Fernando M. Reimers · Uche Amaechi ·
Alysha Banerji · Margaret Wang *Editors*

Education to Build Back Better

What Can We Learn from Education Reform for a Post-pandemic World

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Chapter 1
Education in Crisis. Transforming Schools for a Post-Covid-19 Renaissance

Fernando M. Reimers, Uche Amaechi, Alysha Banerji, and Margaret Wang

1.1 An Education Crisis like No Other

The Covid-19 pandemic shocked education systems around the world in ways for which they were not prepared. The combination of the health and economic shocks to students and their families, and of the constraints to in person instruction resulting from the social distancing measures, limited the opportunities of many students to learn. While educators and education leaders attempted to create alternative forms of remote education, those were improvised and poorly supported. As a result, students not only failed to learn what new material was expected of them in the curriculum, but also *lost* existing knowledge, skills and motivation, as a result of their deficient engagement with school. Although published studies of the impact of the pandemic on educational opportunity are limited at this point, those available indicate that there will be considerable learning loss, more so for disadvantaged students and in the global south (Reimers, 2021a, 2022).

A recent review of research on learning loss during the pandemic was able to identify only eight published studies, all focusing on OECD countries which experienced relatively short periods of school closures (Belgium, the Netherlands, Switzerland, Spain, the United States, Australia, and Germany). These studies confirm learning

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loss in most cases and, in some, increases in educational inequality. Not all educational subjects or cohorts of students were affected equally, however; the same documents report heterogeneous effects of closures on learning for various school subjects and education levels (Donnelly & Patrinos, 2021).

A recent study of the educational strategies during the pandemic in thirteen different countries concludes that the educational impact of the pandemic was mediated by social class and country of residence:

> The pandemic created a context in which students in least developed countries experienced the brunt of six mutually reinforcing challenges: the longest school closures, the lowest levels of resources and institutional capacity to mitigate learning loss, lower levels of access to vaccines, the greatest increases in poverty, lower effectiveness of alternative modalities to education, and the greatest levels of social and educational inequality. For these varied reasons, it is likely that the two most important mediators of the COVID-19 pandemic's impact on educational opportunity were nationality and social class. (Reimers, 2022, 463).

As a result of this disproportionate educational impact on the pandemic in the Global South, existing educational disparities with the Global North widened. Students lost much of what they had learned the previous year, many disengaged from school altogether, and dropout rates increased. The result was education development in reverse, at full speed. Teachers and education leaders watched decades of educational progress vanish in a couple of years. Furthermore, as the pandemic continues to ravage educational opportunity in the jurisdictions in which in person instruction has not resumed, there is growing concern over what will likely be considered the most serious education crisis in the history of public education—and its ripple effects in expanding poverty, social inequality and other social challenges.

The response to this crisis must include not only immediate recovery efforts, directed towards mitigating learning loss and disparities in educational access, but also new motions to address the previous deficiencies of education systems—deficiencies which the COVID-19 pandemic has brought to the fore. Especially in the Global South, the pandemic hit education systems already experiencing a "learning crisis," the result of low quality and relevancy of instruction for many children around the world (World Bank, 2018).

This urgency to "build back better" has placed the subject of curriculum reform squarely on the education policy agenda of most education systems. In addition to addressing gaps in existing systems and unmet past needs, COVID-19 recovery is therefore an opportunity for reform—new efforts, which reframe the goals of the past considering the needs revealed or created by the pandemic and ensure that schools do a better job in preparing students to build a more inclusive and sustainable world (Reimers, 2021a).

Even before the pandemic, educational systems and institutions around the world had begun to direct their attention to the subject of what it is, precisely, that students should learn in a rapidly changing world. In September 2019, UNESCO established an International Commission on the Futures of Education to develop a report to animate broad global dialogue on the goals of education. The report, published in November of 2021, underscored the urgency of enhancing the relevance of education by helping students develop a broad range of competencies, cognitive as well as socio-emotional and focused with greater intensity than two previous reports on the future of education published by UNESCO in 1972 and 1996 on the urgency to rethink pedagogy, curriculum, the teaching profession and the role and organization of schools (UNESCO, 2021). Other efforts similarly focused on revamping the focus of curriculum, such as the OECD's Future of Education and Skills 2030 Initiative, as well as a diversity of national efforts (OECD, 2021). For example, a review of education plans in 15 low-income countries in Africa and Asia conducted by the Global Education Partnership, found that all of them prioritized twenty-first century skills (Global Partnership for Education, 2020, vi). Other studies of recent curriculum reforms confirm this growing interest in broadening the aims of the curriculum (Reimers, 2020a).

The COVID-19 pandemic has accelerated the movement towards reframing educational goals in several ways. First, the new social and economic challenges created or aggravated by the pandemic—including job displacement, gender and social inequality, social fragmentation, democratic governance, and climate change—call for greater intentionality on the part of educational institutions to equip students with the skills to address these challenges. Second, the learning loss and increased rates of school dropout caused by the pandemic will require greater focus into the future, in helping the affected generation develop competencies to catch up, develop the skills necessary to participate in society, and address those larger sociopolitical challenges. Third, the arrangements for educational continuity created during the pandemic, and the needs surfaced by the crisis, brought into focus the importance of prioritizing relevant competencies and to align these learning goals with existing levels of capacity. The period of learning remotely made evident that some students were more ready to learn autonomously and online than others and underscored the importance of supporting students in the socio-emotional domains.

The pandemic heightened awareness of the likely impact of global shocks in our lives, and of the need to prepare for them. This interest in the goals of schools will likely continue during the pandemic and beyond as part of the efforts to "build back better."

As education authorities sought to create alternative ways to educate during and after the pandemic, given the constraints on doing so in-person in schools, it became evident that many students, and teachers, lacked the skills to effectively learn independently and online, in addition, many also lacked access to connectivity and devices to learning online. The great value of reading comprehension as a foundational skill was identified as a major leverage point, as students had to spend more time reading independently at home. The same was true for organizational skills, the ability to concentrate, and perseverance. The crisis also highlighted the need to address mental health needs and food insecurity for some students and made evident the importance of social interaction to sustain engagement and wellbeing.

Having to deliver education through means that were less capacious than in person instruction caused many educators to reprioritize the curriculum. In some cases, this led to greater attention to providing students emotional and social support, and this in turn underscored the interdependency of cognitive and socio-emotional learning. Reprioritizing the curriculum also led to greater attention to what competencies should be the goal of the intended curriculum. As the pandemic laid bare the significance of preexisting challenges, such as poverty, social inequality, or climate change, this added to the urgency of educating students so they could in fact gain the competencies to address these challenges. The questions of how to prepare students for employment, for civic participation, or to contribute to tackling large social challenges such as gender inequality, poverty, social fragmentation, or climate change in a post-pandemic world thus has become critical as the urgency of addressing these challenges has augmented because of the disruptions caused by the pandemic itself.

Paradoxically, this elevated interest in increasing the relevancy of schools—particularly in the Global South, where most students live, and where the impact of the pandemic has been the direst—will have to be addressed in the context of diminished fiscal and institutional capacity, the result of the increased needs caused by the pandemic. This reality underscores the imperative of access to knowledge about how to design implementation strategies that help education systems prepare students with the competencies they need to thrive in a world that is uncertain.

1.2 A Renewed Interest in the Implementation of Educational Change in the Global South

The elevated expectations about what schools should teach has created a new need: to discern how to effectively translate goals into practices that successfully transform the culture of education.

This interest in devising effective implementation strategies of more ambitious goals has led to an interest in "what works," in looking for knowledge about how to implement educational change. Where should we draw this knowledge from to meet this need? While there is ample scholarly literature on the topic of educational change and implementation of educational change, much of this knowledge is the product of research on a limited range of countries in the Global North. While valuable, there are some limitations to drawing on the study of implementing educational change in countries with higher levels of fiscal and institutional capacity, especially as the fiscal capacity in most countries in the Global South is further constrained by the pandemic.

While there has been a growing literature on "high performing countries," drawing on cross national comparisons of student knowledge and skills (Lee et al., 2014; Wang, 2013), there are limits to what knowledge about the characteristics and practices of countries where students achieve at high levels can teach us about how to help countries improve, especially if those countries enjoy greater levels of resources and institutionalization of education. After all, there has been very limited improvement even in "high performing countries" in recent decades. Studies of change of levels of student knowledge and skills over two decades—in the forty-nine countries for which data are available since 2000, which include OECD countries and some middle-income countries—show that such learning outcomes increased steadily only in Estonia and Portugal. They increased during the latter part of that twenty-year period in Jordan, Macao, Russia, and during the earlier part of that period in Albania, Chile, Colombia, Germany, Israel, Montenegro, Peru, Poland, Qatar and Romania. In a nutshell, most countries did not improve, and only seven OECD member states improved (Chile, Colombia, Estonia, Germany, Israel, Poland and Portugal). Among countries in which much educational research on the process of educational change originates, student performance declined in Australia and did not improve in Canada and the United States (Schleicher, 2019, 11).

Furthermore, the most recent assessment of student knowledge and skills conducted by the OECD, underscores the limitations of existing curricula in preparing students to address issues of considerable significance in an increasingly interdependent world. The latest PISA study reported on students' global knowledge and attitudes towards global topics in four competency domains including the ability to: (1) examine issues of local, global and cultural significance; (2) understand and appreciate the perspectives and worldviews of others; (3) engage in open, appropriate and effective interactions across cultures; and (4) take action for collective well-being. The results of this assessment showed not only low levels of knowledge in these important domains, but considerable disconnects between knowledge and the ability to act on that knowledge to solve problems (Boeren, 2019).

Such limitations of pre-existing studies of high performing systems, limited improvement in OECD countries and low levels of global competency as measured by PISA underscore the necessity to expand the knowledge base on which to base efforts to mitigate and revert the damage caused by the pandemic and to build back better.

Surprisingly, there are considerably fewer studies of recent ambitious efforts of educational change in countries in the Global South than studies in the Global North, even though the former would seem to be most relevant to the task of supporting improvement in the South because of shared institutional and resource constraints. The need for such knowledge stems also from the fact that 90% of the population of children and youth are educated in the Global South and because the impact of the pandemic will be disproportionate in the Global South. Additionally, efforts to educate students more effectively may need to be based on design and invention, to address the shortcomings of previous efforts as shown by the low levels of global competency revealed by the most recent PISA assessment.

For example, in preparing students to address climate change, evaluations of the effectiveness of existing programs underscore the limitations of approaches that rely exclusively on the transmission of knowledge of the science of climate change (Reimers, 2021b). Rather than import climate change education programs which have not demonstrated success elsewhere, the design of climate change education programs may draw on the best science about how to develop efficacy in other domains, such as civic engagement, so they can support the development of the full range of cognitive, social and emotional competencies that produce climate action efficacy.

The purpose of this book is to contribute to this necessary knowledge base, reviewing the implementation of recent ambitious education reforms in the Global

South, as well as novel approaches to educate students more effectively for climate action.

Because this renewed emphasis on the education of the whole child via competency-based education and curriculum redesign is likely to be a driver of education efforts in years to come, as education systems seek to rebuild opportunity, and to build back better after the pandemic, there is an urgent need of comparative research on these topics. Learning from countries which have attempted to implement education reform at scale and with the resource constrains more typical of the Global South is likely to be directly relevant to most school systems which will have to operate within similar constraints during and after the pandemic. This book is an effort to address such needs.

1.3 Focus of This Book

This book contains seven chapters examining education reforms at the macro, meso, and micro levels. At the macro level, four studies examine national education reforms in Egypt, Senegal, Taiwan, and Vietnam.

Three of these are reforms with an explicit effort to transform the curriculum so students could develop a breadth of cognitive and socio-emotional competencies, these efforts are analogous to those involved in "building back better" to recover educational losses caused by the pandemic. Additionally, Senegal's reform focuses on a reform to scale opportunities for early childhood holistic development integrating education, health, and nutrition. Such cross-sectoral integration is likely to be of great interest soon given increases in poverty, marginalization and food insecurity caused by the pandemic.

At the meso level, a study examines one of the programs that has reached most scale in India in educating for employment while also focusing on the development of breadth of skills. This topic of education for employment has renewed urgency in a recessionary context and one in which automation and artificial intelligence erode existing jobs.

At the micro, or school, level, two of the chapters examine curriculum reforms to help students develop the competencies to adapt to, mitigate and revert climate change. While these two chapters at the micro level focus on the United States, a high-income country, they address the shortcomings of previous approaches to climate change education and suggest how proofs of concept and "niche reforms" can help ambitious curriculum aligned with the goal of adapting, mitigating, and reverting climate change can succeed where others have failed.

These seven studies were conducted as part of a graduate course on comparative education policy analysis taught at the Harvard Graduate School of Education. In this course, students learn about system level reform, curriculum and standards, and teacher preparation. They also learn to compare system level reforms around the world.

Furthermore, students examine large scale educational change through the integration of five conceptual perspectives: cultural, professional, psychological, institutional and political (Reimers, 2020b). This approach posits that to support large scale implementation of educational change, it is essential to have a complex "theory of mind," which can facilitate communication and collaboration across many stakeholders. That complex theory of mind needs to integrate five alternative ways to construe the process of educational change.

A cultural perspective sees schools as social institutions in interaction with other institutions in society: families, communities, workplaces, religious institutions. The interactions among those institutions and schools mediate the efforts to transform schools. A psychological perspective integrates recent knowledge on how students, teachers and other adults learn a diversity of competencies into the design of curriculum and instruction. A professional perspective attends to how norms, processes, and institutions mobilize expert knowledge to support professional practice—through such measures as teacher professional development or increasing school autonomy, which allows those close to the process of instruction to make the decisions that best serve their students. An institutional perspective focuses on the interactions, coherence, and alignment among the various education processes that support instruction, such as curriculum, professional development, instructional resources, school leadership, and assessment. Finally, a political perspective attends to the negotiation and competition of interests of various stakeholder groups affected by education reform. This framework has been used previously to compare national education reforms (Reimers, 2020a, 2021c).

1.4 Rationale—Why Study the Implementation of Reforms Which Are Relatively Recent, and Some of Them Still Underway?

By focusing on the implementation of reforms, these chapters align with literature in the field that emphasizes the importance of the implementation stage of policy reform, as "the crucial stage in the policy cycle in which successes and failures of policies are decided" (Hargrove, 1975 as quoted in Wegrich, 2016). While research on policy implementation has grown in the years since Hargrove described this as the "missing link" in policy studies, the field continues to benefit from the study of how policy goals are translated on the ground, across a range of international contexts. Earlier studies in the field established that the implementation stage was much more than the mechanical adoption, or failure to adopt, of policy intentions, but rather an evolutionary process, in which those involved in policy learned because of turning ideas into programs and actions:

> There is no need to feel guilty about failing to carry out a mandate inherent in a policy in a literal way, because literal implementation is literally impossible. Unless a policy matter is narrow and uninteresting (i.e., preprogrammed), the policy will never be able to

> contain its own consequences. Implementation will always be evolutionary; it will inevitably reformulate as well as carry out policy. (Majone & Wildavsky, 1979, 179–180).

Studying the implementation of ambitious education reforms in the Global South is essential because it advances knowledge about what policies make sense in such contexts. The reason to study reforms in progress is because this helps understand the evolutionary nature of reform. As with previous publications on this topic (Reimers, 2021c), chapters on Vietnam, Egypt, and Taiwan aim at providing careful and detailed descriptions of reforms as they are being carried out.

This study of the implementation of large-scale education reforms highlights the ways in which the process of policy reform is "a learning process…evolutionary and developmental in nature" (Dalin & Ayono, 1994, xvii). The various chapters in the book show how an iterative approach to reform allows policy makers to adjust and improvements throughout the policy cycle, rather than only after the final outcomes are received. In Chap. 4, for example, the authors discuss how the Taiwanese National Development Conference began designing the subsequent 12-Year reform, only two years into the 9-Year Reform, in response to early lessons from this reform and to incorporate emerging research from the global education movement. Similarly, in Chap. 3, we learn that Egypt's Ministry of Education and Technical Education adopted a phased approach to reform implementation, between 2018 and 2030. By describing and analyzing the implementation of this reform in its first two years, the authors offer a critical analysis that can inform the next phase of implementation.

Many of these chapters incorporate the voices and perspectives of the "street level bureaucrats" whose actions and decisions, in the face of intersecting opportunities, constraints, and daily routines "effectively *become* the public policies they carry out" (Lipsky, 1980). As detailed in the Methods section below, most chapters in this book include data from surveys, interviews or first-hand accounts from teachers, administrators and policy makers—key stakeholders that inform what policy looks like in practice. This reflects a "bottom-up" perspective (Lipsky, 1980) to understanding reform, suggesting that "in order to understand the success and failure of policy implementation, research has to consider policy as the outcome of implementation not as the input to the process" (Wegrich, 2016).

In addition, a study of reform that focuses exclusively on policy goals and outcomes has limited value for policy makers across diverse contexts, whose educational systems may present contextual differences from those of high performing countries. Focusing on the implementation of policy, instead, can give leaders the insight necessary to contextualize reforms. As Reimers (2021d, 7) notes:

> Since countries are at various stages of educational development, in terms of their education priorities and institutional capacity, understanding how systems at various stages of educational development implement strategies to serve the learning needs of students can contribute to theorize what kind of strategies are appropriate at various stages. This can help understand how systems can build the capacity of teachers and administrators to pursue ambitious goals, and how such efforts at capacity building are supported by other institutional reforms.

The authors of each of these chapters place the specific reforms they study within their respective countries' historical and social national context. Taken together, these chapters provide a snapshot of the ways in which governments around the world are responding to a range of challenges, constraints, and opportunities to educate children for the twenty-first century, especially after the disruptions imposed by COVID-19.

In addition to showcasing implementation across a range of diverse contexts, this book also presents variation in the levels of policy analysis. Macro-level analyses examine reforms at the level of decisions and actions made by national actors and agencies in relationship to the influence of international agencies; meso-level analyses investigate the educational institutions in which learning occurs; and micro-level analyses explore individual actors within school systems such as teachers, parents, and students. While on the surface the chapters in these books reflect one of those levels, in practice they offer a multilevel analysis of reforms. For example, the chapters on Taiwan, Vietnam, Egypt, and Senegal are about macro country-level reforms; in comparison, the chapter examining the Multi-Skill Foundation Course (MSFC) is about regional, meso-levels of reform. Finally, the micro-level is explored in two chapters that focus on climate change-focused curriculum for an independent school in Washington, DC and Orange County schools.

Taken together, the way these reforms are evaluated connects macro, meso, and micro levels of analysis. First, many of the reforms are evaluated with both quantitative data as well as qualitative data regarding individual stakeholder's attitudes, motivation to learn, or confidence, which capture micro-level perspectives (Boeren, 2019). For example, the authors analyzing country-level reforms (such as Taiwan's 12-year basic education reform) or region-level reforms (such as the Multi-Skill Foundation Course in Maharashtra, India) integrate interviews and surveys with relevant stakeholders, such as local teachers, students, and school leaders. Conversely, the chapters on micro-level reform (those on climate change curriculum in Washington, DC and Orange County) utilize the five frames to examine these approaches to change from a macro-level perspective. For instance, in the chapter about climate change curriculum in Orange County, the authors recognize the challenges of teaching about climate change in a politically charged and controversial environment; they take these factors into account when creating their own regional curriculum. In addition, the chapter on Washington DC offers insight on how to scale a micro-level reform.

Multiple examples of reform and implementation analysis are used throughout this book, to provide a framework for connecting policy to practice and vice versa. These frameworks furthermore provide a closer view of the dynamics of reform, and what successful reform looks like in motion, so that teachers, schools' leaders, state leaders, and policy makers can work together to ensure successful implementation of policy goals at every level.

1.5 What Are Some of the Challenges in Producing This Kind of Real-Time Analysis?

Although studying the implementation of educational reforms in diverse country contexts is important for the various reasons outlined above, this type of real-time analysis presents numerous challenges particularly when a comparative lens is applied. When analyzing educational reforms, we consider not only their inputs and outputs, but also their intended outcomes and broader societal impacts. Given this approach, perhaps the most significant challenge in conducting these real-time analyses lies in the difficulty of analyzing a reform that is still in progress. Given the evolutionary nature of reform, the process of analysis can be challenging. This is especially the case with bottom-up initiatives, such as those spearheaded by individual or groups of non-governmental organizations. In such bottom-up contexts the inputs and the strategies employed often vary across partner organizations and over time, as tactics evolve. A study in real time provides an incomplete picture of reforms, given their evolutionary nature; moreover, studying a reform in progress means clear outcome goals are not available during the time of the analysis. In some of the analyses, reforms are tracked as they transition from one operational strategy to another. For example, in India, the MSFC reform was studied as it transitioned from a school/local-based strategy in two schools—first in the LAHI model, and then to the scaled model in Maharashtra that operated in partnership with the state government. In this context, where the reform's operational strategy is in flux, analysis of the theory of action becomes clouded as the true nature of the strategy and full scale of the reform is not clear.

Another category of challenges with conducting real-time analysis for educational reforms lies in the analytical process itself—particularly with respect to access to, and study of, relevant data. None of the reforms are implemented in a vacuum. Even if reform strategies and goals remained consistent for the duration of the implementation, many of the reforms were implemented in contexts in which similar and or complementary programs were being executed—most likely impacting the outcome of the reform being analyzed.

In many cases, it is not immediately clear what data may be relevant for robust analysis of educational reform. In the MSFC chapter, for example, the authors note that the reform being studied—a twenty-first century-skill centered vocational course option for high schoolers—is often offered in schools where other students have other vocational-course options, which might result in similar outcomes although the authors are not able to analyze those alternatives. Similarly, in the Orange County climate change curriculum initiative, the authors are not able to account for the various other factors, both internal and external to the school system, which could influence students' environmental attitudes. In cases where it is clearer what data may be needed for analysis, such data is either insufficient or not immediately available—particularly if the analysis is conducted in a relatively short timeframe. The analysis of the Egyptian reform exemplifies this limitation. Written documentation of the reform, financed and supported by a collaboration of private and public organizations, was limited and no formal articulation of the reform's strategy was available.

Despite the challenges of formulating a clear picture of the reform being analyzed or identifying and gaining access to the relevant data necessary to conduct a thorough study, it is still important and valuable to conduct such real-time analyses. As discussed earlier in the chapter such analyses provide a window into the messy process of implementation and highlight the numerous ways that reforms change over time depending on their provenance, their strategies, and other idiosyncratic factors unique to their diverse contexts.

1.6 Competencies or Problems? Sequencing and Pacing of the Reform

As the 2018 PISA report shows, in terms of global competencies, there exists considerable disconnect between knowledge and action among students; and, while what students are learning in schools about climate may be helping them understand the facts about climate change, it is not helping them discern what they can do about the challenge. Effective climate action curriculum is a pathway to close this gap. As evident in the case studies highlighted throughout this book, several reforms are moving towards building twenty-first century skills through competency-based curriculum. However, the two chapters on how climate change curriculum approach twenty-first century skills turn that approach on its head, by starting the design of curriculum with a focus on what problems the students should be prepared to *solve,* rather than focusing on which competencies they should gain.

This novel problem-based approach to the transformation of curricula is quite relevant to larger efforts to transform education, and more intentionally prepare students to address the many challenges augmented by the pandemic. Instead of focusing on developing specific skills such as collaboration, communication, creativity, and critical thinking, a problem-based curriculum is anchored globally—and then contextualized locally, so that students can learn, develop, and apply these 21st-century skills within their relevant environments. The need to prepare students to address social challenges, and to contribute to building a better future, has augmented by the ripple-effects of COVID-19.

The two chapters presenting a novel climate change curriculum in this book differ from the remaining studies of reforms. Rather than offering a study of an ongoing or past reform, these two chapters are future-focused. They also differ in the proposed delivery and pacing of the reform strategy. Rather than a panoptic, system-wide reform, these studies rely on an incremental strategy, which begins with a pilot of a novel curriculum in one school, as a precondition to reform at scale. This contrast in approaches to reform is well grounded in the literature on reform.

In examining the success record of reform at scale in the United States, Cohen and Mehta (2017) differentiate two types of reform and why they succeed: (1) system-level reforms that aim for wide-spread implementation, which succeed when they can work with existing levels of educational capacities and within widely-accepted culture, and (2) niche reforms, which are smaller-scale and often countercultural, and succeed when they mobilize champions to create a subsystem infrastructure to support the reform.

The authors of the two future-oriented chapters on climate change curriculum rely on a niche-, or micro-, level approach to reform. As the authors in the Orange County chapter explain, drawing on Cohen and Mehta's analysis of which reforms scale, the failure of national standards to integrate climate change suggests the opportunity for a niche-level reform—especially in the political context where climate change is not widely accepted, and where a large-scale reform would be unlikely to succeed.

In contrast, the authors of the chapter focusing on climate change curriculum in Washington, DC partnered with an independent school, which afforded them more curricular autonomy and with it, the opportunity to become an exemplar for other schools. Given the limitations of past curriculum reforms in educating for climate change, these chapters provide unique insight on the pacing of reform that transcends what has been attempted, instead of designing a novel approach to sequence and strategy.

By sequencing the reforms, these chapters propose a curricular reform that is not a complete pedagogical shift, but rather provides the opportunity to deepen curriculum that already exists. In addition, education reforms that scale tend to be "responsive to the unique demands and opportunities of national and local context" (Reimers, 2017). The authors emphasize the importance of integrating the local impacts of climate change to make a meaningful and relevant curricular reform within schools. Ultimately, these chapters allow us to explore how niche-level curricular reforms could be successful and how this consideration can be integrated in the development phase of reform. Our view is that these two perspectives on the approach to change, system level vs. niche, are complementary. Arguably, rather than determining whether niche-level reforms are more effective than system-wide reforms, it is more important to analyze *when* countries should implement a niche-level reform vs. a system-wide reform.

The first half of the book, which focuses on reforms that have already occurred or are in progress, also provides important (and different) insights into how to successfully pace and sequence of reforms. These chapters deal with several central questions: does the pacing of reform matter? Should reforms rely on pilots, staggered, or scale all at once? Each of the countries examined offers a different set of answers.

For example, in the case of Taiwan and Egypt, because of limited capabilities, both reforms used grade-level sequencing. In Egypt, the implementation ended up being accelerated by the pandemic, but the first phase of the reform covered K-2. This leads to a follow-up question: how should a sequenced reform be successfully implemented? In a recent OECD report, Schleicher (2018) analyzes how education reform successfully happens and that in particular, curricular reform is best done in a specific sequence, starting with pre-service or in-service teacher education. Instead of incremental grade level sequencing, should the first phase of reforms generally begin with teacher professional development and capacity building? Similarly, the reform in India started with 100 schools in Maharashtra with a focus of training their community members before transitioning into a larger scale initiative. Overall, this book gives an overview of different reforms that scale or attempt to scale in various ways to provide insights on the pacing and sequencing of reforms.

1.7 Methods, Data and Limitations

As students in the course on comparative education policy, the authors of these chapters studied a range of publications on system level reform. They were also provided a protocol to guide data collection. Because the study was conducted during the pandemic, during the period when there were physical distancing restrictions in place, most data were collected remotely, interviewing key informants via web conferencing or communicating via email. The evidence collected included records about the programs studied and individual or group interviews. No observations or face to face in person interviews were possible, given the restrictions in place during the pandemic.

The students in this course on education policy included educators with professional experience in Austria, Bangladesh, Belgium, Belize, Canada, China, Egypt, France, Germany, Greece, India, Italy, Japan, Kosovo, Palestine, Saudi Arabia, Senegal, Sierra Leone, South Africa, Spain, Taiwan, Thailand, Uganda, United Arab Emirates, United Kingdom, United States, Venezuela and Vietnam. Their professional roles included teacher, school leader, school principal, instructional coach, facilitator, trainer, curriculum designer, learning designer, consultant, director of international education, international development professional, fundraiser, and advocate—among other roles.

In the course, students were asked to study a reform of education that explicitly aimed at developing a breadth of skills. Students worked on these assignments in teams, choosing the specific focus and country for the study, in all cases at least one member of the team had direct access to relevant education authorities in the context studied, who could provide the information necessary to conduct the study. Four of the teams focused on education reforms underway or recent, and two of the teams focused instead on designing a curriculum reform which could address climate change. The students worked on these projects between the months of September and December of 2020, during the Covid-19 pandemic, as they were graduate students (online, due to COVID-19) at the Harvard Graduate School of Education. Upon completion of the research projects, the students presented them at a virtual conference, at which the projects received feedback from leaders of practice in the field of international development. Subsequently, students revised the chapters and presented them at a conference among all authors participating in this project, receiving feedback from peers and from the teaching team.

While in each team at least one member had direct access to informants about the reforms they were studying, only one of the authors—the lead author of the study in Vietnam—works in a senior role in the government whose reforms are studied.

The studies rely on surveys, focus groups, published and unpublished documents, and interviews. No observations of classroom instruction or other activities carried out as part of these reforms were conducted.

The following data are included in the studies:

India: Surveys and focus groups of students, parents and community members; interviews of LAHI staff members; external impact assessments.
Taiwan: Literature review of scholarly articles, government documents, and official reports; stakeholder interviews with teachers, school administrators, and education researchers; and a survey administered to teachers.
Egypt: Literature review and interviews with teachers, administrators and policy makers. Access to a research project which is documenting the reform.
Vietnam: International reports and academic literature. Interviews with key stakeholders in Vietnamese education system. Primary sources from government.
Senegal: Quantitative and qualitative data from literature review of academic papers, reports and articles, interviews with key stakeholders in the Senegalese government, international organizations (UN Ambassador), and education system (former teacher and former principal).
Orange County, USA: Literature review and interviews to identify barriers and challenges in climate change education to inform their proposed curricular reform.
Washington DC, USA: Literature review and interviews with teachers, students, and students' caregivers to identify barriers and challenges in climate change education, as well as surveys with teachers who piloted part of their curriculum.

The nature of the data collected brings some inherent limitations to this research. The first is that the studies provide a retrospective account of these reforms, with data collected *after* the fact. It is therefore possible that the memories of informants about key events were influenced by the way the reform was implemented, or by its emerging results. Furthermore, no attempt was made to isolate the study of the reform implementation from other concurrent events, both inside and outside of the education system, which might have influenced the views of those interviewed. Because most of the data collected are based on documents and interviews, not observational, they are subject to various sources of bias that might influence reliability and validity of the reports.

Most of the evidence examined focuses on the components of the reform, its components and theory of action, and on implementation, with limited information on impact on teacher practice or student outcomes. The chapters which include information on teacher practices—such as Taiwan—or student skills—such as India—depend on self-reports, without information to establish a counterfactual. As a result, the studies are mostly about the implementation of these reforms, rather than studies of what those reforms achieved.

1.8 Summaries of the Chapters.

India

This chapter explores the multi-skill foundations course (MSFC) collaboration between Lend-A-Hand India (LAHI), and the local government of Maharashtra, India. On a broader scale, the MSFC, a novel, multidisciplinary vocational course alternative for students in India's secondary schools, targets the increasing gap between the number of highly trained Indian workers needed in the job market and the corresponding number of highly skilled students produced by the school system. According to the chapter, this mismatch of supply and demand is due in part to the lack of practicality of traditional schooling, which is currently focused on memorization and oft-stigmatized vocational options, and overly-focused on trade skills, with little allowance of the importance of twenty-first century skills—skills which are directly correlated to students' long-term employability. In addition to addressing employability, LAHI's MSFC work aims to increase student retention and increase dignity of labor.

LAHI's MSFC model, which started as an independent community-focused initiative in 100 schools in Maharashtra, designed to train community members to deliver MSFC courses, eventually transitioned to a state-government sponsored model. In this model, the government provided financial and human resources support, and LAHI provided strategy, training, and other pedagogical support.

Through a mix of MSFC student surveys, focus groups with MSFC and non-MSFC students, parents and community members, the authors found that LAHI's programming was successful in increasing students' employability, engagement (including retention), and dignity of labor. They also found that the programming, through its strategy of using mix-gender groupings for its project-based activities, had a positive impact on community connections, gender relations, and gender roles. After the study, students reported positive cross-gender collaborative experiences, and parents reported male students participating in domestic chores.

The chapter concludes with observations of the study's limitations, and suggestions regarding ways to improve the quality of the programming experiences, the connection between the programs and community, and the number of students and communities impacted. A model of the program's chief attributes is also presented and proposed as an exemplar to be copied in other contexts.

Egypt

This chapter examines an ambitious reform to improve the quality of education in Egypt. The reform intended to develop a breadth of competencies, following a life skills framework developed by UNICEF, and to support students in developing them through an interdisciplinary curriculum enabled by technology. The implementation of the reform depended on short professional development courses offered to teachers. The reform was financed and supported by a range of international organizations, including inter-governmental agencies such as UNICEF, the World Bank, and USAID, as well as an international education company. The chapter describes that written documentation about the reform is absent, and that no formal and public articulation of the reform's theory of action or logic framework exists. The COVID-19 pandemic accelerated the implementation of some components of the reform, particularly the reliance on distance learning.

The chapter similarly examines the reform through the five perspectives framework, concluding that the reform lacks explicit consideration of cultural, professional and political perspectives, relying instead on psychological and institutional perspectives.

Taiwan

Taiwan's education reform extended the duration of compulsory education to twelve years, while also using the curriculum as an instrument to help students develop breadth of skills, or 21st-century century skills, building on a previous competency-based curriculum reform, that had similarly emphasized educating the whole child up until the ninth grade. The new curriculum aspired to comprehensive preparation for work, life, and civic engagement, emphasizing the importance of educating for lifelong learning. The implementation theory of this reform addressed curriculum, teacher practice, assessment, instructional resources, professional development, administration, parent participation, and partnerships with nongovernmental organizations. It further emphasized achieving coherence and alignment across these various components of the reform.

This chapter also analyzes the implementation of the reform using the five perspectives of educational change studied in the course and discussed above. While the reform was found to be successful in expanding access and in implementing the new competency-based curriculum there were nonetheless some implementation challenges. These include insufficient teacher involvement in the curriculum review and design, the perception that the reform increased the burdens on teachers' time, insufficient public understanding of the reform's goals, and resistances to shifting cultural mindsets about schooling and its purposes.

Vietnam

This chapter presents an analysis of Resolution 29, passed in 2013, which aimed to fundamentally reform Vietnam's educational system from pre-school through higher education. This reform proposed eight key solutions, across education management and administration, teacher professional development, content and pedagogy, assessment, and resources. Resolution 29 also includes specific mandates to strengthen connections between universities and the labor market, foster education for disadvantaged groups, and improve international cooperation in the education sector.

The authors use the five perspectives framework to analyze the reform, and present data from the first seven years of the reform's implementation. Authors highlight key successes from this reform, including the approval of a new competency-based curriculum, and significant changes to high school graduation and university entrance examinations. Moving beyond Resolution 29, the authors recommend focusing on providing high quality training for teachers, especially around pedagogical methods, developing assessments to emphasize project-based learning in place of rote memorization, and building stronger systems for the management of education at all levels.

Senegal

This chapter focuses on the Cases des Tout-Petits (CTP)—an early education program launched in 2006, with the goal of building 28,000 community- based spaces to provide learning and health services for rural children from birth to 6 years of age. These services included health screening for deficiencies and disorders, immunization, offering children nutritious meals, and providing early childhood educational activities in literacy, math, technology, and cultural and moral values. Parents and community members were integrated into programming, to support whole child development. Community funding was also integrated into the model, to ensure local investment and reduce overreliance on governmental support. This reform is highlighted because of its unique integration of education and health, which may demonstrate important implications for future reforms that aim to consider the relationship between these two critical fields.

The authors use the five perspectives framework to analyze the implementation of this reform and identify gaps in the theory of action that may have affected its impact. Key challenges include need for appropriate staffing and training to support the program's dual purposes, a more robust financial model to support sustainability, lack of student achievement data, insufficient coordination among all stakeholders, and a high student–teacher ratio. Authors conclude that the reform demonstrates mixed results, and argue for a clear focus on teacher professionalization, monitoring and evaluation, and systemic coordination, in subsequent education policy.

Orange county, USA

This chapter analyzes the failure of standards (the Next Generation Science Standards) to translating a relevant and crucial global challenge, climate change, into classrooms in Orange County, California—as the authors argue, this is due largely to the decentralized education system in the US, the politicization of climate change, and lack of adequate professional development and resources for educators. The authors conducted interviews with teachers in Orange County and analyzed best practices in countries successful in wide-scale climate change education (Italy and Sweden), with the goal of offering a curriculum for education leaders to understand best practices of climate change education, and then implement these practices within their own local contexts.

The curriculum's theory of change is that if schools had an action-oriented and accessible curriculum, which fostered a sense of common purpose with peer-to-peer learning, then we would see students adopt more environmentally conscious behaviors—such as choosing biking over driving. These behaviors could then influence behaviors in the wider community. This curriculum is therefore peer-led and action-based, with the following modules: "It's real," "It's us," It's bad," and "There's hope." In addition, the curriculum makes the topic personally relevant, transdisciplinary, and solution-oriented with explicit content on systems thinking and addressing the controversy behind climate change.

Washington DC, USA

This chapter analyzes existing climate change education curriculum worldwide, to form a program and implementation plan for an elementary climate-change focused curriculum at the school level. The authors partnered with an independent school in Washington, DC, with two major objectives: first, building a relevant curriculum, and second, modeling how a niche school-level curricular reform could then be translated to a systemic level reform. Their curriculum's theory of change is if students understand the science of climate change, recognize its impacts on their local communities, and create community-oriented solutions leveraging four sectors (media, government, corporate sector, and individual engagement), then they will also be able to apply their learning into actions to address climate change issues. Ultimately, the goal of this curriculum is to create collaborative leaders with twenty-first century skills, who are enabled to prioritize climate action.

The principles behind the curriculum are community-based, participatory, and interdisciplinary learning. In addition, the authors outline a logical framework that emphasizes the importance of building a relationship with school administrators and teachers for feedback and buy-in, forming a core group of champion teachers, providing professional development opportunities for teachers, and adapting the piloted curriculum to other existing programs in the school.

