is potential in your country for an entrepreneur to become successful.

Men lead better Men are better qualified than women to be business leaders.

Entr. create jobs Entrepreneurs create jobs for others.

Men more rights When jobs are scarce, men should have more rights to a job than women.

Entrepreneurs contribute Entrepreneurs contribute to the economic development of the country. One way to offer education that helps students develop these capacities and empower them as

the Fourth Industrial Revolution requires is to make education more relevant by engaging students with real world challenges and providing opportunities for them to learn from projects which engage them in creating solutions to such challenges. As part of the Global Education Innovation Initiative, I have developed, with my collaborators, a series of curriculum resources to support a problem-based education that engages students with significant global challenges, in this way preparing them for global citizenship and global leadership.

The book *Empowering Global Citizens* argues that education should be aligned to help students understand the United Nations Sustainable Development Goals and advance human rights, offering an ambitious and rigorous curriculum to support global citizenship education from kindergarten to high school. The book *Empowering Students to Improve the World in Sixty Lessons* offers protocols to help teachers and school leaders develop school wide strategies that support global citizenship education and global citizenship curriculum aligned with the Sustainable Development Goals, a complement to the Human Rights Declaration in that it spells out our obligations to achieve a world that is inclusive, in peace and sustainable. The book *Learning to Collaborate for the Global Common Good* contains a series of curriculum resources to advance dispositions and skills for student empowerment and civic participation.

The following five principles guide these resources:

- (1) start with the end in mind to design curriculum;
- (2) leverage improvement networks to design curriculum;
- (3) learn by doing;
- (4) power of problem-based education; and
- (5) the power of collaboration in diverse teams.

Attitude	Control	Partic	ripant	
	Before (%)	Before (%)	After (%)	
				Table 2.
Hard work	53%	56%	65%	Attitudes toward
Entrepreneurs selfish	63%	60%	36%	entrepreneurship in Saudi Arabia
Women lead	58%	67%	74%	
Trust	21%	28%	24%	Saudi Alabia.
Entrepreneurs succeed	52%	57%	63%	(question: on a scale
Men lead better	57%	56%	33%	of 1–5, to what extent
Entr. create jobs	34%	34%	52%	do you agree or
Men more rights	59%	56%	52%	disagree with the
Entrepreneurs contribute	35%	39%	48%	following statements)

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The first principle is that a powerful approach to develop curriculum is to start with the end in mind. While most curriculum planning starts with direction in terms of the knowledge or competencies that it is aligned to, it seldom extends that end into a larger vision that informs the selection of such competencies. As a result, while there may well be an implicit long-term vision that provides direction to the competencies which guide the development of curriculum, such vision is not public, and therefore the central hypothesis which guides such curriculum ("if students gain these competencies they will be able to achieve the following") are not public knowledge, and therefore untestable. I propose an alternative approach which makes the two key hypotheses which undergird any curriculum public, and therefore the subject of professional and public accountability. Those key hypotheses are as follows: first, that if we engage students in particular learning experiences, they will gain certain capabilities; second, that if they gain such capabilities, they will be able to achieve particular long-term results, with consequences to them and to the communities of which they are members.

These resources align curriculum with a public, ambitious, non-partisan, vision which has been endorsed by governments around the world. This is as close as we can get to a public compact reflecting humanity's shared aspiration of "the common good". The United Nations Sustainable Development Goals offer an aspirational vision of a world that is inclusive, in peace and sustainable. Each of the 17 goals included in the framework adopted by more than 150 world leaders at the UN General Assembly in 2015. The goals drive a series of specific targets, each spelled out in ways which are measurable. For example, Goal number 1, No Poverty, focuses on eradicating the most extreme forms of poverty from the planet. Six specific targets give concretion to this goal:

- (1) "By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions.
- (2) Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable.
- (3) By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance.
- (4) By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.
- (5) Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions.
- (6) Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions." (Source: United Nations www.undp.org/content/undp/en/home/sustainable-development-goals/goal-1-nopoverty.html).

Achieving each of those targets requires specific actions which, in turn, require specific capabilities that people must have. As these global targets can only be achieved as local

communities do their share, they necessarily implicate actions and choices made by many people around the world. Providing people with the capabilities to take those actions and make those choices is the task of education.

By engaging educators in the analysis of which specific capabilities are necessary to achieve these targets, and in turn discern which pedagogies and experience will help students gain those capabilities, the approach I followed did more than start with the end in mind, it provided a level of transparency and professional and public accountability to the choices made in any curriculum design that are seldom available in state standards or with textbooks and curriculum resources. The publication of these resources in these books provides an additional level of public accountability.