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Chapter 2

Multi-skill Foundation Course in India: The Head, Heart, and Hands of 21st Century Learning

Ryleigh Jacobs, Catherine Pitcher, Richa Gupta, and Rinesa Deshishku

Abstract This chapter examines the Multi-Skill Foundation Course (MSFC), a vocational course conceived by grassroots NGO Vigyan Ashram, and further developed, replicated, and scaled up by Lend-A-Hand India (LAHI) since 2005. In collaboration with the State Government of Maharashtra, the course has been recognized under the National Skills Qualification Framework (NSQF)) and adopted by more than 600 secondary schools across India. The purpose of MSFC is to promote employability, enhance student retention and increase the appreciation for vocational skills by uniquely intersecting vocational skills with 21st century skills in an experiential learning-based pedagogy. Our in-depth analysis of the MSFC includes an overview of vocational education in India, an explanation of the theory of change, and the effect of this niche reform in building 21st century skills. To understand the impact of the reform. We interviewed different actors and surveyed 111 students enrolled in the MSFC. In addition, we organized Focus Discussion Groups (FDGs) comprised of over 20 students from vocational courses, the MSFC, and non-vocational tracks. This analysis reveals that MSFC is having a positive impact on students and their communities by cultivating 21st century skills,

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enhancing employability, and improving gender inclusion through quality vocational education. The final section of the chapter identifies areas of consideration to further strengthen this niche reform and key takeaways from the MSFC.

In this chapter, we examine a secondary vocational program called the Multi-Skill Foundation Course (MSFC), administered by Lend-A-Hand India (LAHI). The MSFC balances the head, heart, and hands of 21st century education as it aims to equip students with a breadth of vocational skills and 21st century skills, through a hands-on student-centered pedagogy. This course empowers students to apply their skills to real world projects in collaborative settings. A study of the theory of action indicates a two-fold path to achieve the goals of the MSFC: *Project Swadheen* (Independence), the creation and implementation of the MSFC curriculum, and *Project Catalyst*, a mechanism to ensure the MSFC is scaling across India through private–public partnerships. However, this chapter focuses specifically on the impact of the course in cultivating 21st century skills in participants. This MSFC is unique because of its intentional integration of 21st century skills into vocational education, and in leveraging the mechanism of private–public partnerships to reach scale in India.

We begin our analysis by first contextualizing the social and political landscape of 21st century skills and vocational education in India. We then describe the methodology of our research and describe the MSFC theory of change. Lastly, we give a detailed description and assessment of the reform and conclude with key lessons learned from this analysis.

2.1 Context

2.1.1 Vocational Skill Development in India

By 2030, one third of the world's working age population will hail from India, with the majority requiring skills the country's existing system is not equipped to provide. The vocational training sector in India (also referred to as Technical and Vocational Education and Training, or TVET) is relatively small. Only 2% of students enrolled in vocational institutions and 4.69% of India's workforce is considered skilled (British Council, 2016). India's fast-growing economy and rapidly expanding workforce requires a strong push for vocational and 21st century skill development.

The National Policy on Skill Development and Entrepreneurship set out to "(1) create a demand for skill development across the country, (2) align skill development with required competencies, (3) connect the supply of skilled resources with national/global demand, and (4) foster entrepreneurship including women's entrepreneurship" (British Council, 2016, p. 20). Noting this, the *Skill India* initiative was launched in 2015 with the aim to train more than 400 million people in different skills by 2022. As a result, India has established different governmental organization in support of skill development; its aim is to introduce vocational education at the general secondary level.

Schools in rural areas that offer vocational education are contributing to the accessibility of skills training for all students. Introducing vocational skills in secondary school has its own challenges, as schools lack adequate financial resources, teacher training, and assessment methods to provide quality vocational courses. However, vocational education in secondary schools has a positive impact on school enrollment and high school graduation rates (UNESCO, 2013). In India, the "Vocationalisation of Secondary Education" reform aims to (1) enhance the employability of youth (2) maintain their competitiveness through provisions of multi-entry, multi-exit, learning opportunities and vertical mobility (3) fill the gap between educated and employable, and (4) increase school retention at the secondary level (World Bank, 2015).

2.1.2 21st Century Skill Education in India

Vocational and 21st century skill education is vital to India's strategy for developing its knowledge economy. Dahlman and Utz (2005) identified a key lever in the progression toward a knowledge economy that is supported by the MSFC: increasing enrollment in tertiary vocational education. The authors make a compelling case for the necessity of educated and skilled workers, but stress that the key area that sets participants apart in the knowledge economy is the development of 21st century skills.

21st century skills can also be referred to as "life skills," "soft skills," "transversal skills," "social emotional learning," and "critical skills," and are used interchangeably despite some significant differences across a range of personal, professional, and cognitive realms (Joynes et al., 2019). Although LAHI uses the term "life skills" in their internal communication, in this chapter we will refer to this set of skills as "21st century skills" given the specific focus on skills that align with Pellegrino and Hilton's (2012) framework of 21st century skills, and the growing prevalence of this term in the literature. Developed by the National Research Council, the Hilton-Pellegrino framework aligns a range of cognitive, interpersonal, and intrapersonal skills that are intended to promote higher order thinking, student-centered opportunities and deeper learning to holistically prepare students for their futures. Despite the compounding evidence of policy and curricula highlighting the importance of 21st century skills in academics, a dearth of literature on 21st century skill coverage in vocational programs remains (Reeve, 2016; Salleh & Puteh, 2017; Tam & Trzmiel, 2018; UNESCO, 2012).

The multi-skill approach in this program is rare among vocational programs. Most countries view vocational training as an entry pathway into the labor force, focusing on a depth of single-vocation skills to build employability for the labor market. This is evident in a variety of contexts, including Germany, Poland, Malaysia, and Vietnam (UNESCO, 2014, 2015). The MSFC broadens the purpose of vocational education to reflect the breadth of skills required in the 21st century. UNESCO and the International Labor Organization argue that vocational education is preparation for an occupational field and therefore, students should have the generic knowledge of occupations to be able to transfer these skills throughout their careers. The report specifically defines the aim of vocational education to "provide scientific knowledge, technical versatility and a cluster of core competencies and generic skills required for rapid adaptation to new ideas and procedures and for steady career development" (UNESCO & ILO, 2002, p. 27). The type of tacit knowledge embedded in multidisciplinary skills training becomes more important in labor markets as they grow into knowledge economies (Olssen & Peters, 2005).

Employers in the 21st century are interested in skills such as problem solving, working in a team-based environment, and effective communication. All told, the literature on context and best practices in 21st century and vocational education, and the projections of India's labor force previously mentioned create a compelling case for a study of the MSFC. The following sections illustrate how the MSFC targets students' development of these competencies: setting students up for success, whether that is measured by moving on to tertiary vocational education, higher education, entrepreneurship, or into the global business world.

2.2 Research Methodology

For our research, qualitative tools were employed to understand this niche reform, along with a quantitative survey to understand the self-reported impacts of the reform on students. The focus of our research was on the MSFC in the state of Maharashtra, as the course is well established there. In contrast, it has only reached scale across other Indian states very recently, making these states less relevant to our study. Our qualitative approach included analysis of secondary sources, such as the NSQF Policy Frameworks and documents, MSFC and other vocational courses' teacher and student resources, teacher training intervention plans, evaluation rubrics, news articles, the websites of civil society organizations and the Hilton-Pellegrino framework to better understand 21st century skills. In addition to the secondary sources, we conducted fifteen interviews with various actors responsible for implementation and instructor training (Appendix A; Appendix E).

To further understand the impact of the MSFC, we adopted a mixed-methods approach, combining quantitative data with qualitative information from our research (Weiss, 1998) as well as previous impact reports from Sattva Consulting (2019), Change Alliance (2019) and Tata Trust (2013). Our data collection tool was a Likert-scale survey adapted from the instrument developed by Reimers and Chung (2018) in his quasi-experimental analysis of Injaz Al-Arab's Company program, as well as previous impact assessments, to reflect the context of the MSFC

(Appendix B). This tool was translated and verified in Hindi and English by team members and is intended to measure attitudinal and 21st century skill changes in students because of the MSFC. The tool was used to collect data from 121 participants in the MSFC. Participants in the study were from diverse demographics: 47% were rural, 53% were from urban settings, 61% identified as female, and 39% identified as male. Additionally, we conducted interviews with Focus Discussion Groups (FDGs) to better understand our tool as well as the results and implications of the MSFC (Appendix C). The FDGs comprised of over 20 students from the MSFC course (including alumni), non-vocational tracks and non-MSFC students enrolled in other vocational courses.

2.3 The Why Behind the MSFC

The Multi-Skill Foundation Course (MSFC) was designed to address the inadequacies of the education system in Maharashtra where there is a 62% dropout rate in middle school and a 76% dropout rate in high school in rural areas (ASER Centre, 2011). It is also intended to respond to the growing gap between the skills provided to youth and the skills needed to thrive in a fast-changing world. India will add roughly 300 million people in the working age group (15–25 years old) to the world by 2040. However, only 4.69% of the workforce in India has developed marketable formal skills, compared to 96% in South Korea, 75% in Germany, 52% in the USA, and 24% in China (Financial Express, 2019). Young people in India view factors like gender and caste-based discrimination, lack of practical education, and lack of mentorship opportunities as major barriers in gaining employability skills (UNICEF, 2018). In high school particularly, the emphasis on academic education is to memorize information for the purpose of getting a grade (Tata Trust, 2013).

This gap was first highlighted by Sunanda Mane, the co-founder of Lend-A-Hand India, during her work with international development projects. Her experience working on workforce enhancement and development across the world greatly influenced the design of the Multi-Skill Foundation Course, its pilot in Maharashtra, and its subsequent adoption by the government. To quote Ms. Mane, "Our schools have great curriculums, but it is critical how they are dispensed. Rote method of learning is rampantly used, which is killing student's creativity, inquisitiveness, analytical and comprehension ability, and even interest in learning and in going to school. To make the learning process meaningful, useful and relevant, Lend-A-Hand India identified the Multi-Skill Foundation Course as a possible answer to this problem," says Mane.

The MSFC scaled nationally, as the Maharashtra Department of Education advocated for adoption of the MSFC as part of the NSQF. In the context of the newly formed National Skill Development Corporation in 2008 and the Skill India campaign by the Prime Minister of India in 2015, advocating for a skill-focused multidisciplinary program was not only relevant, but *essential*. The Government of Maharashtra Department of Education's application to get MSFC recognized as an NSQF compliant course for students nation-wide took five years, with the advocacy process beginning in 2013 and the formal adoption of the course concluding in 2018 (Fig. 2.1).

The recent formation of the National Skill Development Corporation (NSDC) and the Sector Skill Councils affiliated with it gave the MSFC the necessary certification and qualification, thus enabling it to scale. The NSDC was established to revolutionize the skills landscape of India, with a strong focus on building the sector from the ground-up (YourStory, 2019). NSDC was formed by the Ministry of Skill Development & Entrepreneurship, which also holds 49% shares in NSDC (NSDC India, n.d.). With Sector Skill Councils affiliated with NSDC undertaking assessment and certification of MSFC and subsequent approval by National Skill Development Agency (NSDA), MSFC was quickly recognized under the National Skill Qualification Framework.

2.4 Theory of Change

The underlying theory of change is established through three broad goals: (1) to promote employability, (2) to increase student retention, and (3) to promote dignity of labor.

Students in the MSFC build a breadth of skills and knowledge across vocational sectors (Dasra, 2012; Government of Maharashtra, 2015). The skills that MSFC hopes to target include intrapersonal (self-efficacy, capacity for life-long learning, perseverance, self-management, confidence, and integrity), interpersonal (communication, time management, collaboration, and teamwork) and cognitive skills (problem solving, creativity, innovation, and critical thinking) (Lee, 2016; Pellegrino & Hilton, 2012; Reimers, 2020). Additionally, the MSFC's intended outcomes include practical and theoretical knowledge in four core sectors. These include Workshop & Engineering Techniques, Energy & Environment, Gardening, Nursery and Agriculture Techniques, Food Processing Techniques (9th grade) / Personal Health & Hygiene (10th grade) (Central Board of Secondary Education, 2020). Further, the MSFC aims to address gender stereotyping and roles among students by giving them opportunities to practice these interpersonal skills together, across the core sectors. These outcomes are collectively assessed by both schools and specific Sector Skill Councils which are affiliated with the National Skill Development Corporation.

Students enrolled in the MSFC can access these skills and experiences through a class that is integrated within their standard school day. Schools may opt for MSFC from a pool of 73 vocational courses under the National Skills Qualification Framework (NSQF) (Lend-A-Hand India, 2020).

The MSFC is facilitated by a trained external instructor. The government provides schools with a lab and required equipment for the four core sectors covered in the course. Students meet with the instructor in this lab once a week over 9th and 10th grade (Central Board of Secondary Education, 2020).

The implementation of MSFC has its foundation in the training of instructors and budgetary allocations by the government towards instructors' salaries and the MSFC lab equipment. Instructors from private vocational centers are selected to train with LAHI to facilitate the MSFC. These instructors are evaluated by LAHI and are remunerated by the state government for their services. Since these pivotal steps require government resource mobilization at various levels, LAHI deploys a Program Management Unit made up of experienced coordinators, program associates and training usually in the Samagra Shiksha department of the state.

2.5 Theory of Action

The Theory of Action of MSFC can be defined by two projects implemented by Lend-A Hand-India: *Project Swadheen* and *Project Catalyst*. The MSFC integrated skill-based education in two schools as the initial pilot project titled *Project Swadheen* before scaling to the national level through consistent advocacy and cooperation with the government through a project titled *Project Catalyst*. This section illustrates the mechanisms of implementation that various stakeholders, adopted from the pilot to the integration of the MSFC at a policy level.

2.5.1 Project Swadheen

Lend-A-Hand India's journey with MSFC began in 2005, with a pilot in two government-aided private schools in rural Maharashtra. Afterwards, the MSFC was integrated in the official curriculum and implemented in 100 schools across thirteen school districts in Maharashtra (Dasra, 2012). At this stage, LAHI would contribute 80% of the operational costs for the first three years, reduced by 10% every year after that. After a few years of implementation, schools would also charge a fee to parents towards covering the costs. Initially, instructors were selected from the local community, and included microentrepreneurs and homemakers. As the MSFC scaled, these local community members were replaced by staff with vocational certifications. Currently, the MSFC is implemented in 331 schools across Maharashtra and 18,210 students are enrolled in the course (Lend-A-Hand India, 2019; Pathak, 2019).

2.5.2 Project Catalyst

The Government of Maharashtra, through the Department of Education, took five years to introduce the MSFC as a course for students nation-wide, with the advocacy process beginning in 2013 and the formal adoption of the course concluding in 2018. As the MSFC was adopted nationally, LAHI deployed their team members in education bodies of 24 state governments across India, providing technical and project management support to scale up vocational education within the state, advocate for the MSFC and monitor the course in those states. This project is called *Project Catalyst* (Lend-A-Hand India, 2019). The strategy is to place qualified LAHI team members in government offices to provide domain expertise and work alongside government officials to ensure effective delivery of vocational education in the secondary and higher secondary school, and that the MSFC is implemented efficiently and with fidelity. Today, LAHI is supporting skill education in over 10,000 schools and reaching over a million students (Lend-A-Hand India, 2019).

2.6 Program Description

2.6.1 The Integration of 21st Century Skills in the MSFC Curriculum

MSFC's theory of change is based on the integration of 21st century skills into multi-skill vocational training. Lend-A-Hand India focuses on a breadth of skills and vocational experiences across sectors as opposed to a limited area (Dasra, 2012; Government of Maharashtra, 2015). Although not traditionally a part of 21st century skill instruction, this course's focus on destigmatizing work that crosses traditional gender lines can be viewed as increasing self-awareness and critical thinking skills and, although not explicitly a part of the theory of change, is a notable goal of LAHI's leadership team.

2.6.2 Curriculum

The MSFC operates on a "learning by doing" model, which is designed to encourage employability through the cultivation of skills and project-based work. It is a skill-based curriculum that focuses on direct training in skills followed by real-world group projects where students can apply those skills within their communities. All groups are mixed gender and have 21st century skill instruction embedded in the work. In the curriculum there are various vocational skills included, such as carpentry, welding, basic wiring, gardening, food processing, plumbing, and basic first aid (Lend-A-Hand India, n.d.a). Students have a regular instructor for the duration of the year and receive specialized instruction in specific technical skills (plumbing, for example) from guest lecturers, or through field visits. Whenever possible, the program tries to draw from the pool of parents in the class or school for these activities. Additionally, if there is a parent or guest lecturer available whose role does not reflect traditional gender norms (such as a female plumber or a male tailor), intentional efforts are made to work with those individuals, to reduce stereotypes associated with vocational trades. Systemization for how these guest lecturers and field visits prioritize destigmatizing gender roles is not clear.

2.6.3 Projects

Students work together, under the guidance of the instructors, to select group projects based on the needs of the community. The identification of these needs is an important skill that exemplifies the spirit of learning by doing that the MSFC is built on, and further demonstrates how the MSFC exemplifies 21st century learning, going beyond what is typical in vocational education.

One example of such a community project is in *Wazirabad*, where students applied their recently acquired plumbing knowledge to fix a broken pipe. This pipe had previously led to a dysfunctional water fountain in their school. This project served the community by both restoring the students' supply of drinking water and allowing this group to apply their newly taught skills. Other projects include making and selling goods, such as pickles or small wooden goods made in their food preservation and carpentry classes. Students use 21st century skills like communication, self-confidence, creativity, innovation, collaboration, teamwork, critical thinking, perseverance and problem-solving when they engage in their projects and the sale of their crafts.

2.6.4 Capstone

At the end of each year, there is a celebratory event called Swadheen Yatra. At this celebration, students present what they have learned over the duration of the course to teachers and students from their school (Lend-A-Hand India, n.d.a). The event is designed to expand community awareness of the course's impact on students, provide a chance for the community to support students' skill development, and give further chances for students to practice 21st century skills, such as leadership, communication, and presentation skills.

2.6.5 Module A

It is important to note that all students across the 18 National Skills Qualification Framework courses take the same 50-hour class in employability skills called Module A. There are five subjects covered: communication skills, self-management skills, ICT skills, entrepreneurial skills, and green skills (Central Board of Secondary Education, 2020). These skills are taught through a teacher-centered pedagogy and assessed using multiple choice assessment—which is distinct from the pedagogy of the MSFC (Central Board of Secondary Education, 2019).

2.6.6 Instructor Capacity

Instructors of MSFC classes are not typically career educators and have an engineering or a technical degree, often from one of the Industrial Training Institutes. There has been a focus within LAHI on the importance of pedagogy and training for instructors so that vocational and 21st century skill instruction occurs in an effective and student-centered manner. To support this goal LAHI has developed two programs: *Saksham,* a capacity building and mentorship program; and *ChalkLit,* a mobile application to support instructors vocational and pedagogical development.

2.6.6.1 Setting Clear Expectations

Instructors and supervisors use a rubric adapted from Teach for India's model to assess and drive future instructor growth. In addition to on-going professional development opportunities and quarterly external evaluations, the program sets clear expectations for instructors as recommended in the literature (Villegas-Reimers, 2003).

2.6.6.2 Instructor Preparation and Ongoing Mentorship

The *Saksham* capacity building program started in November 2018 and is focused on supporting instructors by equipping them with pedagogical tools and a support system through a team of coaches. LAHI demonstrated reflection and growth through their development of this program. Initially, the program targeted pre-service instructors, but as staff noticed that some of the tools were not being applied in classrooms, they expanded Saksham to include regular mentorship throughout the school year (Lend-A-Hand India, n.d.b).

2.6.6.3 Ongoing Just-In-Time Instructor Support

The *ChalkLit* app makes all content related materials easily accessible to instructors. Standards, lesson plans, and pedagogical tools, such as discussion prompts, are available for every subject. Additionally, there is support for developing vocational content area expertise. Given that instructors likely had expertise in one of the areas of the MSFC prior to becoming instructors, it is understandable that there may be gaps and limitations in their pedagogical capacities; for example, an engineer may need training in food processing, plumbing, or agriculture, to be a more effective educator (Lend-A-Hand India, n.d.c).

2.6.6.4 Instructor Monitoring and Ongoing Targeted Improvement

Instructors are evaluated using a rubric that covers competencies of planning, execution, and building classroom culture, adapted from the rubric Teach for India uses to support its fellows (Lend-A-Hand India, n.d.f). Instructors are introduced and trained in how to use the rubric in their preservice training, and then engage in regular observations with coaches throughout the year guided by the rubric. Instructors and coaches each assign a performance score within each category at four points throughout the year to track progress and to understand personalized priorities for development. This allows instructors to reach better results with their students (Lend-A-Hand India, n.d.e). Regular classroom observations are uncommon in India and typically occur after a problem has been identified. There has been a need to destigmatize observations and rubric evaluations so they are seen as tools for growth rather than as punitive measures.

2.7 Realized Outcomes and Analysis

Evaluating the MSFC is essential to help us understand how the course is fulfilling its vision. In the last ten years, there have been three major impact assessments, each of which help us understand MSFC's results in schools. In addition to these assessments, we analyzed MSFC's impact on students by conducting self-reported surveys with currently enrolled MSFC students (n = 111), along with four focus group discussions with samples from the following populations: current MSFC students, alumni of MSFC, non-MSFC students enrolled in other vocational programs and students enrolled in regular academic programs who do not receive any vocational training. Our analysis and the impact assessments conducted by Tata Trusts (2013), Change Alliance (2019) and Sattva Consulting (2019) reveal that MSFC is fulfilling the goals highlighted in the theory of change: (1) to promote employability, (2) to increase student retention, and (3) to promote dignity of labor.

2.7.1 *Retention*

2.7.1.1 Increased Student Retention and Performance

As the results demonstrate, the MSFC has had a direct impact on increasing student retention by improving attendance and students' attitudes towards school, thus leading to improvement in other disciplines. As a result of the MSFC, students have reported that they are more interested in attending school. Based on self-reported results from the student surveys we designed, 94% of students believed the MSFC inspired them to be more regular in school; 94% noticed an increased interest in their studies; and 82% felt they were more likely to participate in class. Instructors reflected those students are enthusiastic to learn and rarely miss an MSFC school day. It is important to note that specific attendance data was not available to us, and a comprehensive review of such data will illuminate insights into the true impact of the MSF on this parameter. Further, past analysis shows that the practical training provides MSFC students an advantage in theoretical subjects, as they learn to link abstract concepts to real-life projects. Students demonstrated 30% improvement in Science, 28% improvement in Environmental Science, 13% improvement in Language and 14% improvement in Math. Overall, students feel engaged in the MSFC and enthusiastically participated in all activities which appears to have had a ripple effect into their general studies.

To magnify these impacts on retention and attitudes towards school, the MSFC should become more available to all students. Students who want to pursue a career in business felt that other courses, such as Retail, might be better suited to this. In some schools, MSFC is offered at the same time as a second language, and students feel that language should be a priority. Advocating for non-competing time slots, as well as sharing the story of the MSFC across various media platforms and hands-on learning days will persuade community members of the benefits of the MSFC (Bardach, 2019). Naturally, it is unrealistic to expect all students to partake in the MSFC when there are other well suited vocational courses. However, understanding why students are and are not choosing to participate, as well as sharing the power of the MSFC, will certainly allow more students to benefit from this course.

2.7.2 *Employability*

2.7.2.1 Employment and Future-Making

The MSFC has provided students with opportunities to explore a variety of careers, while providing them with 21st century skills required to thrive in our ever-evolving world. In our self-reported surveys, 83% of students indicated that the MSFC broadened their horizon for potential careers and inculcated an understanding of what is required to achieve goals.

Past studies show that, prior to MSFC enrollment, students thought that the only viable career options were medicine or law. However, 90% of students self-reported in our surveys that they felt the MSFC provided them with employability skills that will help them to secure a job in a variety of fields outside the "traditional" roles, as the course was highly relevant. In contrast, our recent FDGs revealed that non-MSFC students were aware of the skills required of them, mentioning self-confidence, perseverance, communication, self-discipline, goal setting, and collaboration. However, they elaborated that their regular school curriculum does not allow for such skills to be built.

The MSFC has enhanced the employability of students due to the exposure to basic vocational and 21st century skills. These effects are reflected in the reduction in the unemployment of MSFC students in past studies. For male MSFC students, the unemployment rate is 6%, and for female MSFC students it is 33%—just half of the national average (Shiksha, 2020). During our FGDs, one alumnus of the MSFC reflected on starting his own garden nursery (one of the skills taught in the MSFC). He believed that the MSFC had a direct influence on him, giving him the confidence to aspire to his dreams and providing him with the skills to engage in meaningful work.

2.7.2.2 21st Century Skills

In addition to the positive increase in employment associated with taking the MSFC, the course also seeks to build employability through the integration of 21st century skills.

21st Century Skills: Cognitive Skills Based on our FDGs, the MSFC students had a clear understanding of the skills they gained during the course. This is likely reflective of how intentional the course was in establishing its curriculum and building these skills in students through the capstone project, *Swadheen Yatra*. Through the "learning by doing" model of the MSFC, students cultivate the following cognitive skills: problem-solving, creativity, innovation, and critical thinking (Lee, 2016; Pellegrino & Hilton, 2012; Reimers, 2020). One project that highlights the use of these cognitive skills was when students responded to the needs of their community by repairing the pipes that supplied a water fountain, restoring water access to a portion of the school. Not only did they have to identify the issue in their community, but they also had to problem-solve to develop potential solutions. Due to the multi-skill nature of the course, students developed critical thinking skills as they worked through the design process, transferring their skills to new situations and taking initiative to learn new skills from experts in the community. Through this iterative problem-solving process, they were able to apply these cognitive skills to real-world contexts and address a need in their community. According to our self-reported surveys, 86% of students indicated the MSFC cultivated problem-solving skills, 84% of students reported being able to make connections between the MSFC and real-world contexts, projects, and coursework, and 76% of students agreed that the course inspired creativity as students have to continually apply their knowledge to engender creative solutions and project ideas. In both our FDGs and in qualitative data collected by Sattva Consulting, students specifically mentioned that they were continually revising and adapting plans to make things work, applying what they had learned in the course (2019).

21st Century Skills: Interpersonal Skills

Furthermore, there is evidence to suggest that the MSFC cultivates a range of interpersonal skills including communication, time management, teamwork, and collaboration (Lee, 2016; Pellegrino & Hilton, 2012; Reimers, 2020).

Regarding time management skills, 87% of MSFC students indicated in our self-reported surveys that the course cultivated time management skills, as students had to plan and manage their projects. For teamwork, 96% of students noted an increase in their ability to collaborate and work well in teams because of the MSFC. All projects through the MSFC are completed in assigned, mixed-gender small groups. Here, students are equipped in building collaboration skills as they engage in projects and problem-solve together. Through this, they learn that working as a team is more effective as it enables various perspectives and ideas to be voiced. In our FGDs, students highlighted that teamwork and collaboration revealed that everyone has a different thought process that should be respected and valued. Teamwork also empowered leadership skills as 88% of students indicated the MSFC enabled them to grow in leadership abilities and the understanding of what makes a good leader as they each had the potential to lead projects and had assigned roles during projects. Communication skills were also highlighted in the surveys. According to respondents, 91% of students indicated that the MSFC had a direct impact on improving their ability to communicate with others through the continual presentation of ideas and projects, with 81% indicating an increased ability and confidence in presenting to peers, and 75% identifying the ability to now present to strangers and adults. Past studies show that MSFC alumni felt more confident in communication and decision-making and felt better equipped to manage time.

21st Century Skills: Intrapersonal Skills.

For intrapersonal skills, the MSFC facilitates the cultivation of self-efficacy, perseverance, self-management, and confidence (Lee, 2016; Pellegrino & Hilton, 2012; Reimers, 2020). In our surveys, 87% of students self-reported that the course promoted initiative and self-motivation. Elders and parents in local communities have shared how students initiate improvements in their communities as they help with electrical wiring, motor repairs, and promote organic agricultural practices. At the school level, students are motivated to engage in basic repairs, such as repairing cabinets, desks, or chairs that would otherwise remain damaged due to limited resources. In one of the MSFC modules, students learned tangible strategies for managing stress. As a result, 68% learned how to manage their stress. 92% of students indicated a new level of perseverance and persistence in school as they had to investigate, troubleshoot and problem solve various needs within their community through projects. Through hands-on experiences students reflected on creating multiple iterations of products and projects, and troubleshooting until they had an exceptional project or product. Additionally, the MSFC appears to be particularly impactful with regards to confidence as 94% of students self-reported that they gained confidence in a variety of areas, including working with others, sharing their opinions, and communication. The opportunity to continually work on these skills through the MSFC, coupled with support from teachers and community experts, enables students to get and respond to feedback and thus, build this confidence.

Assessment of 21st Century Skills

There is overwhelming evidence based on this self-reported information to suggest that the MSFC is equipping students with 21st century skills. However, little evidence is available for the ongoing assessment of such skills in the course. For example, while students give many oral presentations and sell the products to strangers, the communication competency is not explicitly assessed. Members of the Global Education Movement and PISA are striving to develop a multimethod approach to assessing 21st century skills and attitudes, recognizing the importance of their integration (Schleicher, 2018). The MSFC organizers should look to these organizations as well as local ones, like Dream a Dream India, who have already created an assessment instrument for teachers to strengthen their approach (Natraj & Jayaram, 2018).

2.7.3 *Dignity of Labor*

Considering the wide-ranging demographics of the MSFC participants and their exposure to a variety of vocational practices, it can be said that the course has supported dignity of labor for a diverse group of students and has altered the perception that vocational education is only for students with low academic achievement. By exposing students to a variety of careers, community experts, skills, and service projects, students develop an awareness of the value of trades. Past studies show that 97% of MSCF students are satisfied with the course and would recommend it to others. As a result of supporting the dignity of labor, 56% of MSFC students pursue further vocational education, in comparison to only 20% of non-MSFC students. Our FGDs revealed that alumni of the course believe the MSFC should be made accessible to more students. Students are excited by the diversity of the MSFC, with one student in the FDGs specifically reflecting that "anyone can do anything."

2.8 Further Insights

In addition to the positive realized outcomes of the MSFC's theory of change, our research reflects that the course has had a positive impact in other areas, including building teacher capacity, community connections, and gender inclusivity. Based on the best practices in education, we examine these unintended consequences and approaches.

2.8.1 Gender Inclusivity

While the MSFC theory of change does not directly target addressing gender inclusivity and stereotyping, interviews and resources reflected that this is an important proponent to stakeholders, particularly LAHI's co-founder, Sunanda. The MSFC moves beyond societal expectations, serving as a bridge between students of different genders by promoting cross-gender groupings and bringing in vocational experts as guest speakers who defy traditional expectations of gender roles (for example, a female plumber). Students learn to respect each other, work together, and overcome traditional gender stereotyping and roles, initiating a much-needed reduction in the gender-based disparity (Eswaran et al., 2013; Tandon, 2018). Typically, it has been reported that enrollment in most vocational programs is highly skewed in the direction of traditional gender stereotypes. For example, enrollment in textile courses is predominantly female, while enrollment in automotive-related courses is disproportionately male (Ratho, 2019). However, the MSFC is typically evenly split, with 54% of participants being female and 46% male, all engaging in various vocational skills.

Students and teachers have noticed that students' perceptions of gender roles and collaboration with different genders has also shifted. On this topic, during our FGDs, one student reflected, "I used to believe only boys could do engineering but now my perception has changed." In past interviews and surveys with parents, conducted by Sattva Consulting, 99% (n = 148) shared that they had perceived changes in their child pertaining to stereotyping and gendered roles, with 91% mentioning that their boys have been participating in domestic tasks on a regular basis since engaging with the MSFC (2019). Additionally, 90% of MSFC students felt they learned how to cooperate and collaborate with different genders. Despite these strides, however, instructors still notice that boys and girls sit separately and rarely choose to be in groups with the opposite gender unless it is imposed on them. Since this is a cultural shift that would take time, and since participants see the benefit of this by the end of the course, the MSFC should continue to monitor and strive to actualize this important aspect of their program.

2.8.2 Community Connection

Further analysis revealed that the MSFC motto of “learning by doing” is actualized through meaningful community connections. This feature of the MSFC is noteworthy as it enables the impact of the MSFC to transcend beyond student employability, retention, and dignity of labor. Through the realized dignity of labor, students are pursuing various initiatives to serve their communities. Students, families, and communities have benefited from the course at the household, school, and community level. 88% of students believed they applied the skills from the MSFC outside. MSFC students engage in their communities by using their skills in a variety of ways, such as to help parents cook, fix mixers, and repair *Diwali* lights.

At the school level, it is common for MSFC students to repair damaged chairs, tables, and benches. Some of the broader community projects carried out are (1) construction of *Vanrai Bandhara* (seasonal water harvesting/structure), (2) preparing *Rakhis* (products used in an Indian festival) and stalls in *Jatras* (local fairs), and (3) selling local sweets and savory snacks (Shiksha, 2020). The technical skills that students learn during the course are easily applied at home or work environments, and students have been able to find innovative solutions to local challenges and feel empowered to serve their communities.

Additionally, the MSFC brings in community guest lecturers from diverse backgrounds to share their experiences and knowledge on certain topics. This, too, strengthens the ties to the community, while also promoting gender inclusivity, dignity of labor, and retention efforts, allowing participants to see the value of diversity as well as a variety of career options. The MSFC’s desire to include opportunities for students to develop projects that respond to local communities’ needs, as well as the intention to include non-traditional guest speakers are noteworthy initiatives that impact the outcomes of the MSFC. Such real-world engagement and experiences are considered best practices in the realm of education, particularly when cultivating 21st Century Skills (Deans for Impact, 2015).

However, such experiences do not appear to be systemized across schools, and there is little accountability of this. For example, at inception, the MSFC relied heavily on guest speakers. However, since being an offered course in schools, it is the discretion of the instructor to invite and connect with guest speakers. Incorporating these aims into the instructor evaluation rubric, as well as supporting instructors in facilitating community engagement, will further actualize this important lever across schools. Not only will this benefit students as it is an important lever in promoting the program goals, but it will also reciprocally benefit the community by expanding real-world learning and connections (Deans for Impact, 2015).

Further, these community connections might be further strengthened through internships. This amplifies the “learning by doing” multi-skills approach of the MSFC, which is a powerful framework that enables students to cultivate a solid repertoire of 21st century skills and vocational skills. As the MSFC continues to adapt and grow, they are planning to include internships as a requirement of the course to strengthen the necessary experiential learning component of the course (Deans for Impact, 2015; OECD, 2011; Reimers, 2020). These sentiments were echoed by participants in our FDG, who believed that internships would be both practical and exciting. To ensure a successful internship program, the managers of the MSFC and government actors should plan a program that balances the vision of the MSFC and the needs of students and organizations by setting clear expectations and feedback loops.

2.8.3 Instructor Interventions

LAHI’s interventions to support instructor capacity are reflective of most of the World Bank’s Systems Approach for Better Education Results (SABER) Teacher's framework. The eight dimensions included in the SABER approach are: setting clear expectations for teachers, attracting the best into teaching, preparing teachers with useful training and experience, matching teachers’ skills with students’ needs, leading teachers with strong principals, monitoring teaching and learning, supporting teachers to improve instruction, and motivating teachers to perform (Liang et al., 2016; Reimers & Chung, 2018; World Bank, 2013). The dimensions supported in the current approach include setting clear expectations for teachers, preparing teachers with useful training and experience, monitoring teaching and learning, attracting the best into the workforce and supporting teachers to improve instruction. In addition to these, the program also provides strong leadership for its instructors, although this support comes from the Program Management Unit members, not principals.

As a result of the push to build teacher capacity as a mechanism for achieving the programs goals, students felt valued and supported by their instructors—a theme which was reflected strongly in the FDGs. It is this personal connection that students identify as having enabled them to thrive and learn 21st century skills at a deeper level (Deans for Impact, 2015). During our FGDs, students reported that they had a strong connection with their MSFC instructors as they took a genuine interest in them and helped them to pursue their abilities. The level of care reflected by the instructors is likely a reflection of a pedagogical intervention provided for instructors titled “Know your students” (Lend-A-Hand India, n.d.f).

While noteworthy initiatives to build instructor capacity have been reflected throughout documents and interviews, there are elements of the SABER framework that are not addressed. These include motivating teachers to perform and matching teachers with the needs of students. Since instructors are not full-time teachers and the availability of instructors is often limited, it is difficult to match teachers with the needs of students. To motivate teachers, we recommend that instructors be given incentives to take pedagogy and philosophy courses at teacher training institutes, which would help them to align themselves pedagogically with the vision of education in India (World Bank, 2013).

Additionally, certain features of the SABER framework already included in MSFC's approach to building teacher capacity can be expanded. Specifically, ongoing support and monitoring of teachers could be strengthened to ensure the MSFC's goals are being reached. In addition to the existing quarterly external evaluations, school leaders should conduct frequent formative reviews to hone instructor's teaching capacity and professionalism (Kools & Stoll, 2017; Liang et al., 2016; World Bank, 2013). Additional formative supports should be implemented to support instructors through either instructor support networks like the "Formative Support System" in Cambodia (Donaher & Wu, 2020) or in-school mentors. This will enable instructors to better understand the context of the schools they are working in, as well as collaborate with fellow MSFC instructors across schools (Kools & Stoll, 2017; Liang et al., 2016). In adding and refining these elements, the MSFC will build a model that aligns itself more intentionally with the SABER framework designed to empower teachers (World Bank, 2013).

2.9 Limitations of Research

Our results and analysis are promising; however, there are limitations in our approach. While the self-reported surveys and FDGs revealed that beneficiaries identify MSFC as a key player in cultivating important 21st century skills, there are other non-profit interventions in these schools which could be directly and indirectly supporting students in the acquisition of these skills. These interventions include the intentional exposure to, and betterment of, 21st century skills from Akanksha and Design for Change India (Natraj et al., 2016; Vengathattil, 2019).

Further, in our FDGs, it became apparent that various 21st century skills are being taught in other vocational tracks. For example, students in the Retail course—one of the other vocational tracks offered in the public school system and the skilling course most like the MSFC—students confidently referred to the negotiation and communication skills they were proud to have acquired. However, these skills were learned through lecture or role-playing, which is unlikely to provide the same opportunity to gain procedural knowledge of these skills that the "learning by doing" model of the MSFC offers. Further research should be conducted to ascertain the true impact of the MSFC. This work should include a longitudinal study with pre- and post-analysis of the MSFC, controlling for external non-profit interventions to gauge the true impact of the MSFC on 21st century skills, enjoyment of school, and improvement in attitudes. A similar analysis like the quasi-experimental design and methods employed by Reimers, Ortega and Dyer in their analysis of Injaz Al-Arab's Company Program should be adopted (2018).

Additionally, it is important to note that our data was collected during the COVID-19 pandemic, which may affect students' self-reported perceptions of skills learned—particularly non-cognitive skills, such as socioemotional learning or personal wellbeing. Upon reviewing the data, we noticed that while self-reported measures of the 21st century skills were consistent across previous impact reports, in our data collections, certain skills decreased in effect. Managing stress decreased from 81% in the Sattva Consulting report (2019) to 68% in our data. Similarly, creativity decreased from 87% in the Change Alliance (2019) analysis to 76% in our results. Reasons for this should be investigated: they could either be a result of the pandemic, or due to implementation barriers in the course itself. It is also important to mention that these are the skills that were amalgamated into the mandatory Module A course, which is consistent across all the vocational skills courses under the NSQF. Upon reviewing Module A's activities, it appears to be quite theoretical, detracting from the hands-on approach focused on by MSFC. Further investigation of the drop in these skills is required to understand the root cause.

Furthermore, future interviews should focus on understanding instructor capacity, as this is a relatively new piece of this reform. Current evidence is based on student reflections, program coordinators insights and teacher evaluations. Interviews with instructors will yield further insights into the efficacy of the teacher interventions designed to support 21st century skills and the implementation of the MSFC. Another area of focus for future interviews is to investigate if there was any potential impact of the MSFC on students' family and home life. Given that there is such clear engagement with the wider community, it is worthwhile to get an understanding of if, and how, the types of broader community connections that are developed are also present in the home. An additional FGD with parents and family members of enrolled students and alumni could foster more insight about other potential impacts of the program.

Lastly, due to the time constraints and the COVID-19 pandemic, we were unable to expand our research to collect quantitative data for non-MSFC and non-vocational students in general. Additionally, we were unable to have a completely random selection of students to interview qualitatively and quantitatively; we were limited to the selection given to us. This abbreviated selection yielded an analysis that was mostly described by those closest to reform. A comprehensive analysis that incorporates the voices and statistics of internal and external evaluations will better warrant a more holistic analysis of the outcomes against the theory of change.

2.10 Conclusion

The MSFC is reflective of the best practices in the field of education. It is unique due to its dual focus on the development of 21st century skills and vocational skills needed for students to participate as global citizens in today's fast-paced world. MSFC balances the head, heart, and hands of 21st century education, equipping students with the skills necessary to engage in real world projects in collaborative and inclusive settings. Their authentic hands-on, student-centered approach in cultivating 21st century skills and vocational skills improves student employability, as well as attitudes towards school generally; beyond work and academia, the course reportedly impacts gender role perceptions, and encourages community service and labor. Key design features of MSFC are reflective of how this course can serve as a model for the intersection of vocational education with 21st century skills.

- ***Connection***. MSFC students are at the heart of their learning because instructors have been encouraged to build relationships and connect them with their community, increasing their sense of belonging and ownership as global citizens (Aspen Institute, 2019).
- ***Hands on Learning.*** As evident through the MSFC, authentic learning of vocational skills and 21st century skills happen through hands-on opportunities, real-world applications, and community engagement (Deans for Impact, 2015).
- ***Breadth of Skills***. Programs like the MSFC that build on the breadth of vocational and 21st century skills, beyond merely job training, increase student employability and empower students to navigate the ever evolving and interconnected world.
- ***Instructor Capacity.*** Building instructor capacity is essential to ensure the success of MSFC. Pre-service training, ongoing assessment, professional development, and integrated support mechanisms are at the heart of MSFC (Villegas-Reimers, 2003; World Bank, 2013).
- ***Clear Expectations.*** The use of a rubric intended to frame expectations for vocational instructors during the pre-service training encourages a high level of professionalism, reinforces program values, and provides a holistic guide on how to serve the hearts and minds of students (Liang et al., 2016; The World Bank, 2013).
- ***Cultural Shifts***. Intentional pedagogical choices evident in the MSFC, such as group formation, as well as normalizing a breadth of skills, can facilitate cultural shifts, such as gender divides and roles (Reimers, 2020).

Indeed, while good evidence exists to suggest the MSFC has positive outcomes for students, further research on this course should be explored to provide insight to the mechanisms leveraged for niche reforms to move to scale across various states with integrity and to understand how to forge thriving and sustainable public–private partnerships.

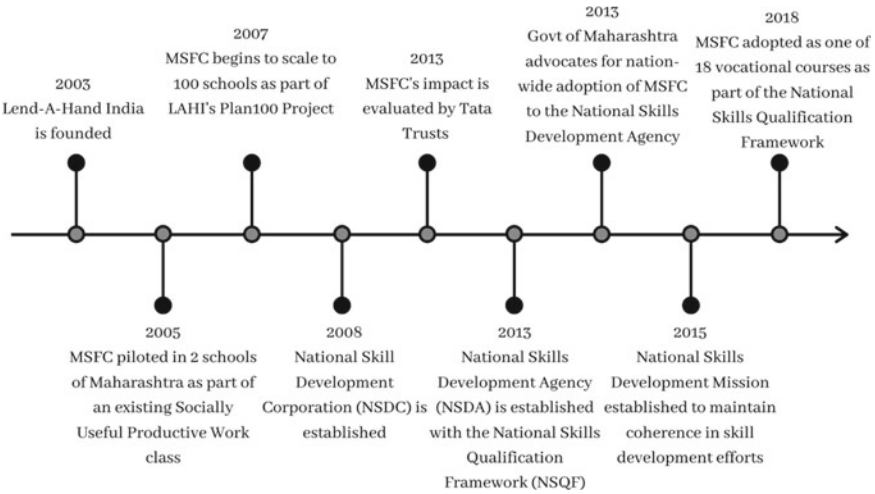
2003
Lend-A-Hand India is founded
2007
MSFC begins to scale to 100 schools as part of LAHI's Plan100 Project
2013
MSFC's impact is evaluated by Tata Trusts
2013
Govt of Maharashtra advocates for nation-wide adoption of MSFC to the National Skills Development Agency
2018
MSFC adopted as one of 18 vocational courses as part of the National Skills Qualification Framework
2005
MSFC piloted in 2 schools of Maharashtra as part of an existing Socially Useful Productive Work class
2008
National Skill Development Corporation (NSDC) is established
2013
National Skills Development Agency (NSDA) is established with the National Skills Qualification Framework (NSQF)
2015
National Skills Development Mission established to maintain coherence in skill development efforts

Fig. 2.1 A brief history of the MSFC

Acknowledgements We would like to acknowledge the time and flexibility of Raj Gilda, Sanket Patil, Nilesh Puradkar, Bhagyshree Kudale, and all the students who we interviewed throughout this process. We would also like to thank Fernando Reimers, Margaret Wang, Alysha Banerji and Uche Amaechi for their insight, guidance, and feedback on this chapter.

Appendix A

Interviewees

Name	Role
Raj Gilda, Sunanda Mane	Co-Founders; Lend-A-Hand India
Sanket Patil, Nilesh Puradkar	Senior Program Officers; Lend-A-Hand India
Bhagyshree Kudale	Project Coordinator: Pune NSQF Team, Lend-A-Hand India
Sahil, Suyash, Prashant, Atharv, Sonali, Sharvari	MSFC Students
Nuru, Ganesh, Apurva, Pranjal, Vijay, Priyanka	MSFC Alumni
Anita, Sangameshwar, Srushti, Numara, Komal, Ganesh	Non-MSFC Vocational Students
Nitika, Siddhi, Pushkar P, Pushkar M	Non-Vocational Students

Information on students was removed to protect their identities.

Appendix B Survey Instrument

Sent through Google Forms and available in two languages for students

Background Information.

Gender	Male		Female	
Living situation	Small city	Town	Metropolitan city	Village

I think the MSFC helped me

1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly disagree.

Learn to communicate with others	1	2	3	4	5
To think more creatively about problems	1	2	3	4	5
To present a topic to a group of classmates	1	2	3	4	5
To present a topic to a group of adults	1	2	3	4	5
Develop the ability to work with others as a team	1	2	3	4	5
Develop initiative and self-motivation	1	2	3	4	5
Develop my abilities as a leader	1	2	3	4	5
To learn to solve problems	1	2	3	4	5
To manage my stress	1	2	3	4	5
To manage my time	1	2	3	4	5
To become more confident	1	2	3	4	5

Because I took the MSFC in school:

1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly disagree.

I am more interested in my studies	1	2	3	4	5
I participate in class more	1	2	3	4	5
I am more regular in school	1	2	3	4	5
I don't feel like dropping out of school	1	2	3	4	5
I know about different career options I can take up	1	2	3	4	5
I know what I need to do to achieve my career goals	1	2	3	4	5

I think:

1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly disagree.

The course will help me in getting a job	1	2	3	4	5
This course helped me recognize there is a clear connection between what we are learning in school and the real world	1	2	3	4	5

Appendix C Focus Group Discussion Questions

MSFC

1. When did you take the MSFC?
2. Why did you choose MSFC?
3. What value did you think it would add to your life/career?
4. What were some things you thought you would learn from MSFC?
5. Why do you think some students did not choose MSFC in school?
6. What is unique about the MSFC in terms of how it is taught?
7. What has been your most impactful/memorable learning experience during MSFC?
8. Tell me about a project you did during the MSFC. What did you learn by doing the project? What opportunities did you have in class to build teamwork?
9. Apart from hard skills, is there something else you learnt about yourself?
10. How is your MSFC teacher different from other teachers?
11. How do you feel about working with the opposite gender? Has MSFC had anything to do with this?
12. How do you think the MSFC will affect your skills as an employee in the workforce?
13. Do you think the MSFC skills will help you in the future? How?
    a. Ask specifically about the 21st century skills reflected in the MSFC (Communication, teamwork, working with other genders, presenting to adults, confidence, etc.).
14. What skills and mindsets do you think are important to succeed in life?
15. Do you think MSFC gave you any of these skills and mindsets? How?
16. Do you think working with hands is better or working in an office at a desk is better? Why?
17. If you could make MSFC better, what would you change about it?
18. How has MSFC impacted you and your community?
19. What did you learn from working on projects in the course?

Non-MSFC Students

1. Why do you think some students chose vocational subjects in school?
2. What vocational skill are you in and when did you take it?
3. Why did you choose this program?
4. Why did you not choose the MSFC?
5. What have you learnt from this program?
6. How are things taught?
7. (a) What has been your most impactful/memorable learning experience during Retail? (b) Tell me about a project you have done as part of Retail?

8. What did you learn by doing the project?
9. Apart from hard skills, is there something else you learnt about yourself?
10. According to you, which skills are required for entrepreneurship?
11. Does your program provide any of these skills?
12. How do you feel about working with the opposite gender? Has your program had anything to do with this?
13. How do you think the vocational program will affect your skills as an employee in the workforce?
14. Do you think the vocational program will help you in the future? how?
15. What skills and mindsets do you think are important to succeed in life?
    a. Once they share, ask specifically about the 21st century skills reflected in the MSFC (communication, teamwork, working with opposite gender, presenting to adults, confidence etc.).

16. Do you think the vocational program gave you any of these skills and mindsets? How?
17. Do you think working with hands is better or working in an office at a desk is better? Why?
18. If you could make your program better, what would you change about it?
19. What opportunities did you have in class to build teamwork?

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Chapter 3
Education 2.0: A Vision for Educational Transformation in Egypt

Nariman Moustafa, Ebtehal Elghamrawy, Katherine King, and Yu (Claire) Hao

Abstract This chapter presents a comprehensive description and analysis of Egypt's Education 2.0 (EDU. 2.0) reform plan for grades K-2. The reform's five key components are described including the new multidisciplinary curriculum, technology integration, school management Continuous Professional Development (CPD), access and infrastructure, and reformed assessment. We analyze this reform from five perspectives and conclude that a cultural shift, high-quality CPD, and a robust accountability system are imperative to sustainable educational reform in Egypt. This cannot be achieved without a shared vision and engagement between teachers, parents, and Egypt's Education Ministry.

3.1 Introduction

In 2018, Egypt's Ministry of Education and Technical Education (MoETE) launched an ambitious series of reforms to align with the country's newly developed 2030 Strategic Vision for social and economic change, with a devoted 7th pillar for education and training. The educational reforms aspire to bring large-scale transformation to the country's education system, which has consistently faced persistent strains related to a rapidly increasing student population, deteriorating teaching quality, rigid curriculum, inequality, uncertain political will for change and lack of resources.

In collaboration with Education 2.0 Research and Documentation Project (RDP)

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Known as Education 2.0 (EDU 2.0), the reforms seek to modernize the country's education system and improve the quality of education for K-12 schooling. The reform's strategic objectives include increasing access to pre-primary education, improving the quality of the K-12 education system in line with international standards, and advancing Egypt's ranking internationally. EDU 2.0 is planned to be implemented in phases between 2018 and 2030. Constrained with limited resources and awaiting the gradual increase in fiscal budget pledged in the 2014 constitution (Nassar, 2019), the MoETE's strategy is to implement this reform gradually to fully transform the education system in grades K-12 by 2030 (Worldbank, 2018). Early grades are to be reformed one year at a time starting in 2018 from pre-primary grades (plan known as EDU 2.0). However, there are simultaneously some selective reforms in higher grades (plan known as EDU 1.0). The objective of EDU 2.0 strategy in its early years of implementation is to transform education in early grades to be "competency-based," focusing on the classroom experience of learners. In parallel, EDU 1.0 also offers some reform actions to students already in the system. By prioritizing and working on key challenges in higher grades such as secondary school assessment, the EDU 1.0 reforms indicate that all students currently within Egypt's education system will receive some extent of the reform proposal, though the focus will be pre-primary and primary grades in the initial phases until EDU 2.0 is fully rolled out to all K-12 (Saavedra, 2019; Worldbank, 2018).

That said, the scope of this paper is on EDU 2.0: in specific K-2. The reform agenda focuses on developing a competency-based, multi-disciplinary, technology-enabled curriculum, in line with the international movement towards fostering 21st-century skills acquisition. Technology integration, updated teaching pedagogy, and reformed assessments are among the critical reform components. Various stakeholders and international partnerships have contributed to the development and implementation of the EDU 2.0 reforms. The new educational vision aligns with Egypt's 2030 Vision 7th pillar and the constitutional mandate to recognize education reform as one of Egypt's top priorities.

This chapter will describe and analyze the reforms in Egyptian grades K-2, during their first phase of implementation from 2018 to 2020. The analysis will begin by describing Egypt's unique context, and the preceding reform iterations leading up to the EDU 2.0 reforms. Next, it will describe the primary components of EDU 2.0, to illustrate how this large-scale reform was conceptualized and developed for implementation. It then analyzes the reform using a comprehensive five perspective model on educational change developed by Reimers (2020a, 2020b). Finally, results and implications of the reform are discussed, especially against the larger context of assessing large-scale educational reforms in middle-income countries. As authors, we attempt to provide a critical analysis of the EDU 2.0 reforms from a policy perspective situated in a larger socio-political framework, drawing connections between the intended goals and the known implementation efforts. We argue that a cultural shift, high-quality Continuous Professional Development (CPD), and a robust accountability system are imperative to sustainable educational reform in Egypt, which cannot be achieved without a shared vision between teachers, parents, and MoETE. We contend that to create the desired outcomes, EDU 2.0 must be intentionally developed with MoETE collaboration, continuous communication, and engagement with stakeholders.

3.2 Research implications

Egypt being a sizable middle-income country with a complex education system, EDU 2.0 can provide valuable insight into the design and implementation of large-scale change. In practice and literature, attention and policy decisions on blended learning have been allocated to higher education than pre-primary and primary school stages (OECD/The World Bank, 2010). Hence, this work can notably contribute to the knowledge surrounding blended learning, public–private partnerships, and digital technology use at the primary level. Additionally, EDU 2.0 may provide insight into teacher development strategies for teaching a multidisciplinary curriculum—one which is inclusive of blending learning, as an approach that is relatively new, without much available relevant literature (UIS, 2020). It will also be essential to assess whether Egypt can improve access to early childhood education to its citizens. This is a larger issue, which also requires mitigating issues of inequality (World Bank, 2018). Currently, there are few instances worldwide of a full-fledged multidisciplinary curriculum at the national level. EDU 2.0, if successful, can be impactful in the latter area and may contribute insights to how such a change can take place within a country characterized by a diverse and complex education system, influenced by varied socioeconomic factors.

3.3 Methodology

To date, there is no single published EDU 2.0 reform strategy document. As a result, this analysis was built on a comprehensive literature review, and a partnership with the Education 2.0 Research and Documentation Project (RDP) led by Dr. Linda Herrera. The RDP is a collaboration project between the MoETE and the Social Research Center at the American University in Cairo, created to document the reforms and gather data during a time of vast educational change. Working closely with RDP's researchers, the collaboration provided access to unpublished reports and firsthand accounts from teachers, principals, and interview transcripts from relevant stakeholders such as Minister advisors, educational business representatives, and a senior UNICEF Education Officer. RDP provided the authors with a database of 51 published newspaper articles, 74 journal articles and book chapters, 15 statistical reports, 62 press conferences and interviews, and 30 official reports. These documents are a mixture of internal documents, published communications within Egypt, and international reports. The RDP is also working on creating an oral history archive containing qualitative data from various stakeholder interviews. We analyzed 10 interview transcripts previously collected by RDP in addition to conducting four firsthand interviews ourselves to complement RDP's archive and offer us a comprehensive insights from all stakeholders. The interviews were semi-structured and sought to elicit perspectives on the design of the reforms, implementation to date, and their application results in relation to achieving Egypt's broader strategic education goals. Our analysis integrated both primary and secondary data sources with Reimers' five perspective framework to assess the intended objectives of the reforms and their implications for vast educational change in Egypt.

3.4 Context for the reforms

With an officially announced renewed focus on economic and societal development, Egypt is envisioning a path forward almost a decade after the Arab Spring, the 2011 revolution and years of political power shifts (Mohamed, 2019). Since the Arab Spring of 2011, Egypt has made modest improvements in economic growth and social conditions (World Bank, 2020). However, persistent challenges remain. Poverty, inequality, and unemployment remain barriers to economic advancement, despite aid from international organizations such as USAID, the European Commission, and the International Monetary Fund, designed to support civil society organizations after the uprisings (Elagati, 2013). Unemployment rose to 9.6% in 2020, with job losses mainly in sectors related to retail and wholesale trade, manufacturing, tourism, transport, and construction (World Bank, 2020). These challenges are compounded by Egypt's rapidly increasing population, which has soared to 102 million in 2020 (Walsh, 2020). With the current trajectory, the population is on track to reach 128 million by 2030 (United Nations, 2020). With the annual population growth around 2%, current economic growth is insufficient to keep pace with this rate of population expansion in Egypt (Mohamed, 2019).

This rapid population growth has placed strains on Egypt's education system, which is the oldest and the largest in the Middle East and North Africa (MENA) region. Supporting over 21 million students in 50,000 schools, the system has undoubtedly been challenged by more significant funding requirements, capacity shortages, and overcrowded classrooms (USAID, 2020a). As a result, the student-to-teacher ratio has increased, teacher capacity has deteriorated, and many teachers cannot provide up to standard learning experiences. Egypt has seen low scores in assessments such as the Trends in International Mathematics and Science Study (TIMSS) and Progress in International Reading Literacy Study (PIRLS). Egypt ranked in the bottom 5% in PIRLS 2016 and ranked 130 out of 137 in the World Economic Forum's Global Competitiveness Report in 2017–2018 (Olson et al., 2008). These assessments highlight some of the major systemic issues the education system is facing: a lack of sufficient teacher training, strained resources, and insufficient quality assurance. Together, these factors have combined to perpetuate a system where students are not mastering foundational skills at the primary level (El Baradei, 2004). Consequently, under-resourced and overcrowded classrooms diminished the education system's ability to provide quality education at an increasing scale (World Bank Statistics, 2021a, 2021b).

Moreover, the standard national curriculum is outdated, and insufficient in delivering quality education. The Egyptian education system has traditionally prioritized rote learning and high-stakes final examinations over active learning and critical thinking (Alan & Varma, 2020). While the EDU 2.0 reforms attempt to revise some assessment strategies, high-stakes tests still largely determine students' progression throughout the education system and future employment prospects (Mohamed, 2019). The emphasis has been traditionally placed on receiving a credential that could assure a job in the public sector, without regard for students' skills to thrive in the twenty-first century (Saavedra, 2019). The necessity for a restructured education system is more crucial now than ever. With more than 700,000 Egyptians entering the job market every year, Egypt's education system struggles to provide relevant and updated curricula that relates to a modern and changing economy (OECD, 2015).

3.5 Previous Educational Reforms

Over the past three decades, several reform strategies, policy changes, and national programs[1] have attempted to improve Egypt's education system. Except for the Community School Programme, most of these reforms focused on improving access, changing pedagogies, and restructuring teachers' professional development training. There was very little focus on developing students' competencies, improving curriculum development, or creating an assessment of outcomes. Rather, most of these reforms worked in isolation, disregarding a comprehensive view of other critical educational elements or links to the country's larger political and socio-economic conditions. The policies lacked coherence within a comprehensive reform plan as part of the country's strategic objectives.

For example, the 2004 Professional Development focused on improving teachers' pedagogy, *without* reforming the curriculum or assessing the teacher or the student. Likewise, the 2007–2012 National Education Strategic Plan sought to adopt "a decentralized education system that enhances community participation, good governance, and effective management at the school level as well as at all administrative levels" (Hamdi, 2019). However, the various unrelated and conceptual objectives of the plan limited the Ministry's ability to build and sustain support for the reforms (OECD, 2015). This is still a persistent challenge in education reform in Egypt: there is a lack of coordination from top-down directives to establish and monitor implementation and evaluation or to find grassroots support that sustains the reform.

However, a key outcome of previous reform was an increased number of enrolled students within the education system. Primary grades net enrollment reached 96.9%, and gross enrollment reached 106.4% in 2019 (UIS, 2020.) Crucially, the reforms successfully expanded access to basic education and achieved improvements in the gender gap parity, which remained substantial until the early 2000s.

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[1] Among these are the Community School Programme (1991–2004) the New School Programme (2000, 2007), the Alexandria Pilot Project (2002–2004), the Education Reform Programme (2004–2009), and National Education Strategic Plan (2007–2012).

Although Egypt has seen several changes because of education reform in the last several years, access to pre-primary enrollment remains one of the lowest in the MENA region at 31% (UIS, 2020). The gap is primarily attributed to the fact that most accessible schools are concentrated in more affluent regions, and access remains limited to less socioeconomically advantaged communities (PWC, 2018). While Egypt has achieved near universal access to primary education, the quality of education remains a critical challenge. As Tarek Shawki, Minister of Education and Technical Education heading the EDU 2.0 reforms notes, "The classic education system of Egypt had expired" (Saavedra, 2019) The EDU 2.0 reforms hopes to focus on addressing these disparities.

3.6 EDU 2.0 Reform Description

EDU 2.0 was introduced by the Egyptian MoETE in August 2017. The reform's primary objectives focus on transitioning the education system away from rote memorization and surface-level learning, and towards an education system that promotes critical thinking, knowledge-based inquiry, and lifelong learning (Saavedra, 2019). The initiative is meant to restructure K-12 education in Egypt drastically, and aligns with Egypt's 2030 Vision for economic, environmental, and social development (Oxford Business Group, 2020). As such, the MoETE plans to have EDU 2.0 fully integrated into the education system by 2030, with the reforms being gradually implemented in phases beginning at the pre-primary level.

3.6.1 Key International Partnerships

The MoETE enlisted the support of several international organizations to finance and collaborate on the reforms. Notably, the World Bank's $500 million loan "Supporting Egypt Education Reform Project" is designed to align with EDU 2.0 and develop long-term educational engagement in Egypt (World Bank, 2018). The World Bank's project focuses on four primary objectives, which are each integrated with EDU 2.0 strategic goals: (a) increase access to pre-primary education and improve infrastructure, (b) improve the quality of learning by utilizing digital technologies, (c) establish frameworks for continuous professional development for teachers and school leaders, and (d) develop new computer-based assessment and examination systems (World Bank, 2018).

Organizations such as UNICEF and UNESCO were instrumental in collaborating with the MoETE to develop a multidisciplinary curriculum that promotes deeper, competency-based learning. International publishers such as Discovery Education and National Geographic have contributed educational materials that cover a range of distinct yet interrelated subjects to expand the existing Egyptian Knowledge Bank (EKB), a first of its kind open source online library of educational content available to all Egyptian citizens (World Bank, 2020).

3.6.2 Theory of Change

The MoETE structured the EDU 2.0's components to align with three overarching strategic education objectives: (a) education for all without discrimination, (b) improving the quality of education in line with international standards, (c) bolster Egypt's ranking locally, regionally, and internationally (Ministry of Planning and Economic Development, 2020). Thus, the MoETE's theory of change suggests that if these strategic objectives are met, then Egypt's education system will transform into a culture of learning, accessible to all, and found in the development of competency-based skills. In turn, these reforms are meant to advance Egypt's competitiveness in educational rankings locally, regionally, and nationally. They will contribute to economic and social development in the country, as envisioned with the country's larger national strategy, Egypt's 2030 Vision (Ministry of Planning and Economic Development, 2020).

To achieve such ambitious plans, the reform appears to be centered in five key components: a new multidisciplinary curriculum, technology integration, teachers, and school management. These components are also alongside Continuous Professional Development (CPD), access and infrastructure, and reformed assessment. The development and key elements of each component is discussed below.

3.6.2.1 Multidisciplinary Curriculum

As part of the first implementation phases of EDU 2.0, a new K-2 curriculum was developed under the Ministry's Center of Curriculum and Instructional Materials Development (CCIMD) leadership. This was done in partnership with multilateral organizations including UNICEF and UNESCO, and private trans-national corporations like Discovery Education (DE). Nahdet Misr, a national privately owned business, was also in consultation (UNICEF, 2018). As a result of these collaborations, the General Framework for the General and Technical Education Curricula (GFGTEC) was designed for the primary grades. This framework complemented the competency-based and multidisciplinary curriculum, which the MoETE later produced for primary and pre-primary grades.

The GFGTEC is a 21st-century skills framework based on the UNICEF-MENA Life Skills and Citizenship Education (LSCE) framework. The LSCE is grounded in the principles of UNICEF framework (UNICEF MENA, 2017). It contains (a) a new curriculum design including standards, activities, and outcomes for each grade level, (b) new physical and digital textbooks, (c) teacher guides, (d) open digital learning content for each chapter for each grade and subject, and (e) a learning management system on the Egyptian Knowledge Bank and an offline app (Discovery Education, 2019a).

The framework and the curriculum center learning around fourteen skills, which should be acquired by each child in their pre-tertiary education. This includes twelve skills from UNICEF LSCE's framework, and two skills (accountability and productivity) proposed by MoETE to fit the Egyptian context (El-Zayat, 2020).

3.6.2.2 Technology Integration

To contend with issues related to deteriorating learning quality, and to modernize the education system, the MoETE had already begun to make the shift towards blended learning strategies and their integration into the national curriculum by the time the EDU 2.0 reforms were introduced. The Egyptian Knowledge Bank was launched in 2016 and continues to be utilized widely in primary level education (Saavedra, 2019). Now available to 23 million teachers and students, the platform is meant to be easily accessible by laptops and mobile phones anywhere in the country and free of charge (Discovery Education, 2020).

The EKB contains encyclopedias in both English and Arabic, online dictionaries, interactive lessons, and a range of books and scientific articles for all ages and preparatory levels. It also contains three hours of originally produced online video programs broadcast daily on WebEdTV, which are customized to the Egyptian national curriculum (Discovery Education, 2020). Teachers can access teaching materials on the EKB that align with the EDU 2.0 curriculum and are able to integrate lessons from the platform into their teaching plans. There are also tools available within the EKB to help monitor student progress and collect data on student activity (Discovery Education, 2020).

In addition to the EKB, the technology integration within EDU 2.0 also sought to digitize the assessment methodology and expand assessment strategies. New computerized assessments were introduced, with the goal of increasing students' competencies in twenty-first century skills while shifting away from rote test memorization.

3.6.2.3 Teacher and School Management Continuous Professional Development

From a strategic planning and policy perspective, the MoETE seems to recognize the need for CPD programs to build and enhance teachers' ability to deliver the reforms' desired objectives (World Bank, 2018). This is evident where teacher and school management professional development has been identified as key to several initiatives within the EDU 2.0 reforms, especially through redesigning a comprehensive CPD framework (World Bank, 2018). Such a framework ought to include foundational teacher training, induction training, and curriculum-based training. Additional assessment of hiring policies, promotion, teacher evaluation, and licensure policies is also needed (World Bank, 2018). Some of these initiatives have been implemented, while others are still under development.

3.6.2.4 Teachers First

The “Teachers First” initiative was co-developed and co-implemented with the private international education organization Imagine Education. The training framework was developed specifically for Egypt and is based on the UNESCO Competency Framework for Teachers (Imagine Education, 2020). It focused on changing attitudes and behaviors. Its four primary pillars included CPD, communities of practice, mentoring, and the use of an online platform for a three-way assessment strategy (self, peer, mentor). These pillars were implemented through training topics such as classroom management, introduction to 21st-century skills, introduction to digital skills, resourceful/innovative teaching pedagogies, and life-long learning skills (Teachers First, 2020). It was implemented in a cascade format, which proceeds as follows.

First, the school principal recommended three teachers to attend a series of workshops outside of the school. Upon return, they were expected to create a PD unit at their school, in which other teachers were trained on best practices in educational pedagogy. At the same time, the teachers participated in an online community of practice on an online app called “Lengo,” which collected awarded credits for self-reported improved professional behavior. They could also receive credits from a mentor or colleague. (Teachers First, 2020).

Teachers First was launched in July 2016, before the official EDU 2.0 reform plan announcement; however, it was discontinued in 2019. The official statement was that “the program did achieve its objective in building the foundation of Egypt’s teachers, and now Teachers First goes from impact to sustainability across Egypt” (Teachers First, 2020).

3.6.2.5 Discovery Education

The education company Discovery Education implemented a curriculum training in 2018, designed to help teachers align with teaching an updated and competency-based curriculum. A series of workshops and trainings was complemented by a detailed teacher guide for the new curriculum, online training and resources, and online Community of Practice (CoP) on a new digital teacher platform, called Professional Learning Journey PLJ (Discovery Education, 2018a, 2018d, 2018e).

The Discovery Education model was also implemented in the form of a cascade training, whereby the MoETE worked in collaboration with Discovery Education to organize a Training of Trainers (TOT) for early-grade teachers and supervisors to be master trainers; these trainers then went on to train the remaining early-grade teachers in all 27 governorates. Delivered in a mandatory three days of training per semester, most early grade teachers and primary school principals took the training (Discovery

Education, 2019a). It was co-developed by CCIMD and Discovery Education and supported by the MoETE budget and USAID as an early grade learning project of $15 million (USAID, 2020c). The implementation had three components: (a) supervisors complete training three days a term, (b) regular school visits and follow up from the MoETE trainer supervisors and Discovery Education team (with data collected digitally during visits), and (c) an online PD and CoP using PLJ teacher framework to enable continuous professional development (Discovery Education, 2018a). The implementation is still ongoing.

3.6.2.6 Access and Infrastructure

The access and infrastructure component of the reform is divided between pre-education and primary education. Thus, the World Bank has dedicated $100 million towards increasing access to pre-primary education, while simultaneously improving the quality of education. The project supports the identification of available spaces in existing schools or community buildings, equipping pre-primary classrooms with furnishings and educational resources, and building and equipping entirely new classrooms (World Bank, 2018). There is a specific focus on reaching underserved communities that have traditionally struggled to gain access to early childhood education.

At the primary level, the access and infrastructure objectives are focused on contending with overcrowding and a lack of resources in Egypt's public schools. The objectives center around repairing existing buildings, while creating plans to scale up the resources available. New education tools are proposed to assist with this endeavor, especially digital technology—which is promoted as a method of modernizing the curriculum, while also leveraging students' ability to complete some tasks at home.

3.6.2.7 Reformed Assessment

With the shift away from rote memorization and high stakes examinations, the EDU 2.0 reforms have highlighted the need for an assessment and examination system which is "[F]air, valid, and reliable" (World Bank, 2018). A new assessment plan accompanies the new curriculum, which favors comprehensive assessments based on a multidisciplinary approach to learning.

Prior to grade 4, examinations have been eliminated entirely and replaced by formative assessments. A student annual report developed by the teacher assesses each child's progress (verbal, written, assigned competencies) on a matrix of four levels, ranging from "above expectation" to "less than expected." This strategy attempts to cultivate internal motivation for learning in the formative years, rather than extrinsic pressure to perform well on exams (MoETE, 2015).

3.7 Known Results

The first phase of the K-2 reforms was planned and launched in a tight timeline from 2017 to 2018, and consequently, several key documents and data sources are missing—each of which would be useful to provide insight into the reform's development and implementation. From our literature review and interviews with key stakeholders, it seems that documents outlining the objectives and implementation strategy for the reforms are neither created, collected, consolidated, nor published yet. A comprehensive strategy plan, work-plan, monitoring and evaluation plan, and communication plan are all missing/unpublished at this stage. Furthermore, baseline assessments on main indicators, progress reports, and quality input measurements are not available, but necessary to measure known results and predict future outcomes. Lastly, evidence of the perception of the reforms, engagement in the implementation, and application of key features are missing among students, teachers, and parents alike. Having these accounts will be useful to continuous quality improvement in the implementation phase. Moreover, these "bottom up" perspectives could be useful in securing buy-in for community engagement and garnering support for education reform.

The sections below are a summative report on key indicators and reported results, covering the period between 2018–2019 and 2019–2020 results are not all published or collected at this time.

3.7.1 Multidisciplinary Curriculum

In collaboration with CCIMD, UNICEF, and Discovery Education, the MoETE was successful in completing several key objectives. These include defining new learning objectives for pre-primary through grade 2, developing new learning content using the UNICEF LSCE framework, creating new textbooks and teacher guides using the EDU 2.0 and LSCE framework, and implementing the new curriculum in schools for pre-primary education through grade 2. Discovery Education continues to work closely with the CCIMD to build capacity, review the curriculum framework, and develop the printed and digital content for students and teachers.

3.7.2 Technology Integration

Technology integration is integral to the EDU 2.0 reforms, and digital infrastructure has been developed to support this scheme. There are over 2,400 digital content resources for pre-primary through grade 2, and 9,349 digitally equipped schools. Students continue to have access to digital learning platforms such as the EKB, Edmodo, and Discovery Education (Egyptian Ministry of Education Information

Center, 2019). This is part of wider digital learning expansion, whereby the MoETE established 9,249 computer labs within Egypt's public schools, and approximately 27,500 classrooms were equipped with digital hardware. Considering the size of Egypt's education system, however, this only represents 16% of the total nation's schools (Oxford Business Group, 2017). Besides, technology alone did not solve the challenges of educational access and quality in classrooms. The uptake of digital technology does not automatically lead to improvement in access or educational outcome, due to challenges such as digital literacy among teachers and students. Despite the significant undertaking of building digital infrastructure, there is widespread need throughout the country to increase internet connectivity, and to deploy a universal learning management system that could support online learning (World Bank, 2018). During the pandemic, school closures led to enforced digital access. Yet, the gap remains for future research to continue collecting data to understand whether and how technology is achieving the goals of EDU 2.0.

3.7.3 Teacher and School Management Continuous Professional Development

The reforms have made significant strides in improving CPD initiatives, all supported by USAID, the World Bank, and Discovery Education. A national teacher training framework was achieved for pre-primary-grade 2, and new teachers now receive content training in CPD initiatives for the new curriculum. 96,000 teachers have been trained using a cascade model, where 5,000 teachers receive a master teacher certification and go on to train others in their cities. 1,500 supervisors oversee this process, and report on it using PLJ (Egyptian Ministry of Education Information Center, 2019; Discovery Education, 2019a).

3.7.4 Access and Infrastructure

3,331 new schools were constructed, and 1,955 classrooms were refurbished. Particular attention was paid to pre-primary schools and classrooms, and to expanding access to pre-primary education in communities that had limited access. The World Bank is a key collaborator in expanding access and infrastructure and plans for mapping new school and classroom spaces are ongoing (World Bank, 2018).

3.7.5 Reformed Assessment

Summative assessments for pre-primary through grade three were eliminated and replaced with formative assessments aimed to target more competency-based learning (Egyptian Ministry of Education Information Center, 2019). As curriculum training develops, there is continued work to address the alignment between teacher training and new assessment strategies that support a competency-based curriculum rather than high stakes examinations. A missing area is also addressing parents perceptions and mindsets around assessments after decades of being accustomed to the need for high-stakes examinations and grades as their only proof for their children's education.

3.7.6 Future Directions

It appears that MoETE has been successful in achieving some of the desired outputs, but it is unclear, however, how these resources are equitably distributed between various groups. Furthermore, more information is needed to assess how these outputs are translated into outcomes or further yet connected to the impact articulated in the announced Theory of Change. Many of the available indicators do not measure implementation quality, which is important to establish in assessing the ongoing implementation of the reforms.