Leverage improvement networks to design curriculum

The second principle underlying these resources is that the task of curriculum design, particularly when it involves domains which are novel or complex, is one that requires collaboration with colleagues. While we may cherish the ideal that each teacher should be able to develop their own curriculum, in practice, the work of teaching is structured in such a way that it seriously limits how much time can be devoted to curriculum design. It is no wonder that there are many online resources designed to help teachers share curriculum and lesson and that, in practice, many teachers resort to published curriculum resources and textbooks.

The reason teachers have already created informal networks to share resources or depend in existing resources is because the complex task of high quality curriculum development is one that benefits from economies of scale. Traditionally this has been the core advantage of textbook publishers, the ability to engage large numbers of professional curriculum developers and writers, in producing high quality materials that can distribute the costs necessary to fund their production across many users of such materials.

But there are limits to that conventional way to achieve economies of scale to producing instructional material, not least of which is that these resources must target some specific group of intended learners, the reason many textbooks are aligned to the standards of the states with more students. One of the merits of the idea of the Common Core, a national set of curriculum standards, was precisely to enable such economies of scale in the development of high-quality instructional resources.

Professional networks have a distinct advantage as a way to leverage collective intelligence. They can adapt dynamically to feedback resulting from rapid cycles of experimentation, and they can augment the learning resulting from similar cycles taking place concurrently in multiple settings. In this sense professional networks have an inherent potential for learning and adaptation that eludes more conventional forms of producing curriculum and textbooks.

Learn by doing

A third principle illustrated by these resources is that professionals must necessarily experiment as a way to create new knowledge. In fact, an improvement network is simply a large laboratory that allows continuous experimentation in the search for solutions to complex challenges.

The epistemology that undergirds this principle is that professional knowledge must draw on practice, it cannot be generated in the absence of or devoid of practice. Teaching is a profession not only in that those who practice it must master expert knowledge to guide their work, but also in the sense that those who practice it must contribute to the development of such expert knowledge. For such practice-based knowledge to become Transforming education

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PRR 4,2 professional knowledge, knowledge available to others in the profession, it must be public knowledge, not private knowledge. A professional network is one way to make the knowledge that emerges from practice subject to the essential scrutiny for it to become public. Furthermore, the reliance on the principles of design-based thinking and of improvement networks, provides a context for systematic experimentation and testing of the hypotheses which are implicit in any curriculum.

Power of problem-based education

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A fourth principle reflected in these resources is that some of the capacities necessary to thrive in the 21st century are best gained by engaging students with real problems, and by inviting students to try out solutions to those problems. Such problem and project-based education draws on the traditions of progressive education developed by John Dewey and are consistent with current knowledge about how to support deeper learning.

Power of collaboration in diverse teams

The achievement of the Sustainable Development Goals will require unprecedented collaboration at all levels. If there is one skill, all learners will need to develop is the skill to collaborate. The reliance of the resources presented in these books on collaborative project-based methodologies is intended to help students and teachers develop such collaborative skills. But if teachers are to teach students to collaborate, they must themselves develop their own skills to collaborate professionally.

Global education is a pathway to develop a broader set of competencies necessary for participation in a changing world, what some have called "21st century skills" or "deeper learning" (Reimers and Chung, 2016, 2018). As teachers seek new forms of learning and teaching to prepare students for the growing and more complex demands of participation in the 21st century, finding effective points of entry for pedagogical renewal is critical.

Change is challenging

The notions that students should engage with real problems, or that they should do this collaboratively, for example, while hardly new, have proven remarkably difficult to translate into new pedagogical approaches that have scaled to serve all students. Global education, insofar as it is largely absent in many schools, provides a convenient point of entry for pedagogical renewal, in a way that does not directly threaten established school cultures but that can gradually fundamentally modernize instruction.

Opportunities to address these challenges in the context of the COVID-19 pandemic

Implementing the curriculum changes mentioned above requires significant systemic changes. Paradoxically, the disruptions caused by the COVID-19 Pandemic create an opportunity to make these changes.

The COVID-19 Pandemic has caused severe disruptions to the lives of people around the world in many domains imaginable. It is not just the harmful damage the Pandemic has caused to the health of millions, and the irreparable loss of the lives it has taken. The Pandemic has also caused ripple effects extending to relationships, employment, civic participation and other spheres of life. Among those ripple effects, the Pandemic has severely impacted education. Directly, interrupting the forms of school and university-based instruction, as measures of physical distancing have caused education institutions to attempt to continue to teach remotely. Indirectly, as the impact of the Pandemic on the

health and income of many families, has created less supportive home conditions for many learners.

The challenge of having to figure out how to continue teaching in the absence of the possibility of convening in the same physical space is one for which most educators and education leaders, as well as students, were unprepared. Just as they were unprepared for a significant drop in the support for education occurring in some families as a result of the sudden demands and stresses which the Pandemic caused. This is, to put it bluntly, a quintessential adaptive educational challenge. One for which there is no playbook, one for which we will have to invent the solution as we navigate it.