3.8 Analysis

Reimers' (2020a, 2020b) five perspective framework allows us to analyze how this national-level reform was designed and implemented to achieve the stated goals—largely, improving educational access and quality. The framework includes cultural, psychological, professional, political, and institutional lenses, which operate together to provide a comprehensive understanding of the complexity and interconnectedness of the reform components within its larger socio-political context.

3.8.1 Cultural Perspective

The cultural perspective of the reforms highlights the relationship between the education system and the larger societal context. It reveals the impact of education and its goals on societal expectations, as both the society and the education system change over time (Reimers, 2020a, 2020b). The EDU 2.0 reforms mark a drastic shift in the culture of Egyptian education, in which the traditional methods of rote memorization and high stakes examinations are exchanged for a multidisciplinary approach to teaching and learning 21st-century skills via technology integration. Making significant changes within a complex education system such as Egypt's is challenging and is limited by the traditional top-down approach that the MoETE has traditionally relied upon. The Minister acknowledged that the biggest needed change, however, is one in citizens' mindsets—stating, "The root problem is cultural, in one aspect" (Saavedra, 2019).

For large-scale change to be sustainable, the MoETE recognizes the need to engage the participants in the education system and to maintain communication as the reforms develop (El-Zayat, 2020). There have been efforts by the MoETE to communicate directly with parents via social media and online messaging platforms, but a comprehensive communication plan outlining the shift in pedagogy and its impacts on students and their families has not yet been developed (El-Zayat, 2020). Thus, for a successful cultural shift surrounding the goals and value of education to take place, it is imperative to open channels of communication and clearly define the objectives of the reforms, such that all citizens can buy-in and play a role in implementing and sustaining change.

3.8.1.1 Curricular Considerations

A cultural analysis of EDU 2.0 also lends itself to an examination of the newly introduced curriculum's larger impact. While the new curriculum is mapped to international frameworks and standards, further research is needed to assess whether they are integrating Egypt's local and diverse epistemologies. To be clear, this focus is not about incorporating diversity lessons in the curriculum or their outcomes. Rather, it is about integrating a local epistemology and ontology; of what is worth knowing, how it should be known, and what is to be true. This stands in contrast to an entirely Western-centric lens, upon which international organizations and corporations (EDU 2.0 new curriculum partners) entirely rely to customarily develop educational content. From our research, it does not appear that the partnerships—be they consultative or as part of the design process—took this point into account, which we recognize as a gap towards achieving a stated vision. Egypt's specific context is an important point to consider in educational reform. The interplay between what the society values and how the education system responds to these values helps define how education will be up-taken by and understood in the society (Reimers, 2020a, 2020b).

3.8.2 Political Perspective

The connection between the education system and the larger society with its different interest groups and the power each holds is a salient consideration in the political perspective of analysis. This perspective recognizes that there are variations in the interests of particular groups involved in educational reform, and the dynamics of these groups may affect how education is politicized both locally and nationally (Reimers, 2020a, 2020b). Integrated into Egypt's national economic and social development strategy and the 2014 constitution, education was identified as one of the country's top priorities for the next decade (Nassar, 2019). As Article 19 of the Egyptian Constitution (2014) states, "The state commits to uphold its aims in education curricula and methods, and to provide education in accordance with global quality criteria" (Nassar, 2019). Article 19 also requires that government spending on the education sector be "[E]qual at least 4% of GDP" (Oxford Business Group, 2020). While this expenditure fell short of that target in recent years, it has gradually risen while not yet reaching the 4% (Oxford Business Group, 2020). Through official documents, education is designated as a top priority in Egypt and is currently supported by the Country President. However, different sources vary in their analysis of whether there is a serious political will behind a massive education transformation like this. Some sources see the support is evident through the funding and the space to create such a change, and others see it unclear given the alarmingly rising inequity in the country (Hamed, 2019). Additionally, there are competing interests for budget allocations, both within the education sector and external to it (Nassar, 2019). Consequently, there are questions as to whether the government has the means to finance such ambitious reform plans (Nassar, 2019).

3.8.2.1 Social Engagement

The EDU 2.0 reforms require the alignment of key stakeholders and the development of shared goals within a complex education system. Considering the various ideas, understandings, and goals of these actors is essential in developing a reform strategy. The interests of parents, for example, may be vastly different than those of teachers, or of large bureaucracies. The misalignment of interests can have negative consequences on the success of the reform strategy. For example, Egyptian teachers have consistently advocated for increased salaries to contend with the challenges presented by an already strained education system and have not yet received compensation in line with international recommendations (World Bank, 2018). If the call for increased salaries is consistently ignored, the government risks losing its current teachers, and may be unable to recruit new teachers in the future—which will affect the reform's ability to be sustainable over time.

A key advantage of educational change is the social transformation that often comes with it, and the opportunity to reduce equity gaps while advancing societal involvement. In many ways, education policy reflects the social contract between a government and its citizenry. This is particularly important for a country like Egypt, which has seen a significant decline in its social justice and human rights indices—while growth in its economic sector mostly benefits the larger-income populace (World Bank Education Statistics, 2021a, b). In a country with alarming inequities like Egypt, social justice and reducing equity gaps need to be a central commitment for reform (Zaki Ewiss et al., 2019).

3.8.3 Psychological Perspective

An analysis of EDU 2.0 through the psychological perspective highlights how theories of learning relate to teaching pedagogy. It can provide insights on what students should be learning, and the best practices for how they should be learning it (Reimers, 2020a, 2020b). Evidence-based learning theory is particularly salient for the EDU 2.0 reforms, which entail the re-evaluation of assessments, educational content, and teacher training programs. Egypt's CCIMD collaborated closely with several key organizations to develop learning content and professional development initiatives that are aligned with international frameworks and best practices in education.

Currently, UNICEF's Life Skills and Citizenship Education (LSCE) framework, the DeSeCo 4-pillar learning dimension and skill outcomes, and UNESCO's teacher training framework are all mapped and benchmarked to international standards which are mostly inspired by the International Baccalaureate (IB) system (El-Zayat, 2020). As a result, the curriculum has a well-defined framework that states its standards, goals, detailed units and themes, projects, and outcomes. The curriculum is also aligned with the Global Education Movement's goals and identified best practices, with a focus on citizenship and sustainable development education (UNICEF, 2018). This alignment with international education standards resulted in the formation of a new curriculum that follows the widely known Western-centric psychology-based education science perspective on how people learn (El-Zayat, 2020). On a policy level, the clearly defined objectives and integration of CPD have allowed the CCIMD to develop learning goals for each grade, and teacher training initiatives that target teachers' ability to deliver the curriculum's objectives.

An overarching objective for curriculum reform with EDU 2.0 was to develop cohesive frameworks to improve the development of 21st-century skills. At each stage of primary education, students should be able to demonstrate skills that improve cognitive, socio-emotional, and behavioral understanding and ability (World Bank, 2018). Notably, Egypt's adoption of the UNICEF's LSCE framework was essential in developing an underlying framework for curriculum and instruction. Egypt was the first Arab country to use UNICEF's framework and operationalize it at the national scale, rather than as a separate curriculum unit or extracurricular activity (El-Zayat, 2020). Perhaps as a result, UNICEF's framework is now used in 14 other Arab countries.

3.8.3.1 Continuous Professional Development in the Psychological Perspective

In addition to defining the competencies that students should be learning, the psychological perspective also encompasses how teachers can be supported in helping students develop these competencies (Reimers, 2020a, 2020b). The implementation of the new EDU 2.0 curriculum under a tight timeline and through a top-down approach is challenging, particularly for teachers who are managing new concepts and pedagogies which require behavioral change.

The standard three days of professional training per term is not sufficient for teachers to be supported in teaching effectively. Rather, additional CPD and on-ground coaching is required for teachers to truly practice teaching the competencies they are trying to develop in their students. As the goal of education in Egypt shifts towards capacity building, teachers will have to help students understand that they "[D]o not need to memorize and achieve certain grades" for high academic achievement (Egypt Today, 2018). Instead, teachers will have to develop teaching strategies that support the competency-based approach that the new curriculum defines (UNICEF, 2018). In terms of competency-based assessments, consideration of how to assess students understand new ideas, solve problems, and retain information will be essential to align the objectives of the curriculum with effective teaching strategies, as well as in conveying to students that academic achievement will be more broadly defined and assessed. As the new curriculum is developed, the psychological perspective will require that the "[O]perational definitions and measurements of the desired competencies" continue to be monitored and assessed (Reimers, 2020a, 2020b, p.12).

3.8.4 Institutional Perspective

The EDU 2.0 reforms were developed with the support of both international and local partners. These partnerships were necessary to establish a unified Egyptian-centered vision of educational reform, with a comprehensive view of the infrastructure needed to support it. The institutional perspective highlights how these partners collaborated and aligned with one another to create a system of support, which made implementation of the EDU 2.0 reforms possible (Reimers, 2020a, 2020b).

To build institutional support, the MoETE obtained financial resources for projects related to the EDU 2.0 reforms, such as a $500 million loan from the World Bank. It also expanded its digital technology infrastructure by aligning the EKB with the new curriculum and created a new partnership with a private internet company to offer subsidized internet access to students. Furthermore, through its partnership with USAID's Teach for Tomorrow Project, the MOETE aims to develop the Teacher CPD system into a teacher career ladder, with professional licensing and incentivization mechanisms between 2020 and 2024 (USAID, 2020b).

In terms of building the capacity of its bureaucratic bodies, the MoETE worked closely with the CCIMD, its national curriculum development body, through training and discussions with partners like Discovery Education and UNICEF (El-Zayat, 2020). Additionally, the World Bank project proposal includes a restructuring of the National Center for Examinations and Educational Evaluations (NCEEE), with the goal of enhancing its capacity as an assessment center, especially in terms of administering computer-based assessments. (World Bank, 2018).

3.8.4.1 Monitoring and Evaluation

The highly centralized nature of the Egyptian governance system, and its ability to accurately monitor impact and outcomes, remains challenging. Data collection and monitoring for such wide-scale change across so many levels of stakeholders presents issues the MoETE has not yet fully contended with. For example, schools received no communication regarding the roll-out of new textbooks in September 2018 until August 2018 (Sharouda, 2020). Presently, there is no work plan in place to define the reform's objectives or to delineate the specific tasks for all partners (Sharouda, 2020). Teachers, supervisors, and parents constantly struggle to find the information they need, often resorting to Facebook and WhatsApp groups to communicate and inform one another (Sharouda, 2020). EDU 2.0 is an ambitious reform, requiring significant capacity building and guidance on implementation. As such, the stakeholders involved require clear objectives and communication to prioritize tasks and develop a coherent alignment of the reform's goals and implementation strategy.

Another issue is a lack of a clear incentive structure, as well as a lack of accountability mechanisms for school staff to create change. This is particularly salient considering the Ministry's announced inability to increase budgets for teacher salaries, as well as its lack of capacity for recruiting teachers as permanent employees (Hamdi, 2019). The system is also currently missing a comprehensive assessment process, to deliver feedback on the performance of schools as learning organizations. Building on what exists at the school level, involving parents and teachers in genuine communal participation, and considering more autonomous school governance models are all options that can be considered as the reform moves forward (OECD, 2011; Sharouda, 2020).

3.8.5 Professional Perspective

From a professional perspective, the reforms can be analyzed according to their ability to be guided by impactful instruction and expert knowledge (Reimers, 2020a, 2020b). This perspective highlights the ability of teachers to operate successfully, and CPD generally. In the Egyptian context, it is essential to analyze not only teachers' "[P]rofessional mindsets and skills," but also the "necessary autonomy and voice" for the new and unexpected challenges of the reform (Reimers, 2020a, 2020b, p.16).

Reviewing the Teachers First program, it seems inclusive of key CPD components. It is favorable to work on teachers' behavior and mindsets ahead of launching a new curriculum. Yet, the program was discontinued on the premise that it was successful and could thus be moved into a sustainability stage (Teachers First, 2020). Arguably, this perspective is unjustified, especially since behavioral change usually takes time, intention, and multiple steps (Harvard Medical School, 2012).

According to Marey et al. (2020), for example, supervisors had previously conducted school visits and evaluated teachers' performance based on a designated rubric that measured learning outcomes. Now, using the Discovery Education teachers' framework, supervisors assess teachers on the "GROW" model, which encompasses effective listening, positive feedback, and assisting teachers' professional development for mentoring other teachers. The supervisor role is designed to move into a mentorship and support role. Arguably, it is risky to bet complex objectives on six days of training a year, delivered in a cascade model: this raises questions on priorities, efficiency, and strategy.

These challenges are not presented to discount tangible achievements the reforms have made so far. The adoption of a new curriculum, the creation of new educational content, and the development of high-quality teacher training materials is no easy feat, especially considering the timeframe in which they were delivered. Challenges remain in the implementation of the reform goals. According to the 6,000 school visit reports produced by Discovery Education, there are five common challenges identified in schools—these include teachers' guide utilization, teaching instructions, community engagement, and training gaps.

3.8.5.1 Teacher Engagement

These remaining challenges, among others, hinder the system's ability to achieve the identified reform goals and objectives. For example, even though teachers' guides and the PLJ platform offer effective information and teaching strategies, some teachers lack understanding of the development vision, have the wrong conceptual understanding, or persistently prioritize only knowledge-based objectives (Discovery Education, 2018b). At the administrative level, the implementation is constrained by a deficiency in the total number of teachers (especially at pre-primary levels), and the difficulty of dividing the class into groups due to students' density (Discovery Education, 2018b). It is positive that MoETE and its CPD partners delve into addressing these challenges. In this respect, the reform highlights the complexity of teachers' behavioral change as a mechanism of implementing new reform.

Contending with a top-down approach, it is critical to understand teachers' voices throughout the reform at the classroom level. To develop a culture of excellence among teachers and provide motivation for teachers to follow EDU 2.0 PD objectives framework, it is essential to consider teachers' contributions to the educational system, and to identify ways in which their feedback can be elicited and integrated into sustainable change (Hamdi, 2019). Additional research is needed in understanding the impact of Egyptian teachers' agency during the reform implementation in the current central structure.

3.9 Reform Status in the Time of COVID-19

COVID-19 accelerated the progress of the MoETE Education 2.0 reform plan, especially regarding utilizing digital infrastructure and technology integration. When the MoETE ordered schools to close on 15th of March 2020, there was existing infrastructure to enable a transition to online learning (El-Zayat, 2020). The Egyptian Knowledge Bank (EKB) already contained a robust database of educational material that the Ministry could utilize to develop a focused strategy for teaching and learning in the wake of the pandemic. This was extended to all grades starting from pre-primary grades, where digital content was matched per unit for each subject (El-Zayat, 2020). Moreover, the MoETE partnered with other technology companies such as Edmodo to deliver interactive sessions between teachers and students, where more than 85% of teachers were registered by May 2020 (El-Zayat, 2020). This would have been considered an unimaginable figure pre-pandemic and indicates that stakeholder engagement significantly increased because of necessity. That said, it is essential to highlight that there was apparent institutional unpreparedness with the rapid implementation in March 2020. The implementation did not have proper institutional support, as again, it was managed and run top-down. Teachers weren't equipped to teach or interact online, students and families were unfamiliar with online learning, and there is a national shortage of access to proper digital infrastructure (El-Zayat, 2020). This illuminates that critical next steps must yet be taken to fill the gaps that remain in implementing policy to match conceptual plans with adequate grassroots support. In this sense, the pandemic will ultimately become a valuable case study for the MoETE as it moves forward with refining and implementing its EDU 2.0 strategy on a larger scale.

3.10 Conclusion

Through a description of the EDU 2.0 reform and a critical analysis of what is known about it and its results so far, this chapter draws parallels between the objectives of educational reform and the factors which impact its implementation. Egypt's unique context is considered to highlight the specific conditions which have given rise to the reform, and which may in turn be influenced by it. Information garnered from international reports, an oral history archive, and national media sources allowed us to discuss the reform process through multiple lenses and perspectives, and to draw connections between the various stakeholders involved. Our analysis conveys that the reforms have a bearing on many aspects of Egyptian life at both micro and macro levels, as schools contend with new teaching and learning strategies, and while the MoETE attempts to fundamentally shift how education is conceptualized throughout the country.

While the vision to integrate technology within a multidisciplinary curriculum in Egypt is ambitious, COVID-19 has demonstrated that it may be possible with more infrastructure, attention to equity and access disparities and the need for grassroots support or buy-in. Moving forward, successful implementation of the reforms will depend on the system's ability to create sustainable change. Monitoring and evaluation systems are needed, as is a cultural shift to engage the community and build support, particularly among teachers and parents. As EDU 2.0 continues to be implemented over the next decade, the reforms will undoubtedly be influential in defining educational priorities and shaping the future of Egypt's education system for generations to come. On the international level, Egypt's reform implementation is poised to contribute to education reform literature in low-middle income countries. With its specific focus on kindergarten and primary students, Education 2.0 also can advance the knowledge base in areas related to curriculum reform impact and technology integration, especially in terms of teaching and learning for early grade levels.

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Chapter 4
On the Path Toward Lifelong Learning: An Early Analysis of Taiwan's 12-Year Basic Education Reform

Blansefloer Coudenys, Gina Strohbach, Tammy Tang, and Rachel Udabe

Abstract Over the past two decades, Taiwan has sought to adopt a holistic approach to education. Reform has been directed towards guiding students to realize their individual potential and to contribute to increasing national competitiveness. In recent years, the extension of basic education from nine to twelve years serves to advance an increasingly equitable, high-performing education system, one which encourages students' lifelong learning and their contributions to a dynamic and diverse society. This chapter assesses the preliminary implementation of Taiwan's 12-Year Basic Education reform, which consists of the 2014 Senior High School Education Act, and the 12-Year Curriculum Guidelines implemented in 2019. We analyze government data sourced through the Ministry of Education and the National Statistics Bureau; interviews with teachers, school administrators, professors, and national education researchers; and an online survey disseminated among teachers around the country. Taiwan's 12-Year Basic Education reform works to reimagine society's definition of educational success and broaden opportunities for all students—by expanding and diversifying enrollment opportunities for senior high school, revising comprehensive curricular guidelines, supporting innovative pedagogies, and increasing school autonomy. Taiwan's transition to twenty-first century learning within a traditionally high-stakes, exam-centric educational culture serves as an important case study for discussion within the global pursuit to redefine teaching and learning for the students of today and citizens of tomorrow.

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4.1 Background

4.1.1 Taiwan's Context

Taiwan is an island on the western edge of the Pacific Ocean. It is home to over 23.5 million people of diverse cultures and beliefs, including sixteen indigenous tribes (Government of Taiwan, 2020). Although geographically small, the de facto independent nation is a leader of democracy in East Asia. Since its first direct presidential election in 1996, the country has advanced and adopted various progressive policies. Taiwan is the first nation in Asia to legalize same-sex unions and is currently led by its first female head of state, President Tsai Ing-wen (Government of Taiwan, 2021). Taiwan is one of the "Four Asian Tigers," alongside Hong Kong, Singapore, and South Korea, so-called for their rapid economic development and thriving industries, such as tourism and technology. Taiwan's steady growth over the past few decades has been attributed to a combination of timely policy decisions, a flexible labor market, and the prioritization of education (Ash & Greene, 2007).

The country's response to the COVID-19 crisis exemplifies its capacity for strong government action and rapid policymaking. From December 31, 2019, onwards, the Taiwan Centers for Disease Control and the Central Epidemic Command Center organized a proactive cross-ministry epidemic prevention strategy, which included health screenings and subsequent additional travel restrictions, public awareness campaigns, quarantine and face mask mandates, and community monitoring (MOFA, 2020). Furthermore, schools were provided with sufficient medical and sanitation equipment, alongside explicit universal protocols for school quarantines and closures. Through this whole-government approach, Taiwan was one of the few nations that did not experience significant pandemic-related disruptions to education in 2020, with the only real change being an extended winter break for additional school disinfection and safety measures (Taiwan CDC, 2020).

Taiwan strives to be a progressive and multicultural hub of Asia, balancing its Chinese, Japanese, and indigenous influences with the impacts of internationalization. Like other countries in the region, Taiwan searches for the equilibrium between conserving traditions and promoting diversity and social justice—alongside the need for sustainable development amid globalization, a falling birth rate, and high youth unemployment. This sociocultural context sets the stage for Taiwan's recent education policy reforms.

4.1.2 Taiwan's Education System

Education is positioned as a tool for empowerment of Taiwanese citizens, and as a mechanism to "ensure Taiwan's global competitiveness" (MOE, 2014). Taiwan's

Ministry of Education (MOE), in partnership with the National Academy for Educational Research (NAER), oversees national education policy, research, and management in a centralized, top-down system. Taiwan has a combined total of 10,931 schools and 4,260,327 students (MOE, 2019a) across twenty-three counties, cities, and special municipalities. There are three levels of basic schooling: primary (grades 1–6), junior high (grades 7–9), and senior high (grades 10–12). Since 1968, compulsory education encompasses grades 1–9 (Chen & Huang, 2017). Students can access academic and vocational pathways in senior high school, as well as university and graduate studies for higher education. Educational spending accounted for over twenty percent of total government expenditure in 2019 (MOE, 2020a).

Education is highly valued in Taiwanese society, which stems in part from Chinese influence and the Confucian tradition. Confucianism emphasizes the social value of education for cultivating learners to achieve social harmony. Advancing through the education system is a symbol of status and a demonstration of high social and moral values. Taiwan has historically utilized high-stakes examinations for entrance into senior high schools and universities as a sign of meritocracy in allocating higher education opportunities. This high-stakes testing, however, is often a source of student stress, as these tests often determine future academic and career pathway options (Chou & Ching, 2012). In this environment, many Taiwanese parents may enroll their children in evening or weekend *buxiban*, or "cram schools," to receive supplementary instruction (Liu, 2012). Cram schools are often clustered in urban areas and charge tuition, therefore contributing to educational inequality and widening the gap between students from families with lower socioeconomic status and those living in rural areas. Additionally, such intense, high-pressure academic environments can negatively impact students, and psychosocial challenges ranging from sleep deprivation to depression have been documented among Taiwanese adolescents in relation to academic stress (Kuan, 2011; Chen et al., 2015). PISA results also show that life satisfaction among Taiwanese students is among the lowest out of participating countries (OECD, 2019a).

Within this often high-pressure and stressful environment, Taiwan's students have also been among the highest academic performers on the PISA examination since the country's first participation in 2006. Students score well above the OECD average in science, mathematics, and reading scores. At the same time, socioeconomic equity in academic achievement has been increasing and is slightly above the OECD average—in the most recent PISA examination, around 12% of disadvantaged students scored among the top performers in all subjects (OECD 2019a). This perhaps mirrors the Ministry of Education's consistent prioritization of educational equity for socioeconomically disadvantaged and rural students, considering that universal access, quality, and academic excellence have been a focus of prior and ongoing reforms (Chou & Ching, 2012). Despite these successes, PISA performance for both mathematics and reading peaked in 2012, with scores in all three subjects declining in recent years. In 2018, scores in mathematics and science reached their lowest point since Taiwan's first participation in the assessment (OECD, 2019a). These recent declines, in addition to the need to address student stress and burnout, create an impetus for reinvigorating the education system and students' learning.

Pursuing high achievement, counteracting academic pressure, and promoting socioeconomic equity through education are all salient goals of Taiwan's education sector. Yet, these challenges are not new. Precursors to recent and ongoing education reforms can be seen in the 1990s, when Taiwan enacted its nation-wide 9-Year Curriculum Reform. This reform introduced competency-based learning into Taiwan's national curriculum and laid much of the groundwork for the later 12-Year reform. The history of this transition is further explored below.

4.1.3 9-Year Curriculum Reform

In the mid-1990s, public opinion in Taiwan encouraged an increasingly decentralized education system and a holistic curriculum to promote the development of knowledge, skills, and attitudes for both academic success and life satisfaction. In 2000, the MOE revised curriculum to "join the global wave of competency-based curriculum development" for students' moral, intellectual, social, physical, and aesthetic development, steering education away from solely test-based knowledge acquisition (Chen & Huang, 2017). The 9-Year Curriculum Reform, implemented from 2001 onwards, explicated ten fundamental competencies related to self, society, and nature, which reflected the new goals of education: to educate the "whole child" and to prepare students for an increasingly diversified, interconnected, and innovation-driven job market (Chen & Huang, 2017; Lin et al., 2015). School subjects were organized into integrated learning areas (e.g., discrete subjects like chemistry and biology were combined into "Science"). Schools were given more discretion to develop individualized curricula and select textbooks, and teachers were given increased autonomy to create their own teaching materials.

However, the rapid, top-down approach of the reform resulted in some confusion and pushback from teachers and the public. Some argued that the curricular competencies were too abstract and high-level for elementary and junior high students, and others stated that they were not accurate representations of essential life competencies (Chen & Huang, 2017). Adaptive teacher training also lagged the reform, leaving teachers without adequate support for their increased autonomy (Lin et al., 2015). Furthermore, the curriculum reform did not alter entrance examinations for senior high school or university enrollment. While the curriculum changed, academic pressure to succeed on these high-stakes and knowledge-based assessments remained. Without an institutional restructuring of the entrance exam process to align with the curricular shift, "school leaders and teachers face[d] the dilemma of whether to teach to the exams or to teach in accordance with the goals of the student-centered, experience-oriented curriculum" (Lin et al., 2015). The demand to alleviate academic pressure, promote competency-based learning, and allow students to develop their knowledge, skills, and individual talents remained after the sweeping 9-Year Curriculum Reform. These continued goals helped set the stage for the subsequent 12-Year reform (MOE, 2014).

4.1.4 Transition from the 9- to 12-Year Curriculum Reform

From the 9-Year Curriculum Reform, changes regarding competency-based curriculum, cross sector implementation, and decentralization laid the groundwork for key aspects of the 12-Year reform. In fact, the intention to provide 12-Year basic education had long existed in the political consciousness; as early as 1989, then Minister of Education Lee Huan proposed extending basic education from nine to twelve years, inspiring the later Senior High School Education Act (Yen & Vun, 2016). In 2003, just two years after the implementation of the 9-Year reform, the National Educational Development Conference initiated the design process for the 12-Year reform, in which the MOE and the Executive Yuan (Taiwan's executive branch) reached a consensus to prepare the 12-Year basic education curriculum (Chien et al., 2013; MOE, 2014). In that same year, the OECD published the DeSeCo framework, delineating nine core competencies that promoted twenty-first century success through lifelong learning. Taiwan's 12-Year Curriculum Guidelines largely echo the DeSeCo framework, and these connections are further discussed in Sect. 2.3.

In 2004, the MOE incorporated the plan for revised curriculum for all grades as one of its major administrative goals, and within two years it established a special assignment office to align the different levels of schooling. NAER was assigned to develop the content of the revised 12-Year curriculum (MOE, 2014). Their research began in 2008, analyzing Taiwan's educational system through an internationally comparative lens to inform a draft of the 12-Year curriculum, which was further revised by the 12-Year Basic Education Curriculum Review Committee (Chen & Huang, 2017; MOE, 2014). In 2011, the 12-Year Basic Education Implementation Plan was approved by the government and officially announced by President Ma Ying-Jeou. The two major parts of the reform are the Senior High School Education Act—extending basic education to include upper secondary schooling—and the basic education curriculum guidelines (MOE, 2014). The Senior High School Education Act was passed in 2013, and the 12-Year Basic Education Curriculum Guidelines were published in 2014.

4.2 12-Year Basic Education Reform

4.2.1 Theory of Change

The 12-Year Basic Education reform is comprised of the Senior High School Education Act and the 12-Year Curriculum Guidelines. The Senior High School Education Act extended basic education from nine to twelve years, increased educational opportunities for all students regardless of socioeconomic background or inherent abilities, and created diversified pathways within upper secondary schools. According to the new 12-Year Curriculum Guidelines, the national curriculum was redefined through emphasis on the core competencies at each stage of learning. The modified guidelines illustrate national aims to inspire students to unleash their full potential, develop knowledge about life, promote career development, and inculcate civic responsibility (MOE, 2014).

By fostering talent development for every student, the 12-Year Basic Education seeks to promote a proactive and engaged citizenry, a prosperous society, and national competitiveness. The Senior High School Education Act aims to expand equitable access to upper secondary schooling, while the 12-Year Curriculum Guidelines reframe core competencies, setting new standards for all students to develop their aptitudes as lifelong learners because of basic education. In this way, Taiwan's 12-Year Basic Education maximizes the potential of the country's education system to foster all students' development and lifelong learning.

4.2.2 Senior High School Education Act

Beginning in 2014, the Senior High School Education Act extended basic education from nine to twelve years, aligning with the fourth Sustainable Development Goal of "free, equitable, and quality primary and secondary education" for all (UN, 2015). The act introduced changes to enrollment, tuition, and entrance exams to promote equity, especially for students in rural areas, students with special needs, and indigenous students. Prior to the Senior High School Education Act, students were required to pass the entrance examination to be admitted to public high school. Students who did not pass the knowledge-based entrance exam would have to either enroll in private school or vocational school to continue secondary education. Private schools in Taiwan tend to both charge tuition and be of lower quality than public schools, which can create a financial barrier for marginalized students (Chou & Ching, 2012). Furthermore, Taiwan's cram school culture indicates that students with more support and financial resources can better prepare for entrance examinations; success on tests may be more difficult for those students whose families cannot afford after-school instruction or who have less time to study because of cost or other barriers and obligations, such as the need to assist with a family business. Because success in senior high school is vital for university admittance, the entrance exams heavily influence students' future trajectories.

To increase equity, the Senior High School Education Act expanded public school choice by codifying four schooling tracks, giving students the option to choose between: general, skills-based (vocational), comprehensive, and specialty-based high school education, which students choose during 9th grade and then attend for 3 years. In the general track, students take university-preparatory core classes in general subjects. In the skills-based vocational track, students take general, vocational, and practicum courses to learn professional skills. The comprehensive track offers courses in both general and specialized subjects, preparing students for entry into either academia or other career paths. Lastly, the specialty-based track provides students with courses tailored towards special aptitudes, such as performance arts.

These pathways provide opportunities for students to develop and cultivate their individual interests, goals, and talents within upper secondary education.

The Act also introduced a diversified entrance program, requiring schools to enroll up to at least 85% of their students through an open, exam-free enrollment. Article 37 of the Act states that "under the exam-free admission program, all applicants can be admitted as long as the number of applicants does not exceed the limit set by the competent authority" (MOE, 2016a). If the number of applicants does exceed the limit, "the final enrollment number shall be determined by the competent authority at the special municipal/county level along with the competent authority of each school district and reported to the central competent authority for future review" (MOE, 2016a). This means that schools may admit a small portion of students based on application criteria like an entrance exam, but it cannot be the primary basis for their enrollment. Further, the number of students not admitted through the exam-free enrollment must be reported to the government for review. Admission varies by program: some programs admit all interested students, and others require demonstration of specific skills or recommendations. However, skills-based and specialty-based senior high schools are not subject to open enrollment requirements because they have their own enrollment procedures, which may include academic subject exams, practical exams, or portfolios also named "technical subject performances" (MOE, 2016a). All students prepare for enrollment into high school through career-planning coursework, which junior high schools are required to integrate into their curriculum. The Act also mandates equitable and inclusive enrollment practices by prohibiting discrimination based on social identity or ability. Certain at-risk student groups, such as students with disabilities, indigenous students, and students from major disaster-stricken areas, supersede enrollment quotas. These students' enrollment is ensured by the central government, rather than by individual schools (MOE, 2016a).

Finally, the Act stipulates that senior high school enrollment must also be tuition-free for most students. Whereas nine years of education is compulsory, and enrollment is exam- and tuition-free, the Senior High School Education Act states that the additional three years of basic education are *primarily* exam-free and "students are voluntarily enrolled to schools based on their inclination, interest, and merit, and shall be enrolled tuition-free pending certain requirements" (MOE, 2016a). These requirements are determined by the schools in cooperation with the municipal or county governments. Under the tuition-free policy, the total amount of student tuition is treated as a subsidy paid out to schools by the government (Chen, 2017). Tuition-free enrollment is not applicable for students who are not of Taiwanese nationality, who have dropped out, or who are enrolled in non-governmental and unsubsidized private schools. To promote equity, socially disadvantaged students may apply for additional subsidies and scholarships on top of tuition-waivers (MOE, 2016a). To subsidize at-risk students' tuition, as well as fund county and school grants for innovative education proposals, the government spent NT$30 billion on the Act's first year of implementation and NT$33 billion the second year (Chen, 2017).

4.2.3 12-Year Curriculum Guidelines—Core Competencies

To complement the institutional changes introduced by the Senior High School Education Act, new curriculum guidelines were introduced, redefining the progression of learning stages and revising the core curricular competencies to reflect international best practices. The new curriculum guidelines drew inspiration from international trends in basic education expansion and policies within the United States, Finland, New Zealand, the UK, and Hong Kong for coherent subject and competency integration, by promoting the holistic development of each child with opportunities to cultivate their individual aptitudes (NIE, 2014). The refined curricular competencies also aimed to clarify the previous 9-Year curriculum and emphasize students' lifelong learning. To this aim, the 12-Year Curriculum Guidelines envision four core goals:

1. To inspire students to unleash their full potential
2. To teach and develop students' knowledge about life
3. To promote students' career development
4. To inculcate students' civic responsibility (MOE, 2014).

These goals recognize that students are self-directed learners, and schools should (1) ignite their motivation and passion; (2) guide them to develop their interactions with self and others; (3) help them apply learning into practice and experience the meaning of life; and (4) obtain the common good (Chen & Huang, 2017). Thus, the revised 12-Year Curriculum Guidelines state: "To implement the ideas and goals of 12-Year Basic Education, core competencies are used as the basis of curriculum development to ensure continuity between educational stages, bridging between domains, and integration between subjects" (MOE 2014). The guidelines consist of nine core competencies in three primary domains and contain a set of standards defining the development of these nine core curricular competencies in five stages.

The 12-Year Curriculum Guidelines recognize that students must take initiative to *act autonomously, communicate interactively,* and engage in *social participation* toward the collective good (MOE, 2014). These three domains are meant to drive lifelong learning. Each domain contains three specific core competencies, which comprise the nine core competencies of the 12-Year Curriculum Guidelines. The framework of cultivating lifelong learners through *spontaneity*, *communicative interaction*, and *social participation* mirrors the three areas the OECD DeSeCo framework uses to classify its twenty-first century core competencies: acting autonomously, using tools interactively, and interacting in heterogenous groups. DeSeCo defines "acting autonomously" as the ability to set goals, to act within the bigger picture, and to form and conduct life plans and personal projects. Taiwan's corresponding "spontaneity" interpretation states that students should act from their own will, use creative flexibility, and work on self-improvement. DeSeCo's category of "using tools interactively" corresponds to Taiwan's "communicative interaction," as it aims to equip students with tools (sociocultural, linguistic, technology-based, and artistic) to actively engage with others and within society. Taiwan's third learning area—referred to as "social participation"—mirrors DeSeCo's "interacting in heterogeneous groups," with the emphasis on accepting and appreciating diversity while collaborating for collective good (MOE, 2014; OECD, 2003). The delineated goals of Taiwan's 12-Year reform reinforce international influences and emphasize teaching and learning practices informed by twenty-first century competencies.

4.2.4 Implementation Steps for the 12-Year Curriculum Guidelines

The 12-Year guidelines explicate eight major items for implementation: (1) curriculum development; (2) teaching implementation; (3) learning assessment and application; (4) teaching resources; (5) teacher professional development; (6) administrative support; (7) participation of parents and nongovernmental organizations; and (8) supplementary provisions (MOE, 2014).

1. Curriculum development entails the creation of individual school-based curriculum development committees, integrated school-adjusted curriculum plans, improvement-focused curriculum evaluation mechanisms, and resources for experimentation and innovation with school autonomy.
2. Teaching implementation includes teacher preparation, support for adaptive and innovative activities, and the practice of varied teaching models to increase learning motivation and foster a positive learning atmosphere.
3. Learning assessment and application places an increased focus on the use of formative and varied assessment types in class to help teachers adjust their methods to benefit learner outcomes. It also suggests the use of tutoring and remedial services depending on student needs.
4. Teaching resources mandate materials, equipment, and budget for teachers to develop innovative pedagogical methods. Curriculum and materials must reflect multiculturalism and an appreciation for diversity; local authorities can adjust curriculum to local needs. The MOE is tasked with creating collaboration channels between teachers, schools, researchers, and the community.
5. Teacher professional development outlines professional learning communities for preparation, observation, and research inside and outside classrooms, emphasizing a change toward a positive peer learning culture and interpersonal and financial support systems. Professionalism increases through content integration and regular relevant workshops.
6. Administrative support highlights the need for competent authorities to help teachers to accomplish curricular goals and implementation steps through funding, informational seminars, and responsive evaluation surveys.
7. Participation of parents and nongovernmental organizations validates the necessity of whole-community support for student learning, especially through

engaging parents in the school environment and utilizing community resources to offer real-life learning opportunities.

8. Supplementary provisions state that progressive implementation will begin in August 2018 (although this was later postponed to August 2019), and local authorities have jurisdiction over providing appropriate education and activities for special education, art and vocational activities, indigenous curriculum, and experimental education.

The guidelines place an emphasis on alignment among these components, stating:

> The objectives are to promote communication between relevant education entities, facilitate flexibility in school curriculum design and development, support teaching and learning activities, integrate diverse teaching resources, and evaluate curriculum implementation outcomes to ensure students' right to learn and enhance teachers' professionalism and responsibilities. Schools are also encouraged to incorporate issues of global importance in their curriculum, offer school-developed courses relevant to local topics, and use project-based, cross-curricular, integrative, practical, and experiential pedagogy.[1] (MOE, 2014)

This comprehensive strategy promotes subject integration, multicultural appreciation, and teacher professionalization. Additionally, the guidelines adapted the senior high school assessment process, provided references for teaching integrated subjects, and required seminars to increase stakeholder awareness—especially for parents. A resource website about the new curriculum was also published by the MOE. The implementation protocols require city and county education bureaus to provide administrative oversight and facilitate cross-school collaboration, but school autonomy is heavily emphasized in curriculum development and teacher support (MOE, 2014). In total, thirty-five pieces of legislation were passed in this reform cycle, with standards for teaching, curriculum, textbooks, assessment, equipment, and other topics (MOE, 2019b).

Implementation of the revised guidelines was projected to begin in the 2018–2019 school year, but a survey conducted by National Taiwan Normal University shortly after the guidelines' publication found that 87.5% of junior high, general, and vocational teachers did not believe that the MOE was ready for 12-Year Basic Education curriculum guideline implementation (NTNU, 2015). In a later interview, the Minister of Education Pan Wen-Chung predicted on-schedule implementation by 2018 because it was the "expectation of many school officials and teachers" (Taipei Times, 2016). However, both schools and teachers felt unprepared with this timeline, so the curriculum implementation was postponed from 2018 to 2019. Beginning in the 2019–2020 school year, the progressive implementation started with the first grade per school level per year (i.e., 1st, 7th, and 10th grades). Subsidies for schools were provided contingent on schools establishing curriculum development committees to oversee the textbook choices, creating a school-based curriculum, and designing evaluation frameworks (MOE, 2019c).

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[1] The guidelines state: "School curriculum development should emphasize the integration of distinct domains, clusters, programs and integrate issues of global importance, including gender equality, human rights, the environment, global ocean, morality, energy, life, technology, reading literacy, international education, and indigenous education" (MOE, 2014).

4.3 Approach to Analysis

Our multidimensional analysis of Taiwan's 12-Year Basic Education reform was conceptualized through the Reimers' five perspectives framework (2020). To understand the systems-level transformations of the Senior High School Education Act, we focused on the institutional perspective through examination of changes in enrollment data, expenditure, and educational attainment.

The psychological perspective helped to evaluate the revised guidelines' competencies and pedagogical goals based on the relationship to scientifically and internationally recognized best practices. Similarly, the professional perspective was used to analyze support for teachers' capacity to deliver curricula, comparing original survey and interview data with published professional development participation statistics from the MOE. This overlapped with the political perspective, which informs our discussion of teachers as key stakeholders, as well as the contextual political environment which shapes responses to reform. Finally, we utilized the cultural perspective to consider how the 12-Year guidelines broadly aim to reform Taiwan's societal framing of the goals of education and the definition of educational success. These lenses provide a holistic assessment of the 12-Year Basic Education reform for Taiwanese education within this preliminary timeframe.

4.3.1 Interview and Survey Methodology

To account for the recency of the revised curriculum guidelines and the limited student-level information available at the time of writing, we conducted semi-structured interviews with nine teachers and seven administrators, researchers, and professors. Administrators and national researchers with publicly available contact information were recruited for interviews via email; others were recruited through professional connections formed through Fulbright Taiwan, an organization which recruits English teachers to foster cultural exchange between the United States and Taiwan. In addition, we surveyed eighty-eight teachers across thirteen administrative divisions. This survey was distributed through a shareable link and disseminated through Fulbright Taiwan's professional network. The online survey included both Likert-style and open-ended questions to assess teachers' experiences, impressions, and practices regarding the 12-Year Curriculum Guidelines' teacher-related components. Most respondents lived in either Kaohsiung City (33 teachers), Hualien County (16 teachers), or Kinmen County (24 teachers), with a nearly even divide between teachers in urban and rural areas. A majority (67%) of respondents are primary school teachers; 11% are junior high school teachers, and 21% are senior high school teachers. Forty-nine percent of respondents have been teaching for ten years or less, and 51% of respondents have been teaching for over ten years.

Finally, we used publicly available data from the Ministry of Education's published statistics and meeting minutes to supplement our understanding of the goals and impact of the 12-Year education reform. From the MOE statistics, we analyzed enrollment rates, graduation rates, and hours of teacher professional development. Additionally, corresponding meeting minutes between governmental officials and working groups were recorded to provide insight into the design process of the new 12-Year Curriculum Guidelines and its learning goals.

4.3.2 Limitations

The limitations of our data should be noted. First, the small sample of teachers was not selected with methods that would denote representation of the larger population. Additionally, teachers who were interviewed or participated in the survey may be those who are more interested in the reform or who have stronger positive or negative impressions about educational change generally. Furthermore, the survey relies purely on teachers' subjective experiences and perceptions. Despite these limitations, we felt that given the centrality of teachers in the 12-Year reform's implementation, attempting to understand these perceptions from the broadest base possible within the limited time of our project was warranted. With this data, we can begin to evaluate the reform's impact on a ground level, with the quality and quantity of teacher implementation to be used as an initial proxy for the reform's impact. Future considerations from stakeholders—including parents and students—alongside student-level data about academic and social outcomes would increase the scope and understanding of this reform.

4.4 Implementation Analysis

4.4.1 Expansion of Equitable Access to Senior High School

In general, Taiwan has a broadly accessible education system in terms of gross and net enrollment. The net percentage of junior high school graduates advancing to upper secondary school has averaged at greater than 99% since 2012. For upper secondary school specifically, net enrollment rates have remained at around 93% since 2011 (MOE, 2019d). While the Senior High School Education Act has broadened enrollment opportunities for students through the diversified entrance program, net enrollment rates have not drastically changed. However, since the Act was implemented in 2014, the percentage of junior high school graduates advancing to senior high school has increased by 0.4% (MOE, 2019e), equating to a few thousand students. Since enrollment was already high prior to the reform, it is possible that this marginal increase is the result of lowered barriers for some of the most marginalized students. Overall, this may indicate the reform's impact of increasing the number of students continuing to upper secondary education.

Students' average years of schooling has also been increasing steadily since 2009, surpassing twelve years of education in 2016—two years after the Senior High School Education Act was passed. By 2019, the average length of schooling for Taiwanese students was 12.3 years, and the expected time of total education was 16.5 years (MOE, 2019f). While these increases appear to have begun before the Senior High School Education Act was passed, a marginal increase was observed in students from junior high school continuing to senior high school. This continued trend of increased years of education reflects a general improvement of access to educational opportunities in Taiwan. The explicit inclusion of disadvantaged students in the Senior High School Education Act also led to an increase in the quantity of classes for students with disabilities: between 2013 and 2019, there was a 15% increase of special needs classes in senior high and vocational schools (MOE, 2019g). In terms of socioeconomic equity, the proportion of students enrolling in private senior high schools versus public senior high schools has decreased substantially between 2013 and 2019 (MOE, 2020b).

On the other hand, vocational high schools have received fewer tuition subsidies compared with general high schools, despite enrolling a higher proportion of poor students and facing greater costs associated with internships and practicum courses (Chen, 2017). Additionally, educational attainment data with respect to other student groups identified in the act—such as indigenous students—does not appear to be as readily monitored and available. Disaggregated data surrounding enrollment changes, graduation rates, and postsecondary plans specifically among disadvantaged students are needed to better assess the Senior High School Education Act's impact on providing an equitable education for all.

4.4.2 Integration of 21st Century Learning in the Classroom

On a theoretical level, twenty-first century competencies are well-integrated into the 12-Year Curriculum Guidelines. On a practical level, most surveyed teachers strongly agreed that they integrate competency-based teaching models into their own practice on a regular basis. They also agreed, though slightly less strongly, that they believe that the competency model in the 12-Year curriculum has positively impacted students' learning. Surveyed teachers further reported feeling confident in using ICT in their classes on a regular basis, which is an important tool for students to develop competencies related to digital literacy and communication.

Formative assessment also appears to be well-integrated; over 80% of teachers report that they use formative assessment at least once a month. Thirteen teachers even reported they use some form of formative assessment at least once per day. Most surveyed teachers (73%) also indicated that methods to help teach twenty-first century skills, such as interdisciplinary classes, have positively impacted students' learning. This focus on students was mirrored in the interviews as well. One senior high school teacher said that the reform has a focus on well-being and on well-rounded students, while a primary school teacher mentioned that teaching methods have changed to encourage inquiry-based learning and open-ended questions. This teacher described the policy's goal as encouraging students to solve problems independently, without teachers providing the answer. Her perception was that this would increase discussion and render classes more interesting. However, despite our survey's indication that competency-based learning is well-integrated, a recurring theme among teacher interviews was the continued prevalence of traditional, teacher-centered practice and reliance on textbooks to determine course content.

Survey results indicate that teachers understand and see value in the curricular changes and in competency-based teaching practices. However, the intended learning outcomes because of these large-scale changes in teaching practices may not yet be fully visible. NAER is currently compiling a database to assess student learning of transversal competencies and to determine how to better support teachers' needs under the new guidelines. Further research on changes to student outcomes and perceptions of the curriculum and pedagogy is necessary for developing alternate perspectives of relevant stakeholders. Moving forward, more data will be needed regarding student employment, educational attainment, and international assessments; this information will yield insight into the success of the revised guidelines in improving students' learning and well-being.

4.4.3 Increase of Autonomy for Schools and Teachers: School-Based Curriculum Development

The revised 12-Year Curriculum Guidelines require schools to develop their own alternative curricula, alongside the new MOE-mandated curriculum. School-based curriculum should be "designed and offered by each school to highlight the school's vision of education and facilitate students' development according to their aptitudes" (MOE, 2014). School-based curriculum includes both required and elective courses developed by individual schools, as well as alternative learning or group learning periods that schools may arrange depending on their students' specific needs. Depending on the learning stage (elementary, junior, or senior high), the school-based alternative curriculum comprises between two to seven class sessions per week, with a greater number of weekly sessions allocated for students who are in grades 3–9. Additionally, the four different tracks of senior high school (outlined by the Senior High School Education Act) have different requirements for the balance of school-developed curriculum and MOE-mandated national curriculum. Specialized and comprehensive high schools have the most autonomy regarding curriculum development, allowing well over half of their required credits to be considered alternative curriculum. For general and vocational high schools, although there are more requirements using MOE-mandated curriculum, students in all four tracks of senior high school can expect to take 2–3 sessions of school-based alternative curriculum per week (MOE, 2014).

School-developed curriculum aims to provide an increased opportunity for schools to "[s]park students' learning interests" and encourage the development of their aptitudes and skills" (MOE, 2014). This reflects the idea that effective instruction integrates student's prior knowledge, motivations, and interests (Aspen Institute, 2019). The revised curriculum guidelines explicitly position these school-based alternative curricula as opportunities to promote twenty-first century skills: schools are encouraged to use this time for theme-, project-, and inquiry-based learning in interdisciplinary cross-subject courses and in professional, service-based, outdoor education, self-directed learning, and experiential courses (MOE, 2014). Courses like "community service learning, experiential courses in outdoor settings, civic practice, small-scale thesis research, and project-based exploration" emphasize practical learning experiences for students, giving them the chance to apply knowledge and skills to real world situations (MOE, 2014). This provision for alternative curricula also allows schools to increase the relevance of their curriculum, by adapting them to their local contexts. For example, schools serving large populations of indigenous students can incorporate indigenous history and culture into curricula and involve local indigenous knowledge-keepers in developing courses, lessons, and projects.[2] These connections between academic and home lives can increase students' interest and pride in their indigenous identities while fostering intrinsic motivation (Lee et al., 2011).

4.4.4 Preparing Teachers for Innovative Pedagogy

The 12-Year guidelines aim to promote increased innovation and adaptive pedagogy among teachers, encouraging student-driven learning in the classroom to facilitate competency development. The revised guidelines thus grant autonomy to schools and teachers to increase adaptive support for students. Therefore, sufficient professional support, teacher buy-in, and self-motivated interest to adapt pedagogical techniques are vital to the success of guideline implementation. The MOE, county governments, and schools provided workshop opportunities in the years leading up to the revised guidelines' implementation, allowing teachers to learn directly about the new curriculum and its pedagogical approaches. Some workshops were mandatory, but others were provided on either a selective application-basis or open to any teacher as self-funded study. Our survey found that most teachers (97%) reported having participated in professional development activities related to the reform at some point, including workshop participation, joint lesson preparation, teaching observation, and/or professional learning communities. In 2018, TALIS responses showed 71.3% of participants engage in collaborative professional development less than once per month (OECD, 2019b). While our survey corroborates that most teachers (63%) participate in collaborative professional development 1–2 times per month or less, about a third of teachers reported engaging in these activities at least once per week—with 12% stating that they engage in PD activities daily.

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[2] In primary school, students are required to enroll in one of these language courses: Minnan, Hakka, Indigenous Languages, or Native Languages of New Immigrants. In junior high school, students can choose to continue enrolling in indigenous language courses. At least one indigenous language session should be held weekly at schools. Native Languages/Native Languages of New Immigrants may be integrated into cross-curricular courses to meet competency requirements (MOE, 2014).

While our survey is not fully representative, these findings may suggest a preliminary increase in the frequency of collaborative professional development supporting teachers' professional competency to implement the revised curriculum. However, one teacher noted that there are fewer government-run workshops on the outlying islands (rural areas), and teachers find it difficult to attend weekend workshops on the main island of Taiwan due to the time commitment and limitations to personal funds. This is supported by government data showing that while workshops have been held across counties, significantly fewer have been held in rural areas (MOE, 2016b).

Despite survey responses, average hours of professional development (PD) per teacher per year decreased between 2013 and 2019, from an average of 89.05 to 70.83 h (analysis of MOE Inservice Portal). The variations between counties and grade levels are wide, with Kaohsiung (an urban county) averaging 60.6 h per teacher—lower than the rural counties of Hualien (67 h) and Kinmen (99 h). Average hours of teacher professional development per teacher also vary. Elementary school teachers participate in the most hours of PD on average, followed by junior high teachers, then senior high teachers (MOE Inservice Portal). Kinmen teachers, in fact, have notably high PD hours for primary school specifically, with 125.08 average hours of PD per teacher, compared to Kaohsiung's 78.35 h and Hualien's 94.23 h. This information counters the notion that quantity of professional development activities across all levels and areas has increased. More data is needed to determine if these discrepancies are related to budget, PD quality versus quantity, or other factors.

Beyond the frequency of professional development, though, an important consideration is whether teachers agree with, and are inspired to use, what they learn from their professional development. Effective professional development is responsive to needs for adult learning and recognizes their capacity as creators, rather than passive recipients of training (Reimers, 2020). Most teachers surveyed agreed that their participation in professional development activities has positively impacted their students' learning, indicating that they have found the PD activities beneficial and useful to their practice. However, this was more strongly agreed upon by elementary school teachers; only 60% of junior high and 50% of senior high teachers perceived a positive impact on student learning because of their PD participation. This could be because our elementary school teacher survey respondents reported more frequent PD activities, but it could also indicate a variance in quality of PD between school levels. Additionally, over 70% of our survey respondents indicated that their school offers incentives for teachers to design curriculum, teaching materials, and innovative assessments, and many believe the incentives have a positive impact on student learning. However, senior high school teachers were slightly less likely to report that they agreed with this.

More research is needed to determine the impact of targeted professional development activities between school levels. Our preliminary data underline an optimistic view: with increased opportunities for collaborative PD and professional incentives, teachers will increase their self-efficacy with the new curriculum and pedagogy. Consequently, teachers can adapt and implement student-based curriculum in the classrooms, resulting in positive impacts on students' learning.

4.4.5 Challenges to Implementation: Conflicts Arising from the "Top–Down" Approach to School Autonomy

Because of the historically centralized approach to government, top-down reforms are the norm in Taiwanese education. Although the 12-Year Curriculum Guidelines aim to promote school autonomy and explicitly call for the involvement of multiple stakeholders—including teachers, administrators, parents, and NGOs—the guidelines have faced some resistance, much like the challenges preceding the 9-Year curriculum reform. Our analysis focuses on the role of teachers as the reform's primary implementors, although perspectives of each of these stakeholders warrants further research and attention as the reform progresses. The first challenge of implementation pertains to teachers' direct and perceived involvement within the reform; some teachers interviewed expressed that they did not feel teachers were adequately involved in the process of revising the curriculum guidelines, and that teachers' interests were not sufficiently addressed throughout the process. For example, one senior high school teacher shared his impression that the reform was made by approximately fifty people, comprised of mostly experts and professors but not many teachers. Other teachers echoed the perception that professors played a disproportionately large role in guideline creation relative to teachers.

Contrary to these perceptions, meeting notes from the MOE National Curriculum Development Committee show that teachers were included in the guidelines' revision process (NAER, 2020). For example, the requirements for indigenous languages included in the revised curriculum require a special division of teachers and NAER professors who specialize in language education. Additionally, the MOE published public websites and online forums to solicit feedback from teachers, parents, and the public, which was then used by the committee members throughout the revision process. However, the extent of teacher engagement with these platforms is uncertain. Despite a clearly defined intention from the MOE to engage diverse stakeholders and involve teachers and the public actively in the process, some teachers still felt detached from the reform and perceived it as predominantly top-down. This perception appears to have limited some teachers' enthusiasm for the process, despite their agreement with the overall goals of the reform.

4.4.6 Impression of Increased Teacher Responsibilities

The historically top-down approach of the Taiwanese education system leaves many with feelings of inadequate MOE consideration regarding stakeholder interests. One national curriculum researcher expressed that the government tends to have a "do as you go" attitude towards policies, not always addressing parent and teacher concerns. This explains the most frequently noted theme among teachers interviewed, which is that the revised guidelines have generally increased responsibilities and teaching demands for them and their colleagues. As one primary school teacher put it: "The intention behind the [curricular] change is good, to encourage students to think critically," but "teachers should have more time to really design the lessons, to teach, [and the MOE should] give teachers more time so that they can do a better job." Under the revised guidelines, teachers are encouraged to plan lessons that spur students' critical thinking and to create activities that permit them to work in small groups on interdisciplinary projects. Despite expectations for innovative pedagogy, systematic changes to teachers' schedules to reflect these new demands—such as increased time scheduled for planning and observation—have not occurred. Some teachers expressed that the pre-existing demands of teaching leave teachers feeling too busy for the additional task of collaboratively innovating lessons.

Before the revised guidelines were implemented, teachers in Taiwan taught an average of 17+ hours per week (OECD, 2019b), with many spending additional hours teaching remedial classes, leading student clubs and extracurricular activities, completing administrative tasks, and serving on school committees to implement a school-based curriculum. TALIS reported that teachers spent a weekly average of nearly 7 h on individual planning, 3 h on collaborative work with colleagues, 4 h on grading, and 4.5 h per week on administrative tasks (OECD, 2019b). Reducing teachers' course responsibilities to give more time to prepare and implement professional development strategies is recommended by the TALIS report (OECD, 2019b), but it is not clear to what extent this has taken place to accommodate for the requirements of the new curriculum guidelines. Increased demands for teachers may also disproportionately impact smaller, rural schools. Without the financial resources to increase staff size, these schools may find challenges in rearranging teachers' schedules to meet new requirements for increased number and diversity of elective courses offered. New requirements for course offerings have also led to teacher shortages, especially in subjects that were not previously emphasized within the education system, such as indigenous languages (Lin et al., 2019).

4.4.7 Public Understanding of the Reform

Another challenge facing the reform's future is the dissemination of information to the public to create awareness of the goals and processes of the revised guidelines. Like the preceding 9-Year reform, the 12-Year Curriculum Guidelines are written with ambiguity. A public concern is the lack of confidence in how the new guidelines will equip students with the knowledge and skills they need to master the "basics" of education. As one teacher explained, she felt nervous and skeptical upon first hearing about the 12-Year Curriculum Guidelines, interpreting them as a wholesale change of the content taught in schools. After she was more familiar with the guidelines, she better understood their purpose, and understood that the guidelines mainly call for changes to teaching methods rather than changes to curricular content. After this, she was able to appreciate how the reform could allow students to better develop critical thinking and interpersonal skills, while ensuring that the curriculum would not skip fundamental content. This mentality parallels parents' misconceptions about competency-based learning which explains their lack of buy-in; according to our survey, most teachers (91%) agreed that parents do not understand the goals of interdisciplinary, competency-based education of the 12-Year Curriculum Guidelines. Interviewees described the concern that curriculum changes will result in the deterioration of students' grades.

4.4.8 Cultural Challenges: Redefining the Purpose of School and Learning

Support for the 12-Year Curriculum Guidelines is impacted by several factors beyond TPD, including larger sociocultural values about the goals of education. While a competency-based curriculum was introduced in the 9-Year reform, the 12-Year guidelines are more closely aligned with competencies from international models, including increased school autonomy, innovative student-centered lessons, and opportunities for students to explore their interests. The 9-Year reform sought to ultimately shift the purpose of schooling to holistic competency development; the 12-Year reform retains this spirit of holistic education and lifelong learning while pivoting to how students relate to the world around them and command their own learning. Like the 9-Year reform challenges, the 12-Year Curriculum Guidelines also appear to have ambiguity in its goals and intended outcomes.

The 12-Year Curriculum Guidelines emphasize innovative pedagogy and applied learning, and thus mark a departure from tradition. Accordingly, day-to-day changes to teaching methods and assessments have lagged curricular changes. Among interviewees, there was a distinct perception that the pedagogical approaches set forth in the revised curriculum guidelines are "imported," producing tension with traditional approaches to education in Taiwan. The biggest perceived conflict is between the student-driven, inquiry-based learning approaches recommended by the curriculum guidelines and the existing teacher- and textbook-centered pedagogy, designed to prepare students for rigorous testing. Many teachers interviewed expressed their belief that the cultural value of academic success defined through high test scores would continue to prevail, regardless of curricular changes.

With increased autonomy to design a school-based curriculum that aligns with student interests, some teachers have expressed that the 12-Year Curriculum Guidelines are burdensome; teachers face the same social and professional pressure to deliver high test scores but must now do so through unfamiliar means. For some teachers, this may mean forestalling guideline-suggested approaches until there is "time" to do so, prioritizing traditional pedagogical methods to prepare students for exams. Simultaneously, interviewees noted a lack of student motivation in school and a dissatisfaction with traditional models of teaching. Thus, there is the simultaneous perception that traditional teaching styles are not sufficient to engage students, as well as a sense of uncertainty for how to effectively practice more interdisciplinary, inquiry-driven approaches. This perceived departure from the norm appears to have left many teachers with a sense of feeling "not ready" for the reform.

Overall, our interviews and survey demonstrated strong consensus that the goals of the 12-Year Curriculum Guidelines are positive and well-intentioned. However, shifting the cultural role of schools from arbiters of test scores to sites of twenty-first century competency development and lifelong learning has proven difficult to change. Like the preceding 9-Year curriculum reform, the revised curriculum guidelines for 12-Year Basic Education have struggled to elicit widespread buy-in. Disconnect between MOE policies and teachers' interests, on top of parent and public misunderstanding, appear to have hindered the most preliminary stages of implementing the 12-Year guidelines. With the widespread perception that test scores and grades are crucial for student success in Taiwanese society, developing collective buy-in among teachers and parents is a critical step for effective implementation of the competency-focused curriculum and innovative pedagogy. Moving forward, as the MOE continues to develop platforms for eliciting feedback and facilitating dialogue among teachers, parents, and the public, the re-envisioning of schools and learning in Taiwan appears promising.

4.5 Conclusion

Taiwan's 12-Year Basic Education reform seeks to increase equity and national educational attainment throughout Taiwan, through the extension and diversification of basic education and the transformation of teaching and learning in the national curriculum guidelines. Although enrollment in Taiwanese upper secondary schools was already high, alleviating entrance exam requirements and tuition has further increased enrollment. What is more, by prioritizing the tuition- and exam-free enrollment of marginalized student groups, the government has promoted more accessible pathways to education for all students.

Taiwan is a developed nation, with high levels of educational access, resources, and attainment. The newly implemented 12-Year Curriculum Guidelines support the development of twenty-first century competencies, individual talent development, and lifelong learning through an interdisciplinary, innovative, and locally adaptive approach. Taiwan's curriculum revision exemplifies the adoption of internationally influenced frameworks to create national-level standards, while promoting mechanisms of school and teacher autonomy for adaptation to local context and student's needs. The push for increased school autonomy in an historically top-down system, as well the approach to competency-based national curriculum in a traditionally test-centric learning culture, makes Taiwan a compelling case study for education reform.

The implementation challenges of the 12-Year Curriculum Guidelines underscore the pivotal role of teachers in curricular reform—and the need to integrate political, professional, and cultural perspectives when considering how to involve teachers as stakeholders as well as curriculum innovators and agents of educational change. Moving forward, the high cultural value that Taiwanese society places on education can be leveraged to promote an increased alignment and shared vision among teachers, parents, the government, and the public. While this analysis will be strengthened by future research of educational outcomes, Taiwan continues to set its students on the path toward lifelong learning, and in doing so, set its society on the path to success.

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Chapter 5
An Emerging Dragon: Vietnamese Education After Resolution 29

Anh Vinh Le, Puyuan Han, Maw Maw Khaing, and Olivia Farrar

Abstract In the years since its independence in 1975, Vietnam has experienced much political, social, economic, and educational change. Multiple comprehensive reforms over the past few decades have served to transform Vietnam from a country of war into an "emerging dragon" across all social and economic sectors, including education. In 2013, Vietnam passed one of the most significant pieces of education legislature in the country's history: Resolution 29, a fundamental and comprehensive education reform that put the development of Vietnam's education system at the top of socioeconomic development plans. This chapter accounts for the major changes of Vietnam education system after Resolution 29, including the country's "success formula" as well as its lapses. It makes further recommendations for educational policymakers and educators in Vietnam regarding the role of the education sector in the coming ever-disruptive social and economic context.

5.1 Introduction

The developmental progress of Vietnam has evolved from an education system struggling with the long, brutalizing post-war conflicts to one that made the headlines in worldwide newspapers for leading other countries in international academic contests and assessments. In its first attempt to participate in the Program for International

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Student Assessment (PISA) in 2012, Vietnamese youths topped those from OECD countries, ranking 17th in mathematics, 8th in science, and 19th in reading out of 65 participating nations. Three years later, in the 2015 PISA, the average score of Vietnam was 32 points above the OECD average (while staying in top 10 worldwide in science)—equivalent to about one full year of schooling. Overall, given its top position in the PISA average score ranking and international academic competitions, Vietnam represents an impressive success story for the effects of efficient investment in education (Kataoka et al., 2020).

On November 4th, 2013, Vietnam passed one of the most significant pieces of education legislature in the country's history: Resolution 29, a fundamental and comprehensive reform of the education system. Resolution 29 was guided by the principle that investments in education result in long-term investments in economic development, and thus put Vietnam's education system at the top of socioeconomic development plans. Beginning in 2013, national and local governments unrolled a series of reforms based around a small number of linked key policy levers: targeted investment, a changed curriculum and pedagogy, and a focus on teacher quality.

This chapter provides an analysis of the reform implementation through Fernando Reimers' five perspectives of educational changes (Reimers, 2020), as well as its outcomes and challenges.

The analysis utilizes both quantitative and qualitative data, including several primary sources directly obtained from the Vietnamese government. Our interpretation of the stated goals and objectives of Resolution 29 derives largely from the official document. We have also summarized data derived from the reports of international organizations (including UNESCO and the World Bank), and academic papers about the results of Resolution 29. The most recent 2020 Vietnam Education Sector Analysis report (MOET, 2020) has informed the bulk of our findings regarding statistical measures of educational attainment and performance in Vietnam since Resolution 29, as it is the most current and comprehensive review of the relevant data.

To supplement our analysis of these papers and findings, we conducted interviews with five leading officials from the Vietnamese education system, including Director/Vice Director Generals of several departments from Ministry of Education and Training and formal Director General of Vietnam Insitute of Educational Sciences. Although we had access to a great deal of information, the lack of quanitative data for ethnic minorities and students with special needs was inevitable. Interviews with senior managers in the education system will help us to fill in this missing information. Besides, these interviews provide invaluable reflections on the implementation and effectiveness of Resolution 29 and inform future directions for educational policy in Vietnam.

5.2 Country Context

To fully understand the impact of Resolution 29, it is first necessary to contextualize our discussion within the political, geographic, demographic, social, macroeconomic, and labor market environments which have affected the Vietnamese education sector over the last two decades. These factors, while external to the immediate education system, shape the development of education demand and supply.

Historically, Vietnam has gone through five waves of education reform in the last several decades. In the first wave, which lasted roughly from 1945 to 1954, Vietnamese education reforms were framed around fighting poverty and illiteracy. Before the country's liberation in 1945, the educational system was under French colonial control, and only 5% of the population was literate (MOET, 2020). The second wave of reform took place during the Vietnam War, when the country was temporarily divided; the main objectives during this period of conflict were to expand the school network and to establish modern universities (Duggan, 2001). Following the end of the war in 1975, the third major educational reform focused on curriculum unification between the North and the South of the country (MOET, 2020). The literacy rate rose to 84% by 1980, and rates continued to increase throughout the 1980s as the government approved new textbooks for all grades over the country through an intensive anti-illiteracy campaign (MOET, 2020).

Until the mid-1990s, Vietnam's national education system was divided into a four-tiered system. This system consisted of (1) pre-school education; (2) general education; (3) vocational education; and (4) higher education (Duggan, 2001). This system was highly fragmented and has since been revised to enable significant growth in general secondary education. Primary schools and lower secondary schools were combined, and these systems have now become separate. Despite many improvements to the education system during this period, severe funding shortages constrained the size and quality of the education system. The fourth wave of reform began in 1986, with the passage of the major national reform 'Doi Moi,' a major national reform that switched the country's economy from a centrally planned system to socialist-oriented market. The biggest achievement in this period was the general expansion of universal education; within the first nine years of the reform, general education grew to 98% enrollment for primary schools and 84% for lower secondary schools (MOET, 2020). Higher education also witnessed a period of growth, with the number of postsecondary students tripling from 1998 to 2011 (Duggan, 2001).

Politically, Vietnam is a socialist country. Central legislative authority rests with the National Assembly of the Socialist Republic of Vietnam, and executive authority rests with line ministries and agencies. At the local level, each tier of government has People's Councils and People's Committees for the conduct of provincial legislative and executive authority. The implementation of Resolution 29 was significant in terms of unifying the objectives of Vietnam's central governing body, the National Assembly. Fundamental and comprehensive changes in education often require changes in political viewpoints, and require coordination between ideas and people, stakeholders and resources, politics and political implementation. Since educational change impacts all levels of society, reform also often results in changes in political leadership and/or administration. As stated in the Resolution 29, “Education is the top priority, the cause of the Communist Party, the Government and the people.” Despite this stated emphasis, the Resolution also acknowledged the government’s shortfalls in reaching its stated mission.

Indeed, the Resolution attributed weaknesses in the existing educational system to political and administrative shortfalls. The Resolution emphasized that strengthening political leadership goes hand in hand with effective policy execution and called for stronger involvement of the Communist Party in the education system. Politically, the reform represented a unifying force between government and society, connecting the aims of education with both the State and the people.

The current economic climate in Vietnam is robust, and favorable for sustained investment in education. Since the *Doi Moi* era in the 1980s, strict commitment to macroeconomic stability and extensive market reforms have helped the country to achieve rapid and inclusive economic growth (IMF, 2017). To facilitate modernization, there has been a labor market shift towards high-skilled jobs. As we will see, Resolution 29 sought to expand economic investment in Vietnam’s education system and to suggest policies for training the labor force. In the lead-up to Resolution 29, education was reprioritized as essential for both social and economic development and as a vehicle for supporting *Doi Moi*.

Geographically, the size and shape of Vietnam has had a substantial impact on its demographics. The population is unevenly distributed from one region and province to another, with the greatest number of people living in the cities. Urbanization is on the rise, primarily fueled by migrations in the population cohorts of students and working age individuals, who move to the cities in search of education and job opportunities in more dynamic economic zones. The average annual population growth rate in urban areas from 2009 to 2019 was 2.6% per year, over twice as high as the average annual national population growth rate, and nearly six times higher than what was observed in rural areas (MOET, 2020). These disparities in population density across the country have a direct impact on school organization and related operating costs (MOET, 2020).

Furthermore, migration trends in the country are currently balanced by population shifts, including a demographic transition and declining population**.** From 2009 to 2019, the percentage of total population within the 15–65 age-group declined by 1.1%, accounting for 68.0% of the total population. Based on the same 2019 data, the proportion of the population under 15 years old and 60 years and older represented 24.3% and 7.7%, respectively (MOET, 2020). While these relative cohort sizes create a demographic window of opportunity for the country (one working age person for half a dependent) it also results in a ‘thinned’ population pyramid at the lower tiers—meaning that, alongside increased life expectancy rates and lower fertility rates, the country will have a large aging population to care for in the future. While a shrinking population eases the overall pressure on the education system and allows Vietnam to benefit from a positive demographic dividend in the immediate context, the shift presents major challenges for the future.

Socially, Vietnam has experienced significant improvements in key social indicators over the last decade, creating a particularity conducive environment for educational demand. However, stark regional, ethnic, and socio-economic disparities prevail, ultimately affecting schooling systems. Rates of poverty in the country dropped precipitously from the period of 2002–2018, falling from over 70% to less than 6% (MOET, 2020). Literacy rates have been on the rise, with the most recent censuses indicating that around 96% of all Vietnamese people aged 15 and over can read and write (MOET, 2020). Vietnam has also made remarkable achievements in health care and disease prevention, especially for children; this is reflected by infant and maternal mortality rates, which have rapidly decreased in the last two decades (MOET, 2020). These markers of increased quality of living have created a fertile environment for the Vietnamese education system.

5.3 The Reform

We can identify five major problems when assessing the Vietnamese education system before 2013. This analysis is based largely around internal reports obtained from the Vietnam Ministry of Education and Training.

The first problem is that Vietnamese education is still heavy in theory, and there is a lack of practice. This is true across grades and subjects, in which teachers and students focused more on rote learning rather than actual understanding. In addition, high-stake exams have led to teaching and learning that revolves almost entirely around exams, rather than imparting skills and lifestyle ethics to students. The concept of “comprehensive education” has not translated into school practice. Ineffective career-guidance programs have also led to a high dropout rate in high schools.

The second problem conerns equity. Vietnam has done a great job in improving equality in education but there are still many things that remain to be done. Vietnam has achieved the goal of universal primary education since 2000 and universalization of lower secondary education since 2010. There is no gender inequality in access to basic education (primary and lower secondary education department). Enrollment rates for ethnic minority students and children with special needs were quite good at the primary level but fell sharply at the secondary levels. In provinces with difficult conditions, the percentage of students continuing to study after lower secondary school is very low, affecting the quality of local human resources.

The third problem is that Vietnam’s education system is fragmented and poorly connected. The lack of linkage between levels and levels of education makes it difficult to separate flows. Formal education and continuing education are also disconnected. The national qualification framework between training levels has not yet been established.

The fourth problem is the outdated teaching and assessment methods. Teaching and learning methods are mainly on transmission of knowledge, which cannot promote initiative and creativity in teachers and learners. The existing forms of assessment only focus on results and knowledge, rather than assessing the progress and capacity of learners. Students are participating in plenty of summative assessments but not so much on formative feedback.

The fifth problem is the administrative mechanism of education. Provisions on decentralization between central and local levels are not clear. Educational institutions, especially higher education institutions, do not have appropriate mechanisms for autonomy.

The final issue is the lack of quality teachers and administrators. In recent decades, the supply of teaching staff in Vietnam has been insufficient in both quantity and quality to keep pace with the demand of institutions and students. Given the size of the sector in 2012, it was estimated that the system had a shortfall of ten thousand teachers. Besides, the quality of teachers and administrators also shows signs of decline. For a long time, teacher education did not attract good students. The cut-off for entering universties of education are relatively low, leading to poor quality new teachers. Quality was an even greater issue within high education facilities, with less than 20% holding a doctorate in the same year.

The shortage in quantity and quality of teaching staff can be explained by the consistently low income in the education sector. Even though the largest share of government expenditure on education is put towards staff compensation—which is common in the education sector, where teachers make the biggest percentage of state officials and are prioritized by the Government in terms of welfare and benefits—the average monthly salary of educators in Vietnam were not competitive when considered against workers from other sectors.

Given the transitional context of the Vietnamese economy within worldwide movements towards globalization, another comprehensive reform was pivotal to the country's socioeconomic development. Thus, a theory of action for the 2013 educational reform addresses these five problems, building off weaknesses to create opportunity. The fundamental and comprehensive education reform in Vietnam thus creates an environment for positive change in Vietnam generally, equipping the young generations with the tools to advance socio-economic development into the future.

5.3.1 Key Solutions

Broadly, Resolution 29 proposed eight key solutions to address the challenges affecting the Vietnamese education system: (i) Enhancing innovation in education management; (ii) Promoting teachers and education managers' development; (iii) Innovating content and teaching methods, examination, testing and education assessment; (iv) Increasing investment of resources and renewing education finance distribution mechanism; (v) Strengthening the linkage between universities and the labor market as well as scientific research and technology transfer to meet societal needs; (vi) Fostering educational development for disadvantaged areas, ethnic minorities and social policy beneficiaries; (vii) Promoting education science; and (viii) Expanding and improving the effectiveness of international cooperation in education.

5.3.1.1 Enhancing Innovation in Education Management

Resolution 29 implemented several key reforms in state and educational management. Some of the main policies included administrative decentralization, especially by allowing local educational agencies to participate in deciding the personnel, finance, and administration of institutions of preschool education, compulsory education, and vocational education.

5.3.1.2 Promoting Teachers and Education Managers' Development

To keep pace with the demand of institutions and students, Resolution 29 determinedthat the teaching force should be increased at all levels, and teacher professional development should be emphasized. Since most teachers in Vietnam were undertrained to practice the changes in curriculum, pedagogical methods, and testing that were put in place with the educational overhaul of Resolution 29, Vietnam has developed various teacher training programs via in-site training courses as well as online platforms (WB, 2016).