In facing adaptive challenges of this sort, it is helpful to ask what's truly important. At a time when our capacity to deliver instruction is limited, what should we prioritize? What skills should we emphasize as learners face new pressures and stresses at home? At a time when the future seems more uncertain, what purposes should we prioritize, and how should we teach?

Questions or this sort call for a navigational compass, for instruments that can help us discern what is valuable and important as we make our way through the night and choppy waters this Pandemic has thrown us into. Learning from comparative analysis and seeking greater relevance are two pathways to such compass. Three recent studies of the Global Education Innovation Initiative offer avenues forward in advancing the kind of changes discussed in this paper.

Educating Students to Improve the World offers a multidimensional framework to change education. I argue in this book that the North Star for schools in our times should be to educate global citizens, with the capacity to collaborate across all human made divides to address the many challenges we share: from pandemics to global poverty, from health disparities to climate change. I review an extensive body of research on global education programs, and a wide range of approaches to global education and suggest that the disconnect between scholarly and pragmatic approaches to advance global education have been hampered by the lack of a good theory. That theory, I argue, needs to simultaneously account for the cultural, psychological, professional, institutional and political nature of educational change. In the book I explain the core tenets of each perspective and use them to synthesize some of the major contributions to the field of global education (Reimers 2020a).

The second book, *Audacious Education Purposes*, is a comparative analysis of major national education reforms in eight different countries in which I test the theory presented in Educating Students [...] as we examine how these nations approached deep and ambitious transformations of the goals of the curriculum in search of greater relevance. Written in collaboration with 14 colleagues in the context of the Global Education Innovation Initiative I direct at the Harvard Graduate School of Education, the book offers a unique comparative study of recent reforms in Brazil, Finland, Japan, Mexico, Peru, Poland, Portugal and Russia (Reimers 2020b).

The book *Empowering Teachers to Make the World Better* dives into greater depth into one of the core pillars of reform identified in the previous book: teacher professional development. Written in collaboration with 22 former graduate students, we examine major initiatives to support public school teachers to augment their capacity to advance deeper learning and 21st century education in Cambodia, Colombia, India, Mexico, the UK and the USA (Reimers 2020c).

Walking our way through a major adaptive education challenge such as the one caused by the Pandemic we are currently experiencing is, in some ways, like walking through the forest in the night. A good way to approach this predicament is together with others, collaboratively, for even if none of us knows, alone, where true north is, we are more likely to find it if we each bring a candle and, together, all these small lights shine brighter and help us see the road ahead. These three books explaining how to align schools and systems with Transforming education a capacious vision of global education and drawing on the lessons of comparative experience of bold and audacious reforms of education purposes are a small candle as we search for a compass that can help us walk together through the long night ahead.

Notes

- 1. This article draws from my recent book *Learning to Improve the World. Entrepreneurship Education in the Middle East.*
- 2. Mullis, I.V.S., Martin, M.O., & Foy, P. (with Olson, J.F., Preuschoff, C., Erberber, E., Arora, A., & Galia, J.), TIMSS 2007 International Mathematics Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades (Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College, 2008) and Martin, M.O., Mullis, I.V.S., & Foy, P. (with Olson, J.F., Erberber, E., Preuschoff, C., & Galia, J.), TIMSS 2007 International Science Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades (Chestnut Hill, MA: TIMSS & PIRLS International Science Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades (Chestnut Hill, MA: TIMSS & PIRLS International Study Center, Boston College, 2008).
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- 6. This survey was part of an evaluation I conducted for the impact of an entrepreneurship education program in six countries in the Middle East, including Saudi Arabia. The results are reported in my book *Learning to Improve the World: Entrepreneurship Education in the Middle East*.

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Fernando M. Reimers is the Ford Foundation Professor of the Practice of International Education and Director of the Global Education Innovation Initiative and of the International Education Policy Master's Program at Harvard University. An expert in the field of Global Education, his research and teaching focus on understanding how to educate children and youth so they can thrive in the 21st century. He is a member of UNESCO's high-level commission on the Futures of Education and has addressed the WISE conference several times.

Professor Reimers has written or edited 33 books, of which the most recent include: Educating Students to Improve the World, Audacious Education Purposes. How governments transform the goals of education systems, Empowering teachers to build a better world. How six nations support teachers for 21st century education, Letters to a New Minister of Education, Teaching and Learning for the 21st Century, Preparing Teachers to Educate Whole Students: An International Comparative Study, Learning to Improve the World, Empowering Global Citizens, Empowering Students to Improve the World in Sixty Lessons. Version 1.0, Learning to Collaborate for the Global Common Good, Fifteen Letters on Education in Singapore, Empowering All Students at Scale, and One Student at a Time. Leading the Global Education Movement.

More information about his work is available here https://fernando-reimers.gse.harvard.edu/. Fernando M. Reimers can be contacted at: Fernando_Reimers@harvard.edu