5.3.1.3 Innovating Content and Teaching methods, Examination, Testing and Education Assessment

Resolution 29 made important statements regarding the purpose of education, especially in terms of aligning Vietnam with twenty-first century goals. The reform emphasized the importance of educational innovation at all levels, from system down to individual. It addressed social and emotional learning (SEL), soft skills, and civic learning, and promoted policies to develop "personality, ethics, lifestyle, law, and citizen's awareness." Social and emotional learning is an integral part of effective schooling at all levels and has become a cornerstone of educational reform worldwide in the last decade. Resolution 29 recognized and emphasized the importance of SEL, attempting to orient education towards valuing learners' capacity and personal qualities. Cultural learning was stressed in the reform, especially in terms of aligning educational goals with fundamental cultural values (including Marxism and the ideology of Ho Chi Minh) and traditional customs and morality. Provisions for physical education, civic education (national defense and security), and practical education (career advice and financial knowledge) were also reaffirmed.

Resolution 29 prioritized revamping educational assessments at all levels of education. Some of the policies included within this general reform effort included: (1) Reducing pressure for exams in secondary schools, especially those designed for admission to vocational schools and universities; (2) Improving the assessment methods associated with vocational education institutions, including by enabling employers to participate in the evaluation of training; (3) Changing the structure and content of university admission examinations, especially by combining entrance exams with school records and incorporating measurements of SEL, technical skills, and organizational abilities within admission papers; (4) Using international programs of assessment to help gauge the success of the education system, from the level of the country as a whole down to each locality.

5.3.1.4 Increasing Investment of Resources and Renewing Education Finance Distribution Mechanism

In many parts of the country, especially impoverished and rural areas, schools were under-resourced. Resolution 29 emphasized the importance of improving resourcing and increasing government expenditure in education across all levels. For preschools and compulsory secondary education, the State committed to raising investments in the development of public educational institutions and encouraging the development of non-public schools to satisfy demands.

The Resolution called to increase funding for higher education and vocational training as well, setting targets for investment based on economic-technical norms and quality standards of education services. Beyond increasing government expenditures, the Resolution called for intensifying private sector educational involvement, especially for vocational education and higher education. By increasing economic competition in education, all learners, employers, and educational institutions would be held to higher standards.

5.3.1.5 Strengthening the Linkage Between Universities and the Labor Market as Well as Scientific Research and Technology Transfer to Meet Societal Needs

Since the *Doi Moi* era beginning in 1986, Vietnam has experienced rapid and inclusive economic growth (IMF, 2017). To maintain this growth, Resolution 29 emphasized the importance of keeping education in step with economic development. As such, the reform instituted policies to connect education with labor market demands. Some of these policies included rearranging and connecting the network of vocational and higher education institutions, choosing uniform standards for training levels and qualifications, and orienting institutions of higher education towards scientific and technical research, application and practice.

5.3.1.6 Fostering Educational Development for Disadvantaged Areas, Ethnic Minorities and Social Policy Beneficiaries

In large part due to the geography and demographics of the country, educational disparities along socioeconomic, ethnic, and regional lines persist in Vietnam. Ethnic minorities, children living in underdeveloped areas, poor families, families with many children, and families whose parents have a background of lower educational attainment tend to be more vulnerable or at risk to fall into the educational wayside. Children from disadvantaged at heightened risk of not being ready for primary school than their better-off peers, and often do not have the same resources to succeed once within the system. Resolution 29 sought to address these educational inequities by promoting investment, expanding educational access, and developing specific policies for the vulnerable groups.

5.3.1.7 Promoting Education Research

To help Vietnam meet the demands of modernization and industrialization, Resolution 29 emphasized the importance of promoting research into educational best practices. The reform implemented policies to raise the quality and effectiveness of scientific and technical research on education, especially in the context of pedagogy and administration. On the budgetary side, these policies centered on increasing investment for institutions of higher education, combining training and research, connecting institutions with businesses, and prioritizing the development of laboratories/technological centers/experimental facilities. To encourage the development of attitudes conducive to a scientifically minded society and education system, Resolution 29 suggested introducing "policies [that] encourage students to do scientific research.

5.3.1.8 Expanding and Improving the Effectiveness of International Cooperation in Education

International cooperation in education is becoming increasingly important and prevalent in today's globalized world. In recognition of this, Resolution 29 implemented policies to help Vietnam exchange best practices with other nations, and to connect the Vietnamese education system with the resources of an interconnected world. Among these policies, Resolution 29 provided for more government-funded overseas training in the sciences and in research, encouraging the increased use of foreign training institutions for higher education and vocational education.

5.3.2 Major Goals

Beyond these eight major policy directions, the Resolution also targeted specific aspects of reform at each level of the education system.

For preschool education, the major goals of the reform were to help children develop their physical, mental, and emotional health, and to prepare children for the early demands of primary education. The reform also set several benchmarks, including universal completion of primary education for all five-year-old children by 2015, exempting all tuition fees by 2020, and standardizing the system of preschools.

For secondary education, Resolution 29 emphasized SEL and healthy physical habits, the formation of personality and civil capability, and early career advice. The Resolution also looked towards improving social and cultural education in secondary schools, with an increased focus on teaching ideals, traditions, ethics, lifestyles, foreign languages, information technology, practical skills and ability to apply knowledge to life. In terms of concrete benchmarks, the Resolution set several interconnected goals: ensuring that all enrolled students graduated from junior high schools by 2015, the quality of secondary education was raised and made compulsory (for at least 9 years) by 2020, and that 80% of adolescents over 18 years of age completed secondary education or equivalent by 2020. Finally, the reform emphasized that all high school curricula incorporate some aspect of vocational guidance, to help prepare students for careers post-graduation.

For vocational education, the reform not only focused on developing a more skilled labor force, but also emphasized "Cultivating the gifted, and developing learners' personal qualities, creativity, and ability of self-learning Furthermore, it sought to expand the network of occupational and vocational schooling within institutions of higher learning, and to diversify technology and training for all professions. Finally, in terms of continuing education, Resolution 29 made an explicit effort to increase educational opportunity across all demographics and regions of the country—especially for those in rural and low SES areas, and for the beneficiaries of incentive policies. The reform emphasized the importance of lifelong learning and helping older cohorts to develop knowledge via continued education (in all forms) and improve professional skills and life quality. These goals were held as essential to enable workers to change career paths, and to ensure continued national and regional economic development.

5.4 Implementation Analysis

In this section, we will analyze the implementation of Resolution 29 to identify the strengths and weaknesses of education policies in the post-resolution period of Resolution, through the lens of Professor Fernando Reimers' Five Perspectives: Cultural, Psychological, Institutional, Political, and Professional (Reimers, 2020).

5.4.1 Cultural Perspective

The educational approach through a cultural perspective will be realized by comparing educational goals with social needs, focusing on the role of education in socioeconomic development, as well as expectations of how schooling fits into larger societal contexts (Reimers, 2020). Vietnamese society has a tradition of attaching importance to learning. Vietnam has always been appreciated for creating a positive learning environment, ensuring school discipline, and helping students have good learning attitudes. The participation and encouragement of young people from parents and students are also positive factors in forming a learning society (WB, 2020). Besides, Vietnamese society always has high expectations for education. Although Vietnam's education has made achievements that are highly appreciated by the international community, comments on the level of people's satisfaction with education on the mass media are still not commensurate. With such cultural characteristics, Resolution 29 has received the attention and support of the entire society.

From another angle, education in Vietnam is still very heavy on exams and academic achievement. As it stands, entrance exams for transfer classes, entrance exams for selective schools, and university entrance exams are reported to be quite stressful. In general education, the race and competition take place right from the moment children prepare for Grade 1. Throughout subsequent levels of education, the competition only becomes fiercer, often requiring auditions among candidates and schools. Consequently, students are overloaded with academic assignments and filled with pressure (Hoang, 2018). For such reasons, in the system of very comprehensive solutions for Resolution 29, assessment reform is chosen as the breakthrough solution. This solution is expected to be the trigger to solve the bottlenecks of the system (CCCP, 2013). However, the innovation of exams and assessment also faces many challenges when it directly affects the interests of many people.

As a result of these intense pressures to achieve, there is considerable dishonesty rooted in the education sector. The phenomenon of cheating in the high school for higher grades in graduation exams is cause for societal worry and frustration. Innovations in testing methods and technology application have helped detect large-scale score fraud in 2017. With the determination of the Ministry of Education and Training and authorities, many educational administrators in some localities were disciplined and some were criminally convicted. However, we did witness that the exams in the following years were held stably and transparently, regaining trust from the society and people (MOET, 2020).

5.4.2 Psychological Perspective

We now look at education through a psychological perspective and attempt to evaluate student learning using science (Reimers, 2020). Vietnam has performed well in increasing access to education through universal education at the primary and lower secondary levels. The quality of education is also praised from the perspective of international assessments and international science Olympiad results (Kataoka et al., 2020). However, there are concerns about how teaching and learning at schools in Vietnam tend to convey knowledge through rote learning. Students are said to be taught to memorize knowledge, instead of being shown how to *apply* knowledge. It has been stated that Vietnam Education is very good on paper, but good exam results alone will not prepare pupils for the next industrial revolution (Reed, 2018).

These issues have been clearly identified by Resolution 29, which aims to educate Vietnamese people with characteristics and competencies that match Vietnam's rapid development (CCCP, 2013). An important component of the innovation is to build a new general education curriculum, moving from a knowledge-based curriculum to a competency-based curriculum. The process of building a new curriculum has been implemented since 2016. By the end of 2018, the Ministry of Education and Training has officially issued a new general education curriculum that fundamentally changes the approach from "according to content" towards "developing characteristics and competencies". The new curriculum is also well-built based on the application of educational science, ensuring vertical connectivity between the levels in the same subject, horizontal connection between subjects in the same class level, and is aligned to the physiological development of learners.

Another point to note in this reform is that the new policy "one curriculum—many textbooks" is applied for the first time. For the past 45 years, Vietnam has pursued the policy of a unified national textbook. This approach helps to ensure the background quality of the education system, but also perpetuates some inadequacies; specifically, teaching and learning remain too attached to textbook materials, rather than encouraging new knowledge or skill acquisition. The new policy is implemented with two goals. The first is to encourage teaching and learning in schools without textbooks, thereby unleashing the creativity of teachers and students in teaching. The second is to prompt schools and localities to actively build practical teaching plans which are suitable to their own needs and expectations (Le, 2020).

Although the curriculum was officially applied in the 2020–2021 school year, the elements of educational methodology, teaching, and assessment have been partially applied at all levels, bringing impacts to teaching and learning in general education (Nguyen et al, 2020).

5.4.3 Institutional Perspective

An institutional perspective requires identifying the norms, structures, organizations, and elements of the system that can enhance education (Reimers, 2020). Determining of the role of existing institutions is an important step in the implementation of Resolution 29. The Ministry of Education and Training is the key player in reform implementation, alongside all relevant departments. Because the scope of Resolution 29 is very wide, with many large projects implemented synchronously, it also reflects limitations in the management capacity of the relevant departments. For example, work of the Renovating General Education Project (GREP) funded by World Bank has been postponed for nearly 2 years, with many tasks cancelled due to limited capacity of the Project Management Board (Duong, 2020).

Considering these limitations, a very strong decentralization mechanism is essential for ensuring consistency in implementation. The provincial Department of Education and Training has a very significant role to play in ensuring the success of the reform equitably. It should be noted that many levers are decentralized to localities—including the management of teacher and the allocation of resources for education—to ensure that the conditions for implementation are met. For example, in primary education, the new general education school requires that all elementary schools offer 2 sessions per day. This direction is suitable to meet the real needs of families. However, only about 65% of localities can meet the conditions for teaching 2 sessions per day. The remaining localities should have a reasonable budget allocation plan to meet the minimum conditions soon (IMF, 2017).

Pedagogical universities also play important roles in curriculum development, teacher training, and preparation. Pedagogical universities are beneficiaries of the Enhancing Teacher Education Project (ETEP). The ETEP project is sponsored by World Bank, with a total investment of up to 100 million USD and the aim of strengthening capacity for 8 pedagogical universities in point (ETEP, 2019).

The commitment to coordinate a range of key stakeholders from central to local in education and related disciplines demonstrates a strength of the Ministry of Educational and Training. However, further studies also suggest that this perspective was challenged because of the limited capabilities of enforcement agencies, as well as the ability to effectively connect between different agencies, even within the Ministry of Education and Training. This restriction will present a major challenge to the long-term goals of the reform.

5.4.4 Political Perspective

The political perspective describes how various groups' interests must be addressed and considered in the development and implementation of reform (Reimers, 2020). Comprehensive reform through Resolution 29 comes from the highest level, the Central Committee of the Communist Party of Vietnam, followed by Resolution 88 of the National Assembly of Vietnam on innovation. programs and textbooks. In many cases, however, political interests will have strong effects on the implementation of reform and may override the educational interests of students and parents (Reimers, 2020). This is unavoidable and must be carefully analyzed to minimize conflicts of interest during implementation.

Further analyzing the implementation of the "one curriculum—many textbooks" policy, we can clearly see the difficulties in this perspective. This policy affects the textbook industry, which has been monopolized for more than 50 years in Vietnam. After the curriculum was approved in late 2018, the competition between textbook publishers increased. The original plan was that the RGEP Project would undertake the construction of an official set of textbooks for the Ministry of Education and Training, and publishers would build other series of textbooks to expand the choices for students. However, there are conflicting opinions regarding this implementation.

On one hand, there are many concerns that the Ministry of Education and Training should not be related to the compilation of the textbooks. This work should be left entirely to the publishers. This approach will create a fair game among publishers. On the other hand, there are also many concerns about the need for an official set of textbooks disseminated by the Ministry of Education and Training. In the early years of implementing the new policy, this is a safe solution to ensure the quality of textbooks that prevents reliance on commercial publishers. In the media, lawmakers are constantly putting pressure on the cancellation of the "one curriculum—many textbooks" policy. These pressures have significantly affected the implementation process, as the RGEP project failed to fulfill its initial mission of building an official textbook set (Ha, 2020).

Despite many such difficulties, the process of reforming curricula and textbooks has had initial successes. By the end of 2019, the Minister of Education and Training has approved 5 sets of Grade 1 textbooks, with a total of 46 books in 9 subjects and educational activities allowing use in the school year 2020–2021. The selection of textbooks is implemented openly and transparently by localities (MOET, 2020).

5.4.5 Professional Perspective

The professional perspective assesses how well teachers and administrators prepare for innovation, in terms of both conceptual and procedural knowledge.

In 2018, the Ministry of Education and Training issued professional standards for teachers and principals of schools and lecturers at pedagogical universities, to improve the quality of the workforce in the education sector. The Enhancing Teacher Education Project has built 9 training modules for teachers at each grade level (elementary, middle, high school) to develop professional competencies, to meet the professional standards of teachers and to meet the requirements of the new general curriculum (DTA, 2019).

With respect to qualification standards, most teachers and educational administrators at all educational levels have met the standard or higher (the percentage of teachers meeting the standard and above standard for kindergarten is 96.6, 99.0% for teachers at junior high schools, 99.6% for teachers of high schools, and 82.7% for university faculty) (MOET, 2020). This is an important basis for the Ministry of Education and Training in proposing raising training qualifications for teachers in the new Education Law 2019.

From an interview with Associate Professor Nguyen Xuan Thanh, Director General of Secondary Education Department, for the Ministry of Education and Training, we can see that the biggest obstacle that teachers must overcome in reforming the education system is psychological in nature—after all, the core information teachers impart remains basically unchanged, and while teachers have been instructed in new pedagogical methods they still lack specific knowledge and skills that are subject specific, that provide appropriate pedagogical competencies within each subject, and allow them to implement instructional tasks and approaches to assess students' knowledge. These should be the focus of professional learning communities for teachers in the coming period. The Director General of Secondary Education also mentioned that the "MOET will also be issuing guidance on professional learning communities and renovating teaching methods and assessment according to the competency-based approach. Our purpose is to raise the quality of professional learning communities at schools, particularly innovative teaching and assessment methods, as well as helping school leaders and teachers to actively select and develop topics and materials, taking the competency-based approach."

5.5 Reform Outcomes

In the last seven years since the implementation of Resolution 29, Vietnam's education has seen many encouraging results. The results can be categorized in terms of the eight main policy thrusts mentioned earlier.

5.5.1 Enhancing Innovation in Education Management

Since the 2013 reform, the Education Ministry of Vietnam has implemented several additional reform laws, which are outlined in the 2020 report *Evaluation of implementation of the 2011–2020 education development strategy* (VNIES, 2020) Since one of the major thrusts of this chapter is exploring the impact of the Resolution 29, noting these recent amendments is necessary for us to mark the changes in the Vietnamese education system.

The National Assembly promulgated the Education Law (amended) in 2019 and the Higher Education Law (amending and supplementing several articles) in 2018. The Prime Minister issued the National Education System towards openness, continuity and lifelong learning. The Prime Minister promulgated the National Qualification Framework to ensure the equivalence of training levels and qualifications. However, the system of legal normative documents on education is not consistent. There are still contradictions and overlaps between sub-law documents (VNIES, 2020).

McAleavy, Ha, and Fitzpatrick identified a policy delivery challenge in Vietnam education system. Primary schools and lower secondary schools are supported and monitored by a district-level Bureau of Education and Training, whereas government high schools are supervised in a similar way by a provincial-level Department of Education and Training. Education department officials are expected to explain policy to schools and provide both support and monitoring to ensure fidelity of implementation. According to the regulations, the process is simultaneously both 'top down' and 'bottom up.' Under the circumstances, management in schools becomes rigid, inflexible, and inactive (McAleavy et al., 2018).

In a recent policy note (WB, 2020), the World Bank also offered an in-depth analysis and assessment of Vietnam's higher education system, thereby giving recommendations on policies to promote higher education system governance. They stated that the higher education system in Vietnam is highly fragmented across many dimensions, including: (1) Vietnam does not have a single body responsible for the entire tertiary education and research system, (2) the existence of several hundred public research institutes operating independently from the universities, (3) multiple by-laws issued in recent years are seen as contributing to the complexity, fragmentation and inconsistencies of the regulatory framework, (4) the role played by MOET in initiating reforms and setting the long-term vision is undermined by inadequate capacity, resources and information, (5) no unified higher education information management system (HEMIS), which hinders evidence-based decision-making from all stakeholders.

5.5.2 Promoting Teacher Professional Development

At the time of Resolution 29, most teachers in Vietnam were undertrained to practice the changes in curriculum, pedagogical methods, testing, and management put in place with the educational overhaul. In the hopes of addressing these issues, Vietnam has developed various teacher training programs via in-site training courses as well as online platforms (WB, 2016). However, after the first semester of implementation, there are still many shortcomings. Currently, teachers do not fully understand the innovation objectives and are not given preparation time (VNIES, 2021). To that end, we believe that the ideology around teacher training needs to be restructured.

As it stands, the MOET has enacted professional standards for teachers, school principals, and lecturers at pedagogical universities. MOET also proposed raising training qualifications for teachers in the new Education Law 2019. Specifically, primary school teachers will have to have a four-year university degree instead of a three-year degree as before (VNIES, 2020).

Some elements of teacher professional development have been successful because of Resolution 29, however. Teacher conditions remain quite favorable, with relatively low pupil to teacher ratios (PTRs) and class sizes that are lower than set standards, especially compared with OECD averages (MOET, 2020). National averages hide regional and provincial disparities. Teacher shortages are not evenly distributed across the country, with some shortages affecting disadvantaged regions more than other regions. Teacher shortage is particularly striking in primary schools offering 2 sessions a day and in upper secondary schools. There is also evidence that teachers are in short supply in kindergartens (MOET, 2020). As reported in an interview with Dr. Nguyen Thi Mai Hoa, Permanent Member of Assembly's Committee for Culture, Education Youth, Adolescents and Children, there have been substantial efforts in Vietnam to promote the guidance, implementation, and preparation of teacher professional development policies by the Ministry of Education and Training.

5.5.3 Innovating Content and Teaching Methods, Examination, Testing and Education Assessment

Major milestones during this period of education include the approval of a new competency-based curriculum, supported by The World Bank Group and launched in 2016. The curriculum was officially approved in 2018, and will be officially implemented from 2020 (MOET, 2018b). This new national curriculum aims to alter the outdated teaching and learning methods—which were formerly structured around the transmission of knowledge and memorization of facts—with technology-based education to equip students with hands on skills necessary for the twenty-first century. Compulsory subjects were reduced and complemented with optional and integrated subjects and theme activities (CPTC, 2018).

This is also the first time that Vietnam allowed the application of the policy of "one curriculum—many textbooks." However, the implementation in the first year met many difficulties. From the fact that teachers have not been fully trained, leading to incorrect understanding of the role of textbooks in the new program. After only 8 weeks, one of the textbooks was rejected by the public, and later discontinued. Content aside, the main cause identified was the inability of teachers to respond to reforms (VNIES, 2021).

Assessment reform at primary level is considered a highlight in the period 2013–2020. The MOET issued Circular 30 in 2014 and Circular 22 in 2016, which guide schools and teachers in innovating the assessment of students. Instead of evaluating the students based on the results, the comprehensive assessment aims to encourage and motivate students. The participatory assessment process is not meant to be compared to other students, but rather focuses on the progress in each student's performance. When launched in 2014, the process has been challenged due to concerns about the feasibility by public opinion, schools, and teachers. However, after two years of implementation, there have been obvious changes in primary education. The guiding principles of learning and teaching at primary schools now are what the students learned and what they could do, rather than their grades (VNIES, 2017).

The high school graduation examination and the university entrance examinations have also been radically renovated in the period of 2013–2020. To begin, the high school graduation examination and the university entrance examination have been combined, to become the national high school examination. The examination is held locally, to reduce, the burden of candidates who must travel to major cities to take university exams, thus reducing financial pressure on parents and society generally (Nguyen et al., 2020).

5.5.4 Increasing Investment of Resources and Renewing Education Finance Distribution Mechanism

One of the key elements of achievement in the Vietnamese education sector is the consistently high expenditure on education, and the focus on primary and basic literacy education to ensure universalization, which specifically benefits the less advantaged regions. Such investment has yielded positive outcomes, with the overall rate of return to schooling in Vietnam surpassing those of most nearby countries (Thanh et al., 2018).

The share of total public expenditure in the education sector has always been among the largest of social and economic sectors for Vietnam; the country also ranks high among East Asia countries, with top sharing of public expenditure on education, approximately equal to Malaysia's. Meanwhile, the figures for Singapore and The Philippines are about 2.5–3%, under 4% for Indonesia, Hong Kong and Japan, and 4.5–5% for Thailand and South Korea. It is worth noting, however, that these figures refer to the public expenditure as proportion of GDP only, and the total amount of education investment in Vietnam remains relatively low (Kataoka et al., 2020).

In recent years, the Vietnamese government's investment on education has been increasing, maintaining around 20% of total budget expenditures (GSO, 2016, 2017). However, the government expenditure on education, usually high at governmental central level, proved to be ineffective when spending autonomy was granted to local authorities. This is the result of the decentralization movement, whereby much of the responsibility of education decision making is shifted to provincial level authorities. In the recent higher education policy note by World Bank (WB, 2020), as of 2013, 64% of total expenditure on education was distributed by local government, whose spending priorities vary substantially across the country. This figure was not improved much in recent years (Viet et al., 2020).

5.5.5 Promoting Science, Technology and Innovation Performance

Despite remarkable progress in the quantity of research output, Vietnam remains at the bottom of benchmarking country list in the recent policy note by World Bank (WB, 2020). In terms of quantity, the number of citable documents per one million inhabitants of Vietnam is higher than that of the Philippines, but lower than that of Indonesia, Malaysia, and Singapore. In terms of quality and impact, Vietnam ranks bottom in the list.

Measures of technology transfer indicate that the contribution of Vietnam's universities to the national innovation system is also very low, at 1.24 patents per million of population, lower than that of Philippines (1.35), Thailand (3.16) and less than even 1% of China (233). On innovation capacity, Vietnam ranked 45th among 126 countries in 2018. This is an improvement of Vietnam from the rank of 64th in 2008.

According to World Bank report on Science, Technology and Innovation in Vietnam, this low performance is identified because of inadequate and inefficient financing, insufficient research talent, limited links to the global research frontier, low level university-industry linkage, and under-developed research/ICT infrastructure (WB, 2019).

5.5.6 Fostering Educational Development for Disadvantaged Areas, Ethnic Minorities and Social Policy Beneficiaries

To ensure equal access to educational opportunities, promoting universalization of general education matters. Vietnam achieved universal primary education in 2000 and universal lower secondary education in 2010. One of the greatest achievements of Vietnam's education over the past five years is the universalization of preschool education for all 5-year-old children. As of 2017, profound effects on the development of preschool education have been documented. Comparing to 2010, the school's retention rate has expanded rapidly, with the enrollment rates of 5-year-old children rising by 13% to reach 99.96% in 2017 (MOET, 2018a).

Vietnam has made impressive strides regarding gender equity in education. While participation rates by female students have always been approximate to male counterparts at all study levels, over the past few years, researchers have found a reverse gender gap in enrollment and attainment rates, particularly regarding upper secondary level completion rates. However, there are still disparities in the quality of education between students in different target groups, especially, for students of ethnical minorities and students with disabilities (Vinh, 2019).

Improving educational access for ethnic minority children is the first policy priority, to be implemented by strengthening current government initiatives. One major leverage point is improving high-quality early-childhood education programs, especially by assigning teaching assistants proficient in the local mother languages in the beginning years of primary school to help facilitate the transition for children who do not speak Vietnamese at home. Another major factor is providing financial support—including cash transfer programs to households, subject to school attendance—to encourage children to attend upper secondary school. The enrollment numbers of ethnic minority students decreased dramatically from primary to tertiary level. These low educational attainment rates towards higher levels of study also seemed to be more potent for some specific groups of ethnic minorities (Dang & Glewwe, 2018).

Despite efforts to support students with disabilities, the outcomes have not been improved, because of lower enrollment population at higher education. According to statistics from 2016 to 2017 by UNICEF and GSO, only 1% children with disabilities are in a special school/classroom (UNICEF & GSO, 2018). The percentage of schools with suitable infrastructure and sanitation facilities for students with disabilities are

2.9% and 9.9%, respectively. Even though a quarter of children with disabilities aged 2–17 live in poor households with schooling opportunity of 21% lower than those without disabilities, only 55.5% benefit from tuition fee reduction or exemption.

5.5.7 Promoting Educational Research

Moving forward, the question Vietnamese policy makers and educators must ask themselves should be how to prepare learners for a fast-changing context and required skills sets. An education environment that favors innovation and creativity, particularly focusing on the role of lifelong learning and sustainable development of learners, is fundamental. The evolution of such a system must be based on research-informed policies, particularly research in the field of educational sciences. According to a bibliometric analysis from Clarivate Web of Science database between 1991 and 2018 (Hoang et al., 2019), even though academic research output in education is rather underdeveloped, we can still observe an upward pattern over the last ten years, which signifies a fertile prospect for education in the country moving forward.

The Government has assigned the Ministry of Education and Training to lead the national research program on educational science in the 2016–2020 period. According to reports, 49 national tasks have been identified to support the implementation of the objectives of Resolution 29. These assignments have made an important contribution to a wide range of legal normative tasks. According to the report of the Office of Educational Science National Program (ESNP, 2020), dozens of monograph book and hundreds of scientific articles have been published, and hundreds of conferences and seminars have been held. The program is expected to continue implementing phase 2 from 2021 to 2025.

5.5.8 Expanding International Cooperation in Education

International cooperation in education has been strongly promoted in the period 2013–2020. The number of overseas students has steadily increased, about 8–10% annually. The number of foreign students in Vietnam also doubled during this period, from 11,000 international students in 2013 to 21,000 international students in 2018. The number of Agreement scholarships awarded by Governments of other countries to Vietnamese students has also nearly doubled, from 862 scholarships granted in 2013 to 1446 scholarships granted in 2019 (Ly & Marginson, 2019).

The size of affiliate programs is also constantly expanding, with about 35,000 people studying each year. The number of foreign-invested educational institutions has expanded, from only two foreign-invested universities to five universities in 2017. To date, there are 29 high schools with foreign investment. FDI projects in education are stable in terms of total investment. However, ODA and non-refundable aid to education have decreased in recent years as Vietnam has entered the group of low middle-income countries. Accreditation of affiliate programs, or foreign educational institutions, remains difficult. There is not much cooperation on credit recognition and conversion with regional and international countries. Therefore, there are still many shortcomings surrounding the recognition of diplomas (DIC, 2019).

5.6 Challenges

This chapter focused on three components in designing the future of teaching and learning from Resolution 29 onwards: pedagogy, assessment, and management. These three elements are interrelated in both function and implementation, and thus should be enacted in harmony.

5.6.1 Pedagogy

Pedagogy is an important component of an effective instructional core. Children's school readiness is positively correlated with high quality trained teachers and higher teacher class ratios (Reimers, 2020). Since teachers' professional development is still under resourced, we suggest reforming the training surrounding pedagogy in Vietnam. For the most successful TPD, teachers should share best practices and learn from each other both vertically and horizontally, in the form of professional learning communities. The higher the teacher training level and reputation, the lower the proportion of children who are vulnerable or at risk. Thus, there must be institutional, political, and professional support to make the necessary changes.

To support these changes, the psychological and cultural framework of teaching also needs to be shifted. We believe that through professional learning communities, teachers will be given safe spaces and opportunities to share and ask about their practice. These communities will empower teachers, by giving them more agency over their lessons. As teachers are the most important stakeholders of education reforms, strengthening the teaching force with strengthen the education system generally. Finally, since teachers' professional development is still under-resourced, we suggest reforming the training surrounding pedagogy. Here again, Vietnam could learn from OECD leaders such as Finland, Hong Kong, and Canada, which hold strict standards for training and selecting their teachers (Reimers, 2020).

5.6.2 Assessment

Vietnamese students at all levels are reportedly lacking in skills and motivation; according to the most recent ESA report, a non-negligible number of students report dislike for attending school or their poor learning capacities, as well as financial constraints (MOET, 2020). We believe that some degree of this pattern can be attributed to Vietnam's educational assessment system, which is still too heavily focused on results rather than processes, and further exacerbates the mismatch between education and practical market demands. With this in mind, we believe that the espoused goals and framework of Vietnam's education system should be changed. The objectives of education could be renovated to better fit the international standards of education, proposed by the OECD report. Rote learning should be abandoned and project-based learning, which suggests cooperation and innovation, should be emphasized more. In this case, we believe that cultural and psychological shifts (especially from parents and teachers) are important and will help to lead the Vietnamese education system towards accepting more formative assessments as opposed to summative assessments.

5.6.3 Management

Ultimately, the management of education (from the level of the Ministry of Education down to district level leaders or principals), the context of education (sociocultural environment, expectations, and norms), as well as the actual pedagogy of education must all come together cohesively to deliver results. Since no single part of this system can function without the other parts, spending on curriculum will amount to nothing without school leaders and teachers who can carry out the pedagogy. If the Vietnamese education system is to create successful training and policy for professional development, it will need continuous support from all institutional and political structures and key stakeholders. Empowering teachers and school leaders will be the most important effort in building on Resolution 29 into the future.

In addition, considering that decentralizing spending autonomy is proven to be ineffective in Vietnam, we suggest that Vietnam holds most of its budgetary power in the central educational authority. Compared with smaller or higher-income countries, Vietnam does not currently have the infrastructure to support breaking the federal budget on education regionally. We also recommend that Vietnam makes its spending more transparent; in countries like Finland, making educational costs publicly available has been proven to have positive results for public discourse and educational change (Reimers, 2020).

5.7 Conclusions

Education should be leveraged as an indispensable asset in confronting the many uncertainties that the future holds for Vietnam. Newly emerging challenges concern the quality of Vietnam's human resource base: the need for higher skill levels, foreign and Western languages, and IT competencies to function in an internationalized market and educational environment. In Vietnam's education policies since 2000, and especially with Resolution 29 in 2013, the dialogue around education has begun to reflect notions of a "learning society." This is a positive trend, which should be encouraged and supported.

Vietnam has been an emerging dragon in education for the last decade, in large part due to the ideologies and successes of Resolution 29. Moving forward, Vietnam can build on the strengths of Resolution 29, and tackle its limitations in the next round of reform. Vietnam has only more success yet to come. The dragon is only waking up.

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Chapter 6
Case Des Tout-Petits: Reforming Early Childhood Education in Senegal

Talla Cisse, Karen Ejiofor, Muna Malin, Amelia Thompson, and Yuan Zhao

Abstract Education systems around the world are grappling with how to respond to a significant global health crisis stemming from the Covid-19 pandemic. Under the leadership of President Abdoulaye Wade, in the early 2000s, Senegal undertook a significant educational reform that sought to address disparities in academic and health challenges faced by early learners. This chapter examines Cases des Tout-Petits, a reform targeting children 0–6 years old, through the lens of Fernando Reimer's five perspectives of educational change. This chapter offers insights to policy makers, researchers, educators, and program designers around the world interested in learning from a dual reform that dramatically shifted the early childhood development landscape in Senegal.

Abbreviations

ANCTP	National Agency of Cases des Tout-Petits
CTP	Case des Tout-Petits ("Children's Huts")

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ECD	Early childhood development
JICA	Japan International Cooperation Agency
MDG	Millennium Development Goals
MFPE	Ministry of Family and Early Childhood
PNDIPE	National Policy for the Integrated Development of Early Childhood
OECD	Organization for Economic Co-operation and Development
PDEF	Education and Training Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNDP	United Nations Development Project
UNICEF	United Nations Children's Fund
UNFPA	United Nations Population Fund
USAID	United States Agency for International Development

6.1 Introduction

The current global pandemic underscores the harsh intersection of global health and education policy; decisions that are made to protect global health are inextricably and more obviously tied to how to educate a citizenry and promote effective public health. For this reason, the exploration of Senegal's early childhood education system during President Abdoulaye Wade's tenure is of relevance as it was the first national education reform policy in Senegal that was largely driven by and tied to education access and health inequities. President Wade's vision of an education system that prioritized the health of its children offers lessons and opportunities for countries around the world redesigning education through a global pandemic.

Considering mass school closures beginning in the spring of 2020 impacting more than one billion students worldwide including millions of students in Senegal, governments have been grappling with how to reopen schools with health concerns in mind, especially pre-primary and primary schools.

On March 16th, Senegal became the first country in sub-Saharan Africa to announce the closure of all schools in its efforts to fight against the spread of COVID-19. This decision impacted approximately 8 million students, putting a strain on Senegal's weak healthcare and education infrastructure (UNESCO, 2021). Prior to the pandemic, Senegal's youth population was one of the world's most vulnerable due to many children disconnected from formal education. According to the Foreign Policy's COVID-19 Global Response Index, Senegal was ranked 2nd out of the 36 countries on global pandemic response despite its lack of doctors (7 for every 100,000 people) (Chakamba, 2020). The country is now wrestling with how to properly reopen schools while keeping health regulations at the forefront. Fortunately, the Senegalese government has experience delivering a dual-focus model that incorporates education and health.

In the early 2000s, President Wade sought reform efforts to tackle disparities in access to early childhood education and child health outcomes between rural and urban contexts. Towards this end, the early childhood education program, Cases des Tout-Petits (CTP), also known as "Children's Huts", was officially developed in 2006 by a decree creating the National Agency of Cases des Tout-Petits (ANCTP). President Wade aspired to build 28,000 hut-shaped structures that would become community-based spaces for learning and supportive services, including immunizations, specifically designed for rural children from birth to 6 years old (Turpin Bassama, 2010). His commitment to whole child development through advancing educational and health equity marked a progressive directional shift for education policy in Senegal. This reform inspired greater alignment between Senegal and the international community's interests in supporting early childhood development. We argue this reform is relevant because of its unique combination of education and health, which at its conception in the early 2000s, was not a global priority. As we consider designing twenty-first century education systems after a global pandemic, the findings of this research could lend itself well to existing and future early childhood development initiatives that embody a holistic approach. Furthermore, we argue this research informs a growing body of knowledge that considers the limitations of education reform through the lens of public health in sub-Saharan Africa. The ambitious nature of the reform and the subsequent challenges have demonstrated the additional capacity needed to fully implement reforms that have a dual focus.

This chapter investigates and reports the reasons that led Senegal to adopt CTP between 2000 to 2010, the motivation behind Wade's vision, an analysis of the reform through Fernando Reimers' five perspectives of educational change (Reimers, 2020), as well as its results and challenges. The analysis utilizes both quantitative and qualitative data from: (1) a review of literature, reports, and articles; and (2) interviews with Senegalese stakeholders such as the current United Nations Ambassador of Senegal, Cheikh Niang; Senegal's former Prime Minister, Dr. Aminata Touré; USAID representative and former national Education Inspector, Malick Diop; a current CTP Principal, Fanta Ndao, and a current CTP teacher, Nafi Guiro. At the inception of the reform, early childhood development was not standardized in Senegal. For this reason, this research encompasses early childhood development programming efforts that span a range of ages between 0 to 6 years old. While Senegal is currently going through a new iteration of CTP under the current administration of President Macky Sall, this work offers a critical assessment of the original model and its potential contribution in shaping early childhood education in postcolonial contexts and globally through a comparative lens.

6.1.1 Research Limitations

Due to a lack of adequate monitoring and evaluation from the agencies overseeing CTP, it was difficult to obtain information about academic performance as well as the long-term academic trajectory of children who have participated in CTP. Despite this limitation, we were able to collect sufficient information on other aspects of CTP through interviews with a range of stakeholders including current educators.

This limitation was minor in relation to the insights offered through these interviews and other sources.

6.2 Country Context Prior to the Reform

Senegal is a low-income country in West Africa. In 2001, about 56.2% of the population lived below $2 USD per day (Watkins, 2006). Senegal's human development index was 0.46 in 2005, ranking 156th out of 177 countries covered by the Human Development Index report according to the UNDP (Watkins, 2006). A moderate ranking on the Gini index revealed Senegal also had a wide disparity in income distribution and consumption (Watkins, 2006).

6.2.1 Developments in the Early Childhood Landscape

Amidst global economic turbulence in the 1980s, Senegal experienced stagnant economic growth and setbacks in education due to a growing population. Leadership reacted with an emphasis on primary schooling resulting in the marginalization of pre-school education (Rayna, 2003). In response to the decline in pre-primary outcomes, early childhood learning became a key feature of the "Ten-Year Education and Training Plan" introduced in the late 1990s and financed by the World Bank (Rayna, 2003). The plan was designed "to break the vicious cycle of poverty" (Turpin Bassama, 2010). This plan was part of the country's Education and Training Development Program (PDEF), which created the policy framework for education in Senegal. The plan had three main objectives: (1) create an education system that will cultivate productive Senegalese citizens aiding in the development of the country; (2) teach Senegalese values so every citizen can uphold the norms and customs of the country; and (3) be free and compulsory until the age of 16 (Rayna, 2003).

In 1999, an interdisciplinary team with expertise in education, nutrition and other fields produced the Study for Early Childhood Development; the report detailed the challenges facing Senegal's young children about education, health, and nutrition (Rayna, 2003). The report also recommended the creation of physical low-cost structures that were appropriate to and could fulfill a range of community needs (Rayna, 2003).

The election of President Wade marked a historic shift in the education trajectory of Senegal. In 2000, President Wade was determined to address the growing gaps in early childhood education by making it a top priority in his presidency (Toure, personal communication, 2020). In particular, he desired to offer support to children facing greater threats to social vulnerability and marginalization, such as those living in rural contexts and other areas lacking access to kindergarten and nursery school programming (Taniguchi, 2014). During that year, Senegal prioritized early childhood development as an outcome of the Declaration of the World Education Forum organized in Dakar by international organizations including UNESCO, UNICEF, UNDP, UNFPA and the World Bank (Taniguchi, 2014). The "Dakar Framework for Action" was developed to improve access to education, the quality of education and the management of the education system (Taniguchi, 2014).

6.2.2 Inequities in Early Education & Health

In 2000, children aged 0–8 years old represented 26.2% of the total population in Senegal (Turpin Bassama, 2010). Senegalese children faced tremendous educational challenges. Pre-primary school enrollment was less than 2.5% of children of the appropriate age at the start of President Wade's tenure in 2000 (World Bank, 2006). The World Bank reported disparities among rural and urban children and lower literacy rates than other countries in sub-Saharan Africa that posed persistent challenges to achieving educational equity and Millennium Development Goals (MDG) (World Bank, 2006). The enrollment rate was 4.3% in urban areas as compared to 0.3% in rural areas. Low quality and inequitable service delivery left youth lacking in opportunity and essential life skills (USAID, 2019). Under these circumstances, the government aimed to promote early childhood education, which could prepare children for future learning to reduce failure rates in later stages of education. Senegal aspired to raise the pre-school attendance rate to 30% and improve the quality of early childhood services by 2010 (Rayna, 2003).

The health outcomes among young children were also dire. In 2005, the under-five mortality rate was 119 per 1,000, and the rate of measle immunization was under 54% (UNICEF, 2013). The percentage of malnourished children (22.7% for children under 5 years old) was lower than the average for sub-Saharan Africa at 29.6% (Humblet et al., 2009). Disparities separating children in rural communities and cities were also a growing concern. For example, whereas approximately 80% of the urban population lived within 30 minutes of a health facility, only 42% of rural residents had similar access resulting in lower immunization rates and higher rates of infant mortality. Further, although under 5 and infant mortality rates were declining at an annual rate of 1.1% and 1.4% respectively (World Bank, 2006), these declines were significantly less than the 4.4% annual decline projected to help Senegal achieve the MDG (World Bank, 2006). CTP emerged from this context.

6.3 The REFORM: Cases Des Tout-Petits

Cases des Tout-Petits (CTP), also known as "Children's Huts," served children ages 0–6 years old from rural backgrounds and provided a space for learning and receiving supportive services (Turpin Bassama, 2010).

6.3.1 Symbolism and Value of the Huts

Huts were selected as the focal physical structure embodying the reform and are integral to understanding the symbolic, cultural and community-based aspects of the reform. These hexagon-shaped buildings had several rooms specially designed for different subjects of learning such as alphabets, literature, and mathematics (Diop, personal communication, 2020). The hut also contained a kitchen, infirmary, an office for supervisory staff, toilets, a food storage store and a landscaped courtyard for games and outdoor activities (e.g., small animal farm-raising and gardening) (Turpin Bassama, 2010). All huts were built from exported materials of high quality (Diop, personal communication, 2020). The shape and materials of the huts symbolized ancestral civilization and attachment to African values (Turpin Bassama, 2010). The costs associated with the building of one hut were considerable and estimated at 18,200,000 CFA (approx. $27,000 USD),[1] due to the imported building materials (Rayna, 2003). State governments were expected to construct the buildings while the local communities managed them. The architectural model was created by Archi-Art, and the architecture of a second generation of the huts was improved with support from the Japan International Cooperation Agency (JICA), Japan's international development agency (Diop, personal communication, 2020; Turpin Bassama, 2010).

6.3.2 Theory of Action

CTP's theory of action was as follows: If Senegal invests early in children's development, communities and cultural awareness, then children will be able to contribute positively to the Senegalese economy in the future. Further, the Ministry of Family and Early Childhood (MFPE) stated, "The State has chosen to invest in child capital to ensure its succession. Early childhood development in Senegal is not a social action, but a macroeconomic action which is at the heart of development through the enhancement of human resources" (Turpin Bassama, 2010).

6.3.3 Program Elements

Element 1: Supporting Holistic Development of Children

The CTP reform offered an integrated three-pronged service delivery model comprised of health, nutrition and education (World Bank, 2018):

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[1] All conversions of Senegalese CFA Franc into USD are based on 2002 conversion rates from World Bank, 2016.

(1) **Health**: Screening for health deficiencies and disorders in children, providing immunization, and giving hygiene education for children and parents

(2) **Nutrition**: Offering children balanced meals and educating parents about nutrition

(3) **Education**: Preparing children for primary school through activities centered on literacy, math, exposure to technology and building morality and cultural values by enlisting community members to support instruction.

Element 2: Mobilizing and Involving Children's Community

Community is at the heart of the CTP model. CTP was managed and supervised by self-elected regional bodies called preschool committees to ensure efficient operations on the local level (Humblet et al., 2009; Diop, personal communication, 2020). The local committee oversaw selecting key personnel and a formal principal was responsible for managing schools and hiring teachers (Diop, personal communication, 2020). The core actors of CTP included: (1) a "monitor" who has obtained a baccalaureate degree served as a multipurpose facilitator; (2) "assistant mothers" literate in the local language participated in the running of activities and supported facility cleanliness and distribution of meals; (3) grandparents as morality educators; (4) Quranic teachers responsible for religious instruction and (5) health workers who conducted immunizations for children (Rayna, 2003; Turpin Bassama, 2010). The role of family members as educators demonstrated the participation of the local community in supporting the whole development of children.

In addition, although the salaries of the employees, upkeep and management of the huts were funded by the state government (Turpin Bassama, 2010), the community was expected to make financial contributions, albeit symbolic, to maintain the service of CTP. Auxiliary staff was paid for by the community (Rayna, 2003). The purpose of community participation was to avoid overreliance on government support by conveying to the community that their active involvement was crucial to children's prosperity. This model took advantage of existing systems that already influenced children's development to meet community needs and to reduce operational costs.

Element 3: Incorporating Cultural Awareness

Cultural and moral education were key components of CTP. It enlisted parents and grandparents to teach local customs and to provide children with a foundation that rooted them in Senegalese values. Instruction in the local language was central to the transmission of cultural and moral education. Senegal is home to many local languages including Wolof, Pulaar, and Sereer. However, due to the influence of French colonization from 1895 to 1960, French is the official language of instruction in the school system, which has caused a gap between children's language of instruction at home and school. Quranic teachers were integrated into the educational model, which merged traditional religious education and formal preschool education. The inclusion of these non-traditional teachers reflected the commitment to make CTP culturally relevant. These actions built a connection between local cultural values and broader knowledge about child development (Soudee, 2009). This culturally responsive approach relayed to children that their ethnic and religious background were important for their development and demonstrated reverence to the national identity of Senegal.

6.3.4 Key Milestones in the Design and Implementation of CTP

In 2001, the oversight of CTP was transitioned to an autonomous ministry, MFPE and finally to the National Agency of Cases des Tout-Petits (ANCTP) (Turpin Bassama, 2010). In 2004, a meeting concerning CTP was held in Dakar. The participants included President Wade, his advisors, members of the Ministry of Family and Early Childhood (MFPE), the Ministry of Education, and the Ministry of Agriculture and Rural Equipment. The meeting covered core issues such as the model design, financial supply, and the management of CTP (Diop, personal communication, 2020). In 2006, a new "National Policy for the Integrated Development of Early Childhood (PNDIPE)" was adopted (Turpin Bassama, 2010). The implementation of this policy marked the start of the CTP program piloted by ANCTP. Until 2007, a total of 180 huts were built and operational throughout the country, and 106 of them were in rural areas (Turpin Bassama, 2010). Circa 2009, the construction of new CTPs gradually came to a halt due to the high cost of the construction materials (Diop, personal communication, 2020).

6.4 Implementation Analysis

This section analyzes the implementation and identifies strengths and weaknesses of CTP through the lens of Fernando Reimers' five perspectives: cultural, psychological, institutional, political, and professional.

6.4.1 Cultural Perspective

Approaching education through a cultural perspective entails aligning educational goals with societal needs; more specifically, the cultural perspective considers the societal expectations of education (Reimers, 2020). In the early years, Senegalese parents expect children to be immersed in learning customs and to begin Quranic study as a way of attaining cultural and religious knowledge. It is common for children to attend Quranic schools before attending primary school. One of the strengths of CTP that reflects a cultural perspective is that it mirrored broader Senegalese expectations and heavily emphasized Senegalese values. Another strength is CTP's incorporation of Quranic instruction which demonstrated the high regard of religious education of children in Senegal. President Wade wanted the huts to represent the home life of children. In the classroom, children sat on the floor, sang Senegalese children's songs and played traditional games (Rayna, 2003). The instatement of grandparents as key educators and conveyors of cultural values also displayed a commitment to the traditional knowledge transfer between elders and children. In contrast, CTP was also developed to shift health and hygiene practices; at the time, handwashing was not a common practice which contributed to the spread of disease.

CTP challenged the expectation that the government would be responsible for paying for educational services by expecting financial support from communities to build ownership of the model. Despite the strength of this community-ownership approach, this expectation was not sustainable considering the lower socioeconomic levels of most communities.

6.4.2 Psychological Perspective

Employing a psychological perspective in education considers the science of how students learn (Reimers, 2020). The rising population of children in the context of inadequate health services coupled with malnutrition contributed to deleterious living conditions for Senegalese children, especially in rural areas (Rayna, 2003). Undeniably, students learn best when they are healthy and well-nourished. This understanding undergirded the creation of CTP. It strived to provide meals to students to support their capacity to learn and focus on school (Niang, personal communication, 2020). The wellbeing of children was supported by maintaining an infirmary in each hut which administered health checkups and encouraged healthy habits, such as hand washing, to reduce the spread of disease (Taniguchi, 2014).

Additionally, CTP embodied the psychological approach necessary to ensure children can thrive at school. Attention was paid to what students learn and instruction was designed to be age appropriate. Classroom activities were play-based and included toys and Senegalese games (Rayna, 2003). Equally important, students learn best in a language that is familiar to them. Research shows that mother tongue instruction in sub-Saharan African schools is "the most efficient in imparting human capital," which lends itself well to the socio-economic goal of CTP's theory of action (Ramachandran, 2017). This corroborates the language design of CTP. Moreover, the assistant mothers, literate in the children's native language, were selected as an important actor of CTP. Although CTP adopted the unified national preschool curriculum, the home-like environment, specially designed learning spaces, and culturally sensitive multi-educator model of CTP offered students a favorable learning environment. Given the strength of the psychological perspective of some rural municipalities, children from CTP showed better performance in primary school preparedness than those attending traditional preschool (Diop, personal communication, 2020).

6.4.3 Institutional Perspective

An institutional perspective requires identifying the norms, structures, organizations, and elements of the system that can enhance education (Reimers, 2020). This perspective is essential in developing an efficient program. Mapping out existing institutions was one of the preliminary steps of Wade's administration. Some of the roles of Ministry of Family and Early Childhood (MFPE), regarding CTP, was to identify appropriate hut sites considering the established criteria (i.e., adequate water supply and location), find and train qualified staff, decide on the equipment required to build, and mobilize the community (Rayna, 2003). The role of managing CTP was later transferred from MFPE to the National Agency of Cases des Tout-Petits (ANCTP).

The stakeholders included the education and training inspectors, health organizations, nongovernmental organizations, the Nutrition Coordination Unit of the Government of Senegal, the Ministry of Education, and the Ministry of Health and Social Action (Diop, personal communication, 2020). Additional stakeholders involved were the Ministries of Environment and Public Hygiene, Health and Disease Prevention, Justice, and Culture and Communication (Rayna, 2003). The construction and funding of huts also engaged NGOs, governmental departments and corporations.

On the ground level, CTP depended on the participation of members of rural communities to function efficiently. CTP also relied on the effective coordination and delegation of tasks between the national, regional, and local authorities with an emphasis on community ownership. This structure was meant to support the sustainability of the model in shaping the delivery of early childhood services beyond a single presidential administration.

The commitment to coordinate a range of key stakeholders from education, health and civil society demonstrates a strength of the adaptation of the institutional perspective to CTP. Designing holistic programming with a dual focus for early learners necessitates such an approach. However, further analysis suggests this perspective was challenged by capacity limits. These limits constrained the likelihood of clear and efficient communication and participation among all stakeholders, the organization of clear and data-driven education and health metrics to support analysis, and the means to ensure all parties effectively implemented the reform. Therefore, the weaknesses in CTP's institutional perspective challenged the reform's overall and long-term success.

6.4.4 Political Perspective

The political perspective, as described by Reimers (2020), illustrates how various groups' interests must be addressed and considered during the design and implementation of a reform. Arguments have been made of the political forces that are powerful in shaping educational reforms and practice. As Reimers (2020) noted, political interests can often override the educational interests of students and parents. Political interests influenced the adoption of CTP. In April of 2000, through the World Forum on Education and the adoption of the Millennium Goals (MDGs), President Wade laid out an ambitious vision to improve early childhood outcomes. Implementation of that vision started with the launch of CTP.

Prior to this point, early childhood education was not a presidential priority. Thus, CTP became a politicized reform because of its association with President Wade. Even though the various departments involved in the reform established and shared similar goals, President Wade's control of the effort created barriers among the parties including education and health officials (UNESCO, 2006). For example, the ANCTP, created to manage the reform, was directly overseen by President Wade rather than one of the ministries. Ultimately, due to the politicized nature and visibility of the reform, urban and rural leaders faced pressure to adopt CTP models in their contexts (Diop, personal communication, 2020). Thus, the political pressure resulted in a shift from CTP's design to focus on rural areas. Along with local support, the Japan International Cooperation Agency (JICA), which had a history of working with communities throughout sub-Saharan Africa, was instrumental in providing financial and technical support to building huts in rural towns and villages in Senegal.

The active participation of diverse stakeholders highlights Reimers' (2020) definition of "consensus-building that influences a number of national specialists and community leaders that are in charge of implementing the policy." Lastly, due to the political realities and President Wade's fervor in adopting CTP, the planning committee failed to establish a financial plan, a discrete list of policy indicators for education and health outcomes, and a plan of action, the last two of which were prepared but not officially adopted (UNESCO, 2006). Thus, while the government adopted CTP in 2004, the Ministry of Education asserted in 2006 that the policy was yet to be "validated" (UNESCO, 2006) revealing that there were lingering disagreements about specific policy elements.

More recently, CTP remains one of the main vehicles for which early childhood health and academic services are delivered nationally. However, a primary challenge early childhood services face is prioritizing quality dual service delivery while effectively navigating political interests and coordinating across various entities mostly within the public sector, but also in the private sector (World Bank, 2017).

6.4.5 Professional Perspective

The professional perspective assesses the level of professionalization of teachers and other educators responsible for instruction and in the case of CTP, the delivery of health services. It also underscores the capacities and knowledge of educators (Reimers, 2020). Clarence Beeby, who led reforms to advance education equality in New Zealand argued that educational systems are characterized by the level of skill and professionalization of its teachers (Reimers, 2020). Senegal's well-intentioned, community-centered model attempted to prioritize teacher capacity and development, but there were insufficient support and results. While children were provided with a care-orientated model, they were often served by teachers with low education levels compared to higher income countries (UNESCO, 2017). It is generally understood that teacher quality is the greatest determinant of student achievement. Although there is a lack of CTP student outcome data, student achievement may have been negatively impacted by receiving instruction from monitors with low education levels. CTP educators were provided with government-led training. The ANCTP also provided facilitators, who served as monitor trainers, with two-month training experiences focusing on the objectives of the National Policy for Integrated Childhood Development (Rayna, 2003). This training was augmented by an additional six-month course in teacher training schools which elevated the professional status of these staff (Rayna, 2003). Other volunteer staff, such as assistant mothers, were literate in the local language and were expected to complete at least primary school education. These community members were required to participate in two weeks' initial training with inspectors and nutritionists to work in CTP (Rayna, 2003).

Pre-school education inspectors had a higher level of training and were appointed coordinators of the regional branches of the ANCTP. They supervised and trained personnel, as well as monitored and supervised CTP management committees. At the departmental level, the coordinators were supported by teachers called "focal points." Although progress was made in the professionalization of the teacher workforce, such as strengthening links across teacher settings to promote continuity in learning and focusing broadly on children's holistic development and well-being, additional strides were needed to strengthen the workforce. Current iterations of the model have improved regarding the professional perspective; the state now hires, trains and deploys teachers to CTPs around the country (Ndao, personal communication, 2020).

Regarding health, USAID (2013) has found in three sub-Saharan African countries, "offering nutritional education programs for women, particularly those with low levels of education, would help them attain better nutritional outcomes for their children." CTP was designed to encourage assistant mothers and grandparents to support academic learning and to be involved in operational activities including meal preparation. However, a specific focus on educating caregivers on child nutrition may have benefited children's long term health outcomes. While CTP has taken great strides in staffing huts with caring community members, increasing the professionalization of teachers with ongoing and standardized training and providing nutrition education to caregivers could lead to an improved social status of the profession and greater health and academic outcomes for children.

6.5 Results

Results of the reform can be grouped under three main categories: (1) academic enrollment and access; (2) child health improvements; and (3) community development and the social value of the child.

6.5.1 Academic Enrollment and Access

Access to equitable early childhood education in rural settings was a major facet of the reform. Enrollment in CTPs grew gradually during the reform period with a high pre-enrollment of girls who made up about 52% of preschool children (Diop, personal communication, 2020). CTP helped contribute to increased enrollment rates in pre-school education from 3% in 1999 to 13% in 2010 (Taniguchi, 2014).

Despite this improvement, pre-school education was still underutilized in rural areas (Taniguchi, 2014). By 2009, there were at least one early childhood development education option per 1,000 for 3–6-year-olds (UNESCO, 2010). However, service density was not equally distributed. In fact, in two primary areas, this density was doubled, Dakar and Ziguinchor, a southern region that at that time was reported to have the highest education rate (UNESCO, 2010). A UNESCO report highlighted the degree of inequity between early childhood institutions in rural and urban districts: the inequality indicator between regions is a ratio of the densest (Dakar where there were 2.4 options per 1,000 children) and least dense access options (Kaolack where there were 0.26 options per 1,000 children) (2010). Children in Kaolack were 9 times less likely to have access to early childhood development programming than children in urban settings (UNESCO, 2010). Although two-thirds of preschool-age children lived in rural areas, only 38% of early childhood institutions were found in these areas, while 62% were in urban contexts (UNESCO, 2010). CTP contributed to the overall access and availability of early childhood services throughout Senegal. However, these findings suggest there should be an analysis of the services needed to determine service density rather than decision-making based on political and/or public pressure.

6.5.2 Child Health Improvements

In 1999, a report described malnutrition as a significant public health problem attributed to 30% of all pediatric hospitalizations; additionally, chronic malnutrition was estimated at 19% (Rayna, 2003). Child mortality was shown as higher in rural areas and associated with mother's educational levels (Rayna, 2003). Child mortality rates were reported to have been 70 per 1,000 for the 0–1 age group, 81 per 1,000 for the 1–4 age group and 145 per 1,000 for the 4–15 age group (Rayna, 2003).

Against this backdrop, CTP helped to encourage improvements in health outcomes for children. UNICEF reported the underweight prevalence in children under 5 years old from 2008–2012 in urban areas was 11.8% compared to rural areas where the ratio was 21.3% (UNICEF, 2013). This finding suggested that a child in a rural setting was two times more likely to be underweight than in an urban setting (UNICEF, 2013). However, nationally mortality rates for children under the age of five continued to fall from approximately 118 per 1,000 children in 2000 to 75 per 1,000 children in

2010 (UNICEF, 2013). The provision of meals and immunizations as part of the CTP model affirmed these commitments. These measures help demonstrate how providing health services was a key pillar in supporting the holistic development of children even if disparities persisted between rural and urban areas.

6.5.3 Community Development and Social Value of the Child

Community development may be understood across two primary areas for CTP: structural development and human capital development. During President Wade's tenure, approximately 599 huts were created (Diop personal communication, 2020). UNESCO reported 37% of huts were fully equipped with multimedia equipment and games, while 97% had libraries. Additionally, in 2007, 36% of the 338 huts built and/or were in development were fully equipped to support outdoor play and 79% with indoor equipment (UNESCO, 2010). However, 599 huts were far lower than the president's initial vision of 28,000 huts. The ambitious nature of the reform coupled with the costs of each hut and challenges related to coordination impeded progress toward this goal.

Research suggests the CTP approach made best use of local human resources through in-community recruitment of staff for children's huts (Rayna, 2003). The integration of grandparents as support personnel alongside trained teachers encouraged the community-ownership design of this model. Additional use of local assets included the use of traditional games and local languages as well as "oral, written and religious traditions" (Rayna, 2003). A focus on whole child development became a national interest with the emergence of CTP. This reform helped Senegal embrace international standards related to child development and labor that protect the rights of children (Diop, personal communication, 2020). As a national Senegalese education inspector, who is now a USAID representative remarked, CTP helped society value children and provided practical support for mothers to help infants and toddlers overcome health and nutritional barriers to development (Diop, personal communication, 2020).

6.6 Challenges

Key challenges of the reform relate to (1) professional development and curriculum; (2) cost structure; (3) student achievement data; (4) coordination and (5) the student–teacher ratio.

6.6.1 Professional Development and Curriculum

In terms of health, the design of CTP necessitates staff who are multiskilled in identifying and treating a range of health deficiencies in children and who have been provided with the capacity to train mothers, grandparents and other community members supporting academic learning (Rayna, 2003). In educational terms, CTP encourages a range of skill sets among staff including—"creativity, socialization, openness to technology" (Rayna, 2003). This approach must therefore be reflected in staff, the curriculum used to guide instruction and professional development programming and resources. Though aspects of supporting early childhood development were included in training offered to staff, a need for training and curriculum that met each facet of CTP would support implementation with a higher degree of fidelity to the model's intentions. Dual capacity development is needed for each component of implementation including staffing, curriculum, training, monitoring, and programming.

6.6.2 Cost Structure

The cost structure of CTPs needed a more robust financial model to support its sustainability. It may reflect an over prioritization on the physical huts to the detriment of other key facets of an effective education reform such as staff training and development. In addition to 18,200,000 CFA (approx. $27,000 USD) for the building of a hut, 4,060,000 CFA (approx. $6,000 USD in 2002) was devoted to equipment, 1,648,000 CFA (approx. $2,500 USD) for staff, 500,000 CFA (approx. $750 USD) for training, 1,000,000 CFA (approx. $1,500 USD) for monitoring and evaluation (Rayna, 2003). Additionally, Senegal required financial support from international bodies including JICA (Diop, personal communication, 2020). Although the state was responsible for constructing huts, local communities and parents were responsible for a range of costs including school supplies and meals (which are currently 2,000 CFA (approx. $3 USD) per month for parents) (Ndao, personal communication, 2020). However, many families lack the financial means to adequately support the operations of local educational structures. Recent budget cuts have resulted in reduced hours for key staff including teachers, custodians and cooks (Ndao, personal communication, 2020). Therefore, model fidelity has been challenged. Over time, reductions in funding resulted in limited and insufficient resources for appropriate monitoring and evaluation programming to assess the effectiveness of the reform and its projected impact on future generations of Senegalese children.

6.6.3 Student Achievement Data

There are limited data monitoring, evaluation, and performance management structures in Senegal. While anecdotal evidence may suggest there were positive impacts of CTP on children in rural communities (Diop personal communication, 2020), more robust structures are needed for empirical analysis and adequate evaluation. The primary goals of CTP were to reduce inequities in early childhood access and health between rural and urban communities. For this reason, data that helps compare enrollment, mortality and immunization rates among 0–6-year-olds help assess how CTP functioned to move Senegal toward greater equity in these areas. However, student level achievement data is needed in considering the efficacy of CTP as an education reform. Limitations in funding and coordination precluded the likelihood of collecting student level data and the potential for longitudinal study of the reform. This data could be useful in evaluating how effectively CTP has helped prepare Senegalese early learners for matriculation in upper grades and successfully enter and contribute to the labor market (Rayna, 2003).

6.6.4 Coordination

Historically the scope of early childhood learning in Senegal has been fragmented. Yet, the successful adoption of the CTP model required a highly cohesive coordination among various stakeholders. A more systematic and ongoing review of all the functions of the various stakeholders and an accurate assessment of the human resources needed to effectively implement the work alongside a technical coordination mechanism would have benefitted implementation (Rayna, 2003). Additionally, each fractal of the coordination and technical arms could have included decision-making representatives from education, health and nutrition departments (Rayna, 2003).

Further, the multi-pronged model, though overseen by a separate government agency, lacked sufficient cross-agency coordination to support effective implementation. Early meetings of key staff were reported to consist of the three department heads and the head of the ministry but was inadequate in interconnecting the various projects while other staff seemed poorly acquainted with key aspects of the work (Rayna, 2003). Therefore, the creation of multi-sector committees at the national and decentralized levels may have helped implement the model more effectively (Rayna, 2003). Among the various bodies involved in the reform, there was confusion within the administration of what responsibilities were associated with which key structural factors.

6.6.5 Student–Teacher Ratio

Despite efforts by the government to improve CTP, the education services were viewed as poor in quality and exacerbated by high student–teacher ratios (Rayna, 2003). It was noted the student–teacher ratio "was higher in 2005 than in 2000 and dropped again in 2008, with 27 students per section for all sectors for 3–6-year-olds" (UNESCO, 2010). In the region of Matam, the average ratio was much higher, although it was the region with the lowest density of services in Senegal (UNESCO, 2010). Similar observations were noted for other rural regions where student–teacher ratios were consistently higher. Additionally, there were instances of higher student–teacher ratios in every region when compared to the average ratio for that area. Currently, the student–teacher ratio of CTP (45:1) is still significantly higher than the international standard of 14:1 (UNESCO, 2017).

6.7 A Path Forward

Following the global economic crisis of the 1980s, Abdoulaye Wade, then President of the Republic of Senegal, stood on the stage of the Forum for Education for All to roll out an audacious vision to transform his country's education system. Rooted in Nyerere's belief that "most of Africa's education systems are based on the assumptions of a colonialist and capitalist society, and therefore designed to transmit the values of the colonizing power and to train individuals for the service of the colonial state" (Nyerere, 1968), President Wade offered a bold path forward to depart from the French colonial school system and improve education for Senegal's children.

In analyzing his hopes to address the disparities in early academic achievement and health inequities between rural and urban contexts through the framework of the five perspectives, the reform demonstrates mixed results. In the education realm, Senegal has generated improvements in preparing early learners to succeed in subsequent years by focusing on literacy, math, and early knowledge of technological skills. A critical component of the reform was to advance a system that supported the development of the community and broader society in which all members share, not only resources, but the responsibility to educate its future leaders. This is evident in the reform's focus on native tongues as the language of instruction. It also shows up in the structure of the huts which were constructed with Senegal's ancestral civilization and values in mind. Most notably, it is seen in the collaboration of parents, grandparents, health workers, and teachers to deliver a culturally relevant framework. The emphasis on serving balanced meals, providing hygiene education, and giving health screenings, can provide an important case study as sub-Saharan African countries look to model new systems post the COVID-19 pandemic. While CTP had some successes, there are concerns for future iterations. Wade's top-down approach to the reform fostered a unique political environment that was further hampered by a lack of coordination among ministries and regional authorities. A key takeaway is a focus on a shared implementation strategy amongst policy makers and key stakeholders during the policy formulation process.

Today, the current administration led by President Macky Sall should continue to improve the vision set by Wade in 2000. The physical structures (huts) developed during President Wade's tenure continue to exist and are used as multipurpose spaces for the community where academic programming takes place. Most importantly, it should strive to come up with a clear vision for an early education policy that places emphasis on the professionalization of teachers. There is an urgent need to provide educators with the ongoing training and support that emphasizes the mastery of literacy and math skills. It is imperative to combine the support for teachers and principals with a robust data and evaluation system that will inform future policy development and program design. Lastly, unaided by a strong national presence, Case des Tout-Petits stands to lose ground in the coming years. Thus, a clearer structure of key stakeholders and their roles could establish more fidelity for Case des Tout-Petits' longevity.

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Chapter 7
Middle School Climate Change Mitigation and Adaptation Curriculum in the United States: Peers Lead Peers Through Change and Action

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Abstract While the previous chapters of this book tackle reforms in existing, established national programs, this chapter is an emergent proposition to a change in policy at local school district levels in the United States. Change is dependent on and influenced by the educational ecosystem around the student which includes such stakeholders as parents, teachers, teacher preparation programs, community groups, curriculum and textbook developers, businesses, universities, local and federal agencies, and policy leaders. The criteria for what makes a climate change curriculum "effective" are difficult to name: first, because the subject itself is divisive, and second because humankind has not yet fully understood all there is to know about tackling climate change. Thus, in this chapter, a normative pro stance is taken in support of climate change education, as the need to implement climate change education in school echoes UNESCO's notion that climate education "is crucial to promote climate action. It helps people understand so they can address the impacts of the climate crisis, empowering them with the knowledge, skills, values, and attitudes needed to act as agents of change (Education for climate action, 2021). In Orange County, California—like many places in the United States—climate change is a politically charged and controversial topic. When 20 states adopted the well-regarded Next Generation Science Standards (NGSS) in 2014, it was hoped that schools across the country would improve climate change education. However, we found that adopting new science standards does not necessarily mean that teaching and learning about

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climate change has improved in general, and this is made more complex by the fact that each state determines its own education system, and little can be mandated at a national level. Many factors contribute to inadequate student learning about the causes, impact, and especially the strategies to mitigate climate change among Orange County middle school students. We aim for education leaders to understand these best practices and encourage them to apply these to their contexts. We offer a curriculum based on best practices, one that is peer-led and garners hope. We wish for students to see themselves as agents of change and leaders of the not-so-distant tomorrow who become inspired to mitigate, adapt, and reverse climate change.

7.1 Introduction

Our chapter focuses on creating a peer-led, action-based climate change curriculum in Orange County, California. Despite our focus on a specific context, we hope that leaders at all levels can distill the best practices we have found, apply them to their own communities, and urge members of the education community to implement curricula and other practices to best meet the needs of this most pressing issue. We will first discuss the current state of climate change and of climate change education in the context of Orange County, California. Secondly, we will discuss several factors contributing to the problem of ineffective student learning about the causes, impact, and strategies to mitigate climate change. Thirdly, we will discuss the literature review on some of the best practices to teach climate change. Lastly, we will offer a solution to the problem by providing a climate change curriculum that encourages hope among learners. Thus, students will see themselves as agents of change and leaders of the not-so-distant tomorrow who are inspired to mitigate, adapt, and reverse climate change.

7.2 Analysis of the Problem

Before describing the current state of climate change education, it is important to see the urgency behind climate change itself. CO_2 emissions are the highest they have been in over 800,000 years, and the Arctic Ocean is expected to be ice-free by the middle of this century (Climate Change Evidence: How Do We Know?, 2021). Today's children are seeing and experiencing the impacts: California, for example, is seeing increases in asthma, more severe droughts, increased forest fires, and rising sea levels (Ehlers, 2020; Kloog et al., 2013; Orange County Water District, 2020). Time is not on our side: climate change scientists say we have eleven years left to avoid disaster (Wagner & Samaras, 2019). Our world's youth are the primary stakeholders in this issue, as they will shoulder the burden of climate change's effects. Still, we know that secondary stakeholders such as parents, teachers, and policymakers will need to be on board to implement climate change education, therein presenting an additional challenge.

In thinking about the problem as a deficit, too little *effective* student learning is taking place about the causes, impact, and especially the strategies to mitigate climate change among Orange County middle school students. Several factors contributing to this problem is (1) poorly trained teachers or educators averse to teaching the controversial topic, (2) parental opposition, (3) politics, (4) the lack of quality teaching resources on climate change that promote action, and (5) no state requirement that each California public school student learns climate change to graduate. In fact, while a sound, basic understanding of the science of climate change is a foundation, a stronger emphasis on civic responsibility is key to successfully learning about—and acting on—climate change.

According to one framework developed by Hoffman, four sources of distrust explain why climate change is a polarizing subject in the United States. This can shed light on the beliefs education can reinforce and the implications we want to avoid (Hoffman, 2015).

The first source of distrust is that of the messenger. There is a commonly held belief that university professors and other academics, most of whom lean left in their politics, are guided by their political persuasions. The climate change debate is rife with character assaults of politicians and celebrities and with that, we urge that educators using our curriculum take note to avoid naming high-profile celebrities or politicians in their instruction.

The second source of distrust is related to the process that produced that message. There exists an idea that scientists are not to be trusted, that the merit of their research is based on its conformity to preconceived democratic ideologies (Hoffman, 2015). Our curriculum utilizes other disciplines, namely mathematics and science, so that students can see and take part in the process themselves and make their own observations, as opposed to only reading other people's conclusions.

Third, many people distrust the message itself. This can be understood from a psychological perspective: for many, the predictions made by climate scientists feel too catastrophic to be true. Some of this is tied to religion: for some, to believe that the future of the world lies in the hands of mankind challenges the notion of God. Conservative talk show host Rush Limbaugh, for example, once argued that you could not believe in anthropogenic climate change while believing in God (Hoffman, 2015). Religion is largely to be kept out of public schools due to U.S. law, but we do allow for students to voice doubts and questions and reframe the narrative so that students can see a responsibility to protect the earth as aligned with, not in opposition to, their faith.

Lastly, the fourth source of distrust is that of the solutions implied from the message. Many proposals made by environmentalists involve dismantling or kneecapping all nonrenewable energy industries, which stirs fears of economic recessions (Hoffman, 2015). By revealing a world of possible solutions, our hope is that students see the plethora of tools that already lay at our disposal and that there are still many to be designed.

7.3 Current State of Climate Change Education in the U.S. At the Middle School Level

The cultural taboo of climate change has its implications for education. In January 2020, California Assemblywoman Luz Rivas introduced a bill to mandate the study of climate change, but ironically, the California wildfires and COVID-19 tabled discussion of the bill in the California Assembly and it expired (Leal, 2019). In response to Ms. Rivas' bill, the Chicago think-tank, The Heartland Institute, advised its readers:

> "Climate alarm is being pushed in many state legislatures, where legislators are attempting to force a politicized ideology onto students trapped in government schools," Jarratt said. "Teachers should not be forced to teach a politicized, ideological view of climate change...The best way to prevent politics from taking over the classroom is to grant parents the power to remove their children from schools that teach in politically biased ways". (Arz, 2020)

An April 2019 NPR/Ipsos poll revealed 80% of American parents and 86% of teachers want their students to learn about climate change. Nevertheless, the average U.S. teacher spends *just two hours per year* on topics related to climate change. Furthermore, almost half of U.S. teachers do not teach it at all. According to a 2016 *Science* research article, most U.S. teachers are poorly informed about climate change and lack formal education on the subject—this can be attributed to generational gaps, as many teachers may have completed their training programs before climate change was an issue (Worland, 2016). Add to this that many history and science textbooks skirt the issue to avoid the controversial subject, favoring reassurances of progress over asking critical questions (Loewen, 2007). Hence, climate change education becomes treacherous ground for teachers. Without adequate and accessible resources, "a skilled teacher who wants to address climate change can do so, but an inexperienced teacher or one confronting climate denial will have a hard time" knowing how to address the topic (NSCE, 2020).

Educators are caught between the urgency of teaching climate change to this next generation who will bear the brunt of managing it, and the potential political fallout from teaching a controversial topic (Worland, 2016). The National Center for Science Education (NCSE) reports 40% of U.S. middle and high school teachers teach climate change as a matter of *opinion*, creating confusion in their students in their 2016 report, *Mixed Messages: How Climate Change Is Taught in America's Public Schools.* In the United States, law forbids the mandate of any curriculum on the federal or even state level—curricula are only adopted by local districts. Adding to the variability between states and districts is that of individual classrooms: How teachers unpack the standards and translate those to learning objectives can vary from classroom to classroom, and school to school within the same district, depending on how schools go about unpacking state standards into the curriculum taught. If a state's board of education required a specific number of credit hours of climate change education for teacher preparation and certification, this would improve teacher capacity, education materials, and student understanding of the issue.

While adults argue, students sense the urgency about what they don't know: as middle-schooler Tom Walfield of Danvers, Massachusetts, states, " I will be 39 in the year 2040 … and to put it plainly, I am terrified of the direction we are heading in. The fact that we could see a global crisis in 2040 over climate change is horrifying. I don't think I am as scared with climate change, as I am with how little we are actually doing to prevent it," (The Learning Network, 2018). A curriculum designed to empower students can then develop their capacity to influence peers and family members.

In fact, teaching middle-school children about climate change may be one of the most important things we can do to save the planet (Christensen, 2019). Developmentally, middle school students can grasp complex ideas while remaining open-minded. They can also influence their parents' perspectives on climate change. Interestingly, researchers found that middle-school daughters held the greatest sway in changing opinion of the most resistant group of all: middle-class males (Christensen, 2019). When climate change lessons are based around two elements—(1) encouraging interaction with family and (2) understanding the impact of climate change in a broader sense—they exert the greatest impact in inspiring individuals to act (Lawson et al., 2019; Leiserowitz et al., 2019).

Peer-assisted learning (Lesson 6 of our unit) can be of great benefit to teaching climate change education, because it can help students feel more relaxed and comfortable during sessions (Glyn et al., 2006). This is very important when dealing with topics that might cause anxiety. Additionally, peer learners will find it useful learning from someone that brings a student-like approach, and who is close to their age (Glyn et al., 2006). Finally, student peers are often trusted messengers who know which pieces of information are especially relevant because of shared common experiences. This learning strategy builds community and develops relationships as part of the learning process, which can be viewed as an added benefit for climate resilience (Ocana & Wolfson, 2020). As members of the same generation, mentors and mentees would develop a "we" mindset that fosters a sense of unity and common purpose.

Making the Grade? released in October 2020 by the National Center for Science Education and the Texas Freedom Network Education Foundation, ranked every U.S. state after an evaluation by three scientists on the quality of the state's climate change curriculum. The twenty states that adopted the Next Generation Science Standards (NGSS) received a B+ and five states did even better, proving that it is even possible to improve upon the NGSS. The remaining states received grades C+ to F, including some of the most populous states: their state standards "promote the false narrative that the existence, cause, and seriousness of climate change are a matter of debate among climate scientists," while other states fail to mention the issue explicitly or at all, or address it vaguely (Making the Grade? 2020). The report recommends states' science standards uniformly reflect scientific consensus on climate change, require that every teacher discusses the subject with their students, and requires both pre-service and in-service study for teachers so that they are informed of current research (Making the Grade? 2020).

Climate change curriculum, if present at all, is typically found in middle school standards—however, middle school educators worry about frightening young students when teaching it (Westervelt, 2017). Nevertheless, middle school is the best developmental level to reach students to explore climate change, as this is where they understand complex systems and how they and others can be affected (Westervelt, 2017). Giving students opportunities for change makes them less likely to feel overwhelmed or discouraged, but more apt to act and inspire their family members to act towards improving climate policy (Lawson et al., 2019; Monroe et al., 2017). Lin Anderson, Director of Teacher Support at the National Center for Science Education (NCSE) suggests adding a "solutions element" to every middle school lesson on climate change to mitigate anxiety and emphasize action:

> Studies are showing climate anxiety is very real for middle and high schooler students, but especially in middle school. I try to leave every lesson I do with an element of hope so that students realize there are technologies and ways to combat climate change while they learn about what is currently going wrong at the same time... the most important thing is to try to give them examples of ways we are winning already. (McNicholl, 2020)

The introduction of the Next Generation Standards (NGSS) has been a gateway to introduce climate change education into the curriculum in the middle and high school grades. To date, however, only 20 states have mandated the adoption of these standards, and 24 states have developed their own science standards using the recommendations of the NGSS standards (Next Generation Science Standards: For States, By States, 2013). Adopting the standards is a step forward, but more is required—for example, adequate teacher training and access to good quality resources. Furthermore, climate change education should not be the sole responsibility of science teachers. Other subject standards such as English, civics, and social studies, should include climate change, as it would maximize the opportunities for students to learn about climate change from various perspectives.

With this in mind, we can turn towards specific case studies of states with effective climate change curriculums. New Jersey was the first state in the country to mandate climate change be included in its standards—not only through NGSS, but also under other subjects like language arts and art (Official Site of The State of New Jersey). This reform since it is set to take effect in the 2021–2022 school year and is a promising step forward.

There are other states trying to include climate change education in their public schools. For example, Connecticut's House Bill 5215 sought to include climate change instruction in the state's public-school curriculum. As of 2020, about "18 measures to support climate change education in the public schools were active in the state houses of ten states" (Branch, 2020). California, for example, proposed that the adopted course for science include in courses material relating to the causes and effects of climate change. The bill, however, died in committee on June 19, 2020. The majority of the 18 measures failed to pass.

While politics, and other interests hinder the processes of climate change education making its way to every classroom in America, we hope to see the reform come from actions students take to make the case for climate change education.

7.4 Current State of Climate Change Education in California at the Middle School Level: What is Lacking in the Literature Review of Previous Climate Change Curriculum in California?

In our creation of a climate change curriculum, one of the first questions we had to ask concerned contextual gaps of knowledge. For our context, we were working with the already existing NGSS standards, but recognize that education standardization is not utilized everywhere. Still, identifying these gaps can illuminate places for further focus depending on your region, and we encourage proponents of climate change education to do the same.

California education code 60,605.85 required the California State Board of education to adopt the *Next Generation Science Standards for California Public Schools* (NGSS for California Public Schools, K-12). The California Department of Education published a document where it listed a table as a suggested sequence for articulation across the middle school grades science curriculum. From looking at the table, it is evident that climate is explicitly taught in grade 6. There is no expectation that it would be taught in other grade levels if following the publish articulation model (Table 7.1).

Table 7.1 Arrangement for articulation (California Department of Education)

Grade	Cross cutting concepts	Life	Earth and space	Physical	Engineering
Eighth	Stability and change; scale, proportion and quantity	Natural selection	History of the Earth Space systems	Waves and Electro-magnetic radiation Energy Forces and interactions	ETS
Seventh	Energy and matter: flows, cycles, and conservation; cause and effect	Ecosystems	Natural resources	Structure and property of matter	ETS
Sixth	Patterns; structure and function; systems and system models	Cells and Organisms	Weather and climate	Energy	ETS
Fifth	Energy and matter: flows, cycles and conservation Scale, proportion and quantity	Matter cycles through living and non-living things	Earth in space, interactions of earth systems	Properties and structure of matter	ETS

To further our analysis, we examined the available climate curriculum in California. Specifically, we reviewed three curriculum resources that are used across California:

1. *The Education and Environment Initiative (EEI)*: upon registration and approval from the EEI, this provides teachers access to curricular material. The materials are for grades K-12, and deal with environmental topics in California. Within the units there is some information on how humans impact the environment, and some on the greenhouse gases. However, we did not find any unit that motivated students to take action to mitigate climate change.
2. *Changing Planet* is a curriculum developed by *NBC Learn* in conjunction with the *National Earth Science Foundation* and *Windows to The Universe*. The curriculum is based on a series of videos centered around "twelve key indicators of climate change, as well as lesson plans for teachers to use to explore the science behind these indicators with their students at the secondary level." (https://www.windows2universe.org/). The videos and the lesson plans are of high quality, but it's only recommended for high school students. This resource also does not call for action from the students.
3. *Alliance for Climate Education:* produces high-quality videos that educate youth on climate change and encourages students to act. However, it is not limited to a single context (state or school system)—thus limiting its relevance in this analysis.

Our curriculum builds on the limitations of the curriculums we explored. It is localized and action-driven and includes bite-sized science to build a conceptual understanding of the science behind climate change.

7.4.1 Interviews with Orange County Science Teachers on Climate Change Education

We interviewed current and former Orange County science teachers for their perspectives on the status of climate change curriculum in Orange County. Climate change education is spotty at best, varying from school to school, and dependent on the relative affluence of school districts' zip codes. Yet, it also varies even from teacher to teacher *within* a single science department. For example, one teacher in the Orange County system told us that although she wanted to teach the material, her conservative colleague was a climate change denier, and she was concerned about the resulting fallout (McNicholl, 2021). Professional development (PD) is carried out at the county level. The county dictates to teachers which PD workshops they need to attend and when. These workshops rarely involve specific areas of science content, however. Environmental problems might be used in these workshops, but only as examples of how to engage K-12 students and teach any science content more effectively (McNicholl, 2021). Optional PD offerings in climate change education do exist, but teachers self-select into those sessions—thus, the cycle continues. Finally, although there is a mechanism for writing district standards where teachers collaborate over the summer, it has not been done yet for climate change education.

California also faces a science teacher shortage. In 2017, half of incoming California science teachers entered classrooms without full credentials (Kohli, 2019). To address this gap, both the University of California and California State University—the institutions responsible for preparing over half of California's K-12 teachers—launched the Climate Change Literacy Project, teaming teachers with scientists. This initiative should produce more informed teacher graduates entering California science departments, who could have a positive influence on their colleagues.

7.5 Climate Change Lessons from Italy and Sweden

In this section, we segue into taking note of bold initiatives in climate change education in Italy and Sweden, which can be used as comparative reference. Though these contexts are different from Orange County, they are some of the only examples of wide-scale climate change education. A year ago, Italy's pro-environment Prime Minister Fioramonti made history by announcing that in the 2020–21 academic year, Italian K-12 students would be required to learn about climate change, becoming the first country to ever require climate change in the national curriculum with the end goal of becoming "sustainable citizens." Italian students will spend at least 33 h per year studying climate change, with a transdisciplinary focus that emphasizes civics, math, physics, and geography classes alongside courses in science (Horowitz, 2019).

Although Sweden does not have the same mandate for explicitly teaching climate change as Italy, its 50-year history of teaching environmental education reflects Sweden's citizens' appreciation for nature (Cars & West, 2014). Sweden's sustainability development education is noteworthy because it emphasizes outdoor education and social responsibility, in addition to science. Based on this, we can see that while science is an integral component to understanding climate change, it is not the only component. This is consistent with other research that shows that too much scientific complexity obscures foundational concepts and implies that only experts can address the issue (Rhodes & Wang, 2021). This emphasis on building children's relationship with the natural world shows correlation with a will to preserve it. In effect, though Sweden does not have an enforceable mandate as Italy does, Sweden has been teaching climate change education in practice (Olander & Olander, 2016).

We acknowledge that Italy and Sweden are homogenous countries, and that their education is mandated at the national level. In contrast, educational policy in the United States is determined by each of the individual 50 state boards of education. Nevertheless, we can transfer these salient ideas from Italy and Sweden to implement climate change education in every part of the U.S. education ecosystem and focus on the civic responsibility aspect of climate change education to motivate students to find creative solutions.

7.6 Best Practices and Rationale of Our Curriculum

How climate change is taught will depend on the national and regional context and the grade level of the students. Since there are so few examples of wide-scale climate change education, there is little research on most effective practices (or, as mentioned earlier, what could even be defined as "effective"). These practices are distilled from the previously cited research on Italy and Sweden, and from a variety of climate change curricula that spoke to knowledge gaps and the political controversy. From what we explored, the most appropriate practices for our context will be to: 1. Make CCE personally relevant, 2. Include experiential learning and outdoor education, 3. Encourage the transfer of local knowledge to global awareness (i.e., going "*glocal*"), 4. Implement a transdisciplinary approach to CCE, 5. Teach systems thinking, 6. Use a solution-oriented approach to CCE, 7. Implement peer-to-peer learning, and 8. Talk through the controversy of climate change.

One of the most effective themes we found is the need to make climate change education personally relevant to the student. Climate change researchers suggest students need to see climate change not as a hypothetical or nebulous threat, but something observable within their own communities (Monroe et al., 2017). Furthermore, there is also emphasis on engaging learners experientially through labs, field trips, and in-class debates (Monroe et al., 2017). Still, students need to explore beyond their local context. While local projects are certainly meaningful, this learning method has limitations, as project-based curricula often ignores how students can transfer what knowledge they gain outside of the given context (Rhodes & Wang, 2021). The implications we see here would be for our curriculum to demonstrate the relationship between students' local communities and the rest of the natural world.

Regarding making climate change education hands-on and engaging, while we have limited power in our curriculum to execute field trips, we can provide information resources and recommend Orange County schools take this into consideration. Given the region's proximity to many natural landscapes and environmental organizations, students could benefit from being able to interact with scientists. Interaction with scientists (and the tools they use) has shown to be effective in building students' interest in climate change (Monroe et al., 2017).

A transdisciplinary approach—or integrating multiple disciplines to teach an idea—is particularly useful in teaching climate change and sustainable development. To quote research offered by Lekies and Moore (2020), "Transdisciplinary methods draw from multiple and often unrelated disciplines, integrate and synthesize information, allow for new collaborations, foster mutual understanding, engage non-academic stakeholders, and generate and apply new knowledge" (Lekies and Moore, 2020). Incorporating tools learned in social sciences, mathematics, and biology makes the content more relevant and relatable mimicking the same intricacies and connections made in real life. According to Yu and Chiang (2017), transdisciplinary approaches are beneficial for students in that they result in "better performance in practical modules" and they address "the real interest of the students." Additionally, creating a climate change curriculum with multiple lenses "provides the students with a range of different perspectives for addressing climate change, perspectives they can draw on to formulate changes in status quo systems, based on the use of these perspectives" (Beach et al., 2017). When students hear, for example, how climate change impacts individual people, students further develop their connection to the environment by building empathy (Wallace, 2019). We sought to develop a transdisciplinary curriculum that explored the science of climate change, while also teaching ethical decision making, civics, and global citizenship. An example in our curriculum is our transdisciplinary modules targeting climatic risks in Orange County. For instance, when we create a module on air quality in Orange County, we would not only emphasize the scientific indicators that determine the quality, but also the human factors that affect air quality, such as the impact poor air quality has on various human populations, and actions we can take to solve such problems.

Global *and* local action is necessary if we are to mitigate, adapt to, and ultimately reverse climate change. Becker (2017) argues education at the local level should always be approached with respect to the local/regional situation, and possibly also in consideration of the global aspects, expressed in the newly created word '*glocal.*' In our proposed curriculum, we include an action component for the summative assessment for the module. The action will be pegged to a local climatic risk present in Orange County.

The most recent adoption of NGSS standards in California requires the teaching of systems and systems models (Next Generation Science Standards: For States, By States, 2013). One high school standard related to environment and human actions states: "Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity" (Next Generation Science Standards: For States, By States, 2013). Although the standards expose students to systems thinking, they do not explore systems in a broader sense—such as how, for example, air pollution can affect the economic system of a country, or the healthcare system because of chronic disease developed from poor air quality. This is an important consideration for our curriculum, as we embed in our modules system and system thinking, by using Harvard's Project Zero's *Agency by Design* tools to introduce systems thinking.

Another component included in our curriculum to fit our context is cooperative and peer-assisted learning. The model that our client, Best Delegate, employs is one in which high school students teach and coach middle school students. We reviewed literature for examples of peer-learning in climate change education and sustainable development, but there was little available. We did a broader search to determine a peer-assisted learning model that could be transposed onto our curriculum. Peer-assisted learning is defined as a "situation in which people from similar social groupings who are not professional teachers help each other to learn and learn themselves by teaching" (Glyn et al., 2006). Glyn et al. (2006) noted the peer learner and the peer teachers "described feeling more relaxed and comfortable during the session," which can be particularly useful for us, as climate change can be a difficult topic to discuss. After all, climate change is highly politically- and religiously- charged in the context of the U.S. educational system, and one reason teachers shy away from teaching it at all. Another benefit was peer learners emphasized "they felt the peer teachers would bring a unique and very useful perspective to the session due to their immediacy with the material and their student-like approach" (Glyn et al., 2006).

Cooperative learning is essential to developing twenty-first century skills and is ideal for learning about the topic of climate change education. Cooperative learning allows students to "work together to accomplish shared goals, and there is a mutual responsibility to work for one's own success" (Johnson & Johnson, 2012). Of the four types of cooperative learning Johnson and Johnson describe, including formal and informal cooperative learning, cooperative base groups (providing long-term academic support), and constructive controversy (cooperation involving intellectual conflicts). The latter is most applicable in helping students understand their own positions on climate change. Constructive controversy can be defined when "one person's ideas, opinions, information, theories, or conclusions are incompatible with those of another, and the two seek to reach an agreement" (Johnson & Johnson, 2012). This definition is useful given the research that shows the need for teachers to talk through the controversy of climate change (Monroe et al., 2017). Thus, by introducing and embracing conflict, students learn to actively listen to multiple perspectives, find common ground, and find creative solutions. Ideally, our curriculum would include a simulation on a climate change topic that would involve students breaking into groups defined by a stakeholder—farmers, automobile workers, residents of coastal areas, etc.—and students would need to define their positions on the conflict, then actively work with other groups to discuss their positions, and finally cooperatively arrive at a mutually acceptable outcome.

In teaching through controversial subjects, it is essential for the curriculum to create space for students to decode their own biases and determine the credibility of information (Rhodes & Wang, 2021). Teaching with a constructivist approach rather than a transmission-based approach would allow students to interpret information independently—in essence, discover for themselves—and talk through what skepticism or misconceptions they may have. Such a design would encourage skills in inquiry and analysis (Rhodes & Wang, 2021).

An important limitation we must consider when applying the best practices we have discussed in our context is that we create a curriculum taught by non-teachers (high school students); therefore, we need to make sure it is scripted and scaffolded as much as possible. On the other hand, the advantage of having the heavily scripted and scaffolded curriculum is that other non-teacher users can use the material to teach, and teachers with little training who are new to the topic can also use it as a guide.

In addition to incorporating the best practices discussed above, we have broken down our curriculum unit into four modules, each containing several lessons. As noted by The Environmental and Energy Study Institute (2019), the four modules are based on four scientific ideas about climate change that scientists agree on: "It's real, It's us, It's bad, There's hope." All our lessons are aligned to the NGSS Standards, Common Core standards, the UN Sustainable Development Goals (where applicable) and to our client's desired goals of student skill set achievement.

It's real: Our first module is dedicated to establishing a safe space for students to engage in constructive controversy. We did so by creating a lesson about setting up norms of engagement that students will adhere to during the unit. We then proceed by introducing a lesson that explains what science is, how scientific inquiry is done, and why we should believe scientists. The lesson gives students a toolkit, consisting of methods to judge whether something is based in science or not and ways to critically engage with information they receive. We included the toolkit because, as noted by Rhodes and Wang (2021), "It is essential for the curriculum to create space for students to decode their own biases and determine the credibility of information."

In the "It's real" module, we present students with local and global images of climatic risks, and some solutions developed to tackle them. The module introduces local evidence of climate change that makes the situation more personal, while also presenting more global evidence. The images we presented were carefully curated, as recommended by the Climate Visual's "seven core principles for effective visual communication" (n.d.). These principles are as follows: 1. Images show real people, 2. Tell new stories; 3. Show climate change causes at a scale (systems), 4. Show emotionally powerful impacts, 5. Understand your audience (we chose images that were appropriate for young students), 6. Show local (but serious) impacts, 6. Be careful with protest imagery (Climate Visuals n.d.). Students are expected to engage with the images following one of Harvard's Project Zero Thinking Routines: "See, Think, Wonder" (See, Think, Wonder n.d.).

The module culminates by introducing the students to the summative project and introducing some of the science by looking at temperature change. The summative project asks students to pitch a solution to a climatic risk for Orange County. The pitch will be delivered in a Pecha Kucha presentation format, which allows students to tell their story in twenty images, with twenty seconds for each image. The series of pitches would be presented in front of an audience and decided by the students but would ideally include members outside of the classroom. This module teaches students the difference between climate and weather and builds an understanding of how temperature has increased over an extended period even as cold weather events continue to occur. This naturally leads us to ask the reasons behind these changes, which leads to the next idea: It's us.

It's us: This module makes the relationship between climate change and human activity personally relevant to the students. It begins by having students calculate their family's carbon footprint, by examining and listing their everyday activities and those of their family members. This is designed to encourage productive and educational discussion at home. Given that our surveys identified a disproportionate number of students whose parents are climate change contrarians, this module could influence their families' perspectives through discussion. Moving from the family level to the global level, the final lesson in the "It's us" module exemplifies human impact at a systems level—which, as we noted in our literature review, is not necessarily covered in the NGSS standards. This lesson aims to connect personal actions to widespread impacts so that students see how the total sum of human activity comes with a hefty CO_2 price tag, connecting to the next module's theme.

It's bad: In this module, students explore the deleterious impacts of climate change. We start again from a local context, by having students learn about the wildfires that have ravaged California and their causes. Following this series, students explore how climate change affects communities across the world, and how some communities are affected more than others. Students build understanding that climate change does not just mean a change in temperature, but also an increase in extreme weather events, health problems, and disruptions in food access. It is here we want students to see that while they and many others may be insulated from many (though not all) of the effects of climate change, others are not so fortunate. These multiple perspectives aid students in developing "empathy, triggered by making a connection to the environment" (Wallace, 2019).

There's hope: Our culminating module, designed to be the final of the four, is intended to end with a hopeful, inspiring, and action-oriented message. The first lesson in this module introduces students to some of the technology developed to mitigate climate change, as well as the barriers to committing to such technologies. The second lesson then explores legislation in different places that have been enacted in response to climate change. This lesson allows students to see how policy influences our day-to-day lives and demonstrates how people can influence and hinder the development of legislation. Students are also given space to discuss why someone may refute climate science or oppose different solutions.

The last two lessons in the module are dedicated to students applying and demonstrating all they have learned throughout the curriculum. The penultimate lesson has students presenting their climatic solution via Pecha Kucha pitches to an audience of their choice. We leave room for flexibility at this point of the curriculum implementation but encourage students to consider presenting to people outside of their school community and/or via social media or other online platforms.

The last lesson is a simulation of a climate change summit. Students will take the roles of various stakeholders and solve a climate issue. In this simulation, students will practice skills of persuasion, negotiation, and data analysis as they discuss priorities and finalize a decision on a given topic—in this case, a question of dam renovation. By immersing themselves in a real scenario about water resource planning, students engage in meaningful conversations, and understand that differences in goals create conflict—after all, there are few climate solutions that are obvious and universally supported.

7.7 Theory of Change

While carrying out our literature review, we found that climate change education (CCE) and sustainability development education both teach the impact of human activity on the environment. According to UNESCO (2021), the purpose of climate change education in the context of sustainability development is "To help audiences understand, address, mitigate, adapt to, and reverse the impacts of climate change, we need to put our world on a more sustainable path of development and build a new generation of climate change-aware citizens."

Translating this global goal to our context, Orange County, the long-term goal of our project became to reduce carbon emissions in Orange County by at least ten percent in ten years. This objective carries the assumption that population growth in the area remains stable in that time. If schools had an action-oriented and accessible curriculum, one which fostered a sense of common purpose with peer-to-peer learning, then we would see students adopt more environmentally conscious behaviors, such as choosing biking over driving. These behaviors could then influence behaviors in the wider community. More environmentally conscious behaviors would then result in reduction of carbon emissions and other greenhouse gas emissions. To measure how many students changed their behaviors, we would use pre- and post-curriculum surveys to probe the manner and frequency of various student-performed activities. For students to demonstrate the desired change in behaviors, we would need to ensure that a certain number of students completed the curriculum, and this could be evidenced by the completion of work throughout the curriculum and the number of Pecha Kucha presentations that occurred at each site.

It is a major assumption that school leaders will find, download, and implement the curriculum. Necessary activities to achieve this desired output include publicizing the curriculum via Best Delegate's website, highlighting its strengths, and creating an implementation guide for teachers, peer mentors, and peer mentees, such that lessons are clear, focused, and balance structure with flexibility (Table 7.2).

We recognize that our theory holds several key assumptions, and that schools are open systems generally. We have aimed to utilize tools that best inform us of the quality of our design and allow us to improve on our practices.

7.8 Setting the Stage for Change (Five Perspectives)

We used Reimers' five perspectives to analyze the assumptions underlying our approach. We felt this step was crucial to make sure that our activities were diverse, and that we incorporated at least some of the perspectives' elements within our plan for change (Reimers, 2020).

Cultural: An assumption underlying the cultural lens holds that many of the students come from families whose parents might be climate change contrarians in Orange County. For example, one reason for their conflict with the idea of climate change might stem from religious beliefs that they feel contradict science. Hence, our curriculum provides the students with the knowledge of what science is and what it can and cannot answer, giving them critical thinking tools to judge whether an idea is based in science or not. Even if our assumption is wrong, having this activity will still be beneficial for the students, and the change we seek to happen should lead to some form of cultural change.

Psychological: We are assuming that we can change students' behaviors, and their behavior changes can influence those of their parents and other members of their community—this is challenging, but possible. To make changing behavior easier, neuroscience research advises to "include a reward with personal sources of value by linking the new behavior with core values and beliefs that are central to the person's identity" (Berkman et al., 2017). Meaning, if we give students tools that

Table 7.2 Logical framework of the curriculum

	Project description	Objectively verifiable indicators of achievement	Sources and means of verification	Assumption/risk
Goal	Adoption of more eco-conscious behaviors and greater environmental advocacy	Percent reduction in CO_2 emissions # of people who name the environment as their biggest political issue	Comparison of data publicly available	Population growth remains stable in Orange County
Outcome	80% of students demonstrate change in knowledge and behaviors within the year of taking course	Students can identify climatic risks, ways to adapt and mitigate climate change, and display climate friendly behaviors	Pre- and post-unit surveys	Survey responses are accurate
Output	~1,000 students complete the curriculum each year	Number of students completing the curriculum	Journals/portfolios documenting their work through the modules	Students complete all module activities and learning journals within a semester
			Number of Pecha Kucha presentations demonstrating their climatic risk solutions	
Activities	Make the curriculum widely accessible, make it visible by marketing it on the Best Delegate website and social media	The curriculum, the implementation plan and the guide for adaptation to different contexts are widely accessible and easy to find	Number of downloads off the Best delegate website	Teachers/students will download curriculum and teach it in its entirety
	Provide implementation guide			
	A guide for adaptation to different contexts to maximize impact			

develop empathy, interpersonal, and intrapersonal skills, we will be helping them look at their values and grow in their thinking. The reward can be as simple as either feeling better about making a change that benefits others or being extrinsically motivated by successfully presenting solutions and getting recognition for it.

We also considered the psychology of learning, including Bloom's Taxonomy, to ensure that the students were not merely memorizing the material. In different parts of the curriculum, we asked the students to apply, analyze, evaluate and create, all corresponding to an increasing level of complexity, culminating in having students create a solution to one of the climatic risks identified in their context. Lastly, there is the psychology of emotion. As noted, this topic can stir anxiety and challenge the idea that the world is naturally orderly and stable. We respond to this by incorporating solutions and messages of hope.

Professional: One reason teachers shy away from teaching climate change education is that they have not received adequate training, or that with the multitude of resources available it is hard to know where to begin. We made sure our curriculum was scaffolded and scripted in some cases so that peer mentors could use it easily. The curriculum could be used by a beginner teacher with no training on climate change and could also be easily modified by more experienced teachers. Although we wished to make a coherent, logical and sequenced curriculum, we designed lessons and modules that could also stand on their own. We have also thought about how to help teachers and peer mentors in other contexts modify the curriculum, which we will review in the section about implementation.

Institutional: From our conversations with our client and from looking at the NGSS science standards, we know that climate change has been taught in Orange County. As mentioned earlier in the paper, California received a B+ grade in a report from the National Center for Science Education and Texas Freedom Network Education Fund (Making the grade? 2020). One reason is that the language in the standards refer to climate change as something humans are *influencing*, rather than *causing*. We assume that within our client's network, there are a mix of schools with a varying degree of climate change education. Some schools might have a well-established curriculum that addresses climate change, and some might be without such a curriculum. Though we might not enact institutional change through this project alone, we hope that the students and teachers who use our curriculum will be empowered to take action that influences policy and technology.

Political: In the US, climate change is a highly politicized topic, which has led many stakeholders with competing agendas to sensationalize the "debate" of climate change. This debate could hinder some legislators' efforts in proposing laws that could positively affect the environment. We stay clear of mentioning specific political parties or candidates and their agendas for addressing climate change, as this might shut down students with opposing political views. However, it would be irresponsible for us to not acknowledge the controversy of the topic. We build in space for discussion that allows for students to understand competing goals while maintaining that certain facts are undebatable. We also hope that the students become empowered to participate in bottom-up reform by reaching out to policymakers who could use their power to make changes regionally, nationally and even globally.

7.9 Impact Evaluation

As the climate change curriculum must be adapted to different contexts before implementation, formative evaluation can be a very useful tool in making course materials relevant to students. Formative evaluation can help student leaders and teachers understand what class activities and materials would best engage the target students and reach their instructional goals. Student leaders and teachers can test teach a sample lesson or conduct interviews with target students who resemble attitudinal and behavioral research methods. In the implementation guide we provide with the curriculum; we will include a list of indicators that demonstrate how well the adaptation is meeting the instructional goals and engaging the students. In addition, it is always helpful to seek feedback from local teachers, student leaders and activists, and experts or practitioners in climate change as the curriculum is being adapted.

For the summative or impact evaluation, we will mainly be measuring the indicators set out in our logical framework. Table 7.3 summarizes the data collection plan.

Curriculum adapted to different contexts can set out indicators based on the local context. Besides measuring the indicators, it is also important to understand the impact the curriculum will have beyond the target students. We can employ the Creating Communities of Innovation Spheres of Influence tool developed by Project Zero at Harvard. The tool “helps to look beyond our immediate environment and consider broader impacts our innovation project may have on various stakeholder groups” (Sphere of Influence, 2019). Using this tool, we constructed a sphere of influence that includes target students, the school adopting the curriculum, the local community and students and teachers worldwide.

As the tool suggests, it is important for designers and implementers to reflect on the impact the project has had on each sphere (Sphere of Influence, 2019). Although the target students will be the direct beneficiaries of our curriculum, their learning outcomes and behavioral changes will very likely influence their peers in the same school. We also encourage students to post their solution-oriented presentation, the Pecha Kucha, on a designated website so that social entrepreneurs, policy makers, or other climate change activists in the local community might be inspired to act. Through the Model UN simulation where students debate on the issue as different stakeholders, we hope to bring together students and teachers worldwide who are using our curriculum and those who are passionate about climate change. Reflecting on the sphere of influence will allow us to explore new potential channels through which we can disseminate our curriculum and best practices.

Table 7.3 Data collection plan

Objective to be tested	Indicator	Data source	Data type	Data collection instrument	Timing of data collection
A reduction of CO_2 in Orange County by 10% in 10 years	Percent of reduction in CO_2 emission	Official statistics	Quantitative data	California air resources board	Start of the project, 2, 4, 6, 8, and 10 years after implementation
80% of students demonstrate change in knowledge and behaviors within the year of taking the course	Students can identify climatic risks, ways to adapt and mitigate climate change, and display climate friendly behaviors	Students who take the course in Orange County	Qualitative data	Pre-course survey and post-course questionnaire Teacher and parents' observation/Interview with teachers and parents	Before and after taking the course
Around 1000 students complete the curriculum each year	Number of students completing the curriculum	Best Delegate website, websites where the curriculum is publicly accessible, Pecha Kucha presentation site	Quantitative	Data collection mechanisms embedded in the different websites and platforms	6 months and a year after implementation
				The number of Pecha Kucha presentations posted	

7.10 Conclusion

Teaching climate change is politically charged and controversial. In the United States, the task is made more challenging by the absence of curricular standards and mandates, unprepared teachers and parents, and high-quality learning materials that are accessible and relevant. Considering this, we propose an action-based, peer-assisted climate change curriculum, which empowers students to be agents and leaders in mitigating, adapting and reversing climate change. The design of learning activities is informed by best practices worldwide, particularly from Italy and Sweden. We are aware of the variety of climatic risks, as well as the cultural and political barriers to teaching climate change across contexts. Therefore, we highly encourage student leaders and teachers worldwide to make use of our implementation guide in adapting the teaching and learning materials to a local context. We hope our work creates a platform where educators, students and climate change advocates can exchange effective practices in teaching and learning about climate change. We are committed to working with different stakeholders to improve and update the curriculum—the future of our planet relies on a generation of informed, inspired, and proactive students.

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Chapter 8
Creating Brighter Futures: Building Climate Leaders in the United States Through a Community-Focused Curriculum

Kathryn Bauman-Hill, Susan Dai, and Arcadia Payne

Abstract Throughout this volume, our co-authors focus on top-down education reforms. In this analysis, we take a different approach to education reform, instead focusing on the impact of translating a niche school-level curricular reform to expand to the systemic level. In this paper, we will argue for the need for an elementary climate change-focused curriculum and outline the components necessary to make such a program successful. We partnered with an independent school in the Washington, DC region to contextualize the process of building such a curriculum, with the additional benefit of the school being near political power. Nevertheless, the implications of our findings are applicable to a variety of contexts, including international ones. In our methodology, we examined best practices for creating a rigorous elementary curriculum that centers around climate change education and leadership development. We combined successful elements of climate change education programs, including participatory learning, interdisciplinary integration, and a focus on community-based learning. We utilized a logical framework to identify assumptions and risks, implementation steps, achievement indicators, and program evaluation tools, which helped us identify key considerations for scaling an elementary climate change curriculum.

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Abbreviations

FOR	Friends of the Rappahannock
MUN	Model United Nations
NGSS	Next Generation Science Standards
SDG	United Nations Sustainable Development Goals

8.1 Introduction and Importance of Climate Change Education

The previous chapters in this book address government-implemented education reforms—however, as any educator, student, or caregiver will confirm, policy changes are primarily felt within the school setting directly. While policies impact each level of our education systems globally, there is a noticeable gap in comprehensive, collaborative education regarding a subject that affects every person in our world: climate change. Symptoms like rising temperatures, ocean acidification, and sea level rise contribute to diminished agricultural capacity, exposure to health problems, and exacerbated weather events. According to the UN International Organization for Migration, the number of migrants fleeing environmental hazards may fall anywhere between 25 million to 1 billion by the year 2050 (Bassetti, 2019). Considering that both climate hazards and displacement of this scale would affect countries worldwide, it is increasingly clear that understanding and managing the adverse effects of climate change must be a priority within our education systems. This paper will contextualize development of an elementary climate change curriculum, delve into a review of existing climate education programs worldwide, form a program theory and implementation plan for a climate curriculum at the school level, and finally, discuss evaluation, impact, and scalability for a curriculum.

This chapter specifically examines the likelihood of developing climate change curriculum for elementary schools in the United States. It does so by exploring the design, implementation, and evaluation of climate change curricula, which are applicable lessons to any context. Climate change is considered a controversial topic in the United States, with discourse and action driven by political beliefs and party rhetoric. The United States formally pulled out of the Paris Agreement under the Trump Administration and have recently rejoined it with the support of the Biden Administration. Due to the depth of the renewed commitment of the United States to resolve climate change concerns, creating a younger generation aware of the effects of climate change who can create innovative solutions is essential. Schools have a critical role in educating students on this issue. Ensuring that students are exposed to climate change concepts at an early age is a crucial step in raising awareness and developing future leaders invested in climate change concerns.

To this end, by integrating climate change education within school systems, schools can highlight environmental protection as a core value and reinforce habits in students that drive systemic change by instilling stewardship, climate change awareness, and leadership in students. Using the concept of adaptive change, through which we intend to uplift climate change in the values and habits of students and their families, we argue that this change is appropriate and doable through the introduction of a community-focused climate change leadership curriculum.

This paper focuses on school systems in Washington, DC. The location was chosen for two different reasons: first, due to the team's familiarity with education systems and independent schools in the region, and second, its designation as the national capital, and thus the heart of U.S. political decision-making, including issues such as climate change. Through our analysis, we have determined that a targeted response through participatory, climate-focused elementary school curricula is needed. Acknowledging the gaps in existing school curricula helps to create a robust, substantive curriculum that positions students to be prepared for leadership roles. We have identified numerous benefits in utilizing an education response framed in critical, collaborative learning and other twenty-first century skills. Not only will students develop knowledge and tools to contribute to climate justice and mitigation of climate risks in Washington, DC, but students will gain skills that build confidence in navigating media, government, the corporate sector, and individual engagement. Additionally, elementary school students will learn the importance of a climate-oriented mindset to inform their future education and professional experiences. The curriculum will be based on Next Generation Science Standards (NGSS) as well as certain United Nations Sustainable Development Goals (SDGs), to emphasize moral and civic responsibility. In the long-term, this sets up Washington, DC's future leaders to take definitive action towards mitigating climate risks. While we do focus on the context of Washington, DC in this paper, the lessons and implications of implementing community-focused climate change education for elementary students are applicable for scaling in countries worldwide. Students who practice leadership grounded in empathy and social responsibility become leaders grounded in empathy and social responsibility.

Part I

8.2 Local Context

In this section, we explore water-related issues caused by rising temperatures in local contexts. With several rivers, creeks, and streams in its jurisdiction, the general Washington, DC region is more susceptible to flooding from storms, tidal surges, and sea level rise (Chesapeake Bay Foundation, 2020; Climate Central, 2014; Samenow, 2014). Increasing temperatures and precipitation contribute to flooding potential both in Washington, DC and in the Chesapeake Bay area, approximately 30 miles away (District of Columbia, n.d.; National Ocean Service, 2020). Land use by humans through farming and suburban sprawl, along with temperature changes, have directly impacted the water quality throughout the whole watershed (Maloney et al., 2020; Najjar et al., 2010; Orth et al., 2017). The wetlands that outline the Chesapeake Bay are a rich environment for many life forms within the ecosystem. Numerous factors affect the delicate balance of these wetlands (Kirwan & Megonigal, 2013). An increase in population has created more risks for the land, animals, and plants. Water quality and storm runoff affect wetlands and streams, influencing the animal life within the waterways in the surrounding Chesapeake Bay region (Watts et al., 2019). Fish, shellfish, and submerged aquatic vegetation are affected by similar factors as the wetlands, leading to immense potential for disrupting the watershed ecosystem (Najjar et al., 2010; Orth et al., 2017).

In addition to changing the ecosystem, climate change will continue to disturb industry, exacerbate storms, and harm human health. Declines in coastal biodiversity decimate fishing and aquaculture industries and the food supply (Chesapeake Bay Foundation, 2020; U.S. Global Change Research Program, 2018). Sea level rise in Washington, DC is already affecting businesses adjacent to the city through persistent flooding (Fenston, 2019; U.S. Global Change Research Program, 2018). Furthermore, there has been a shift in housing as island residents within the Chesapeake Bay are forced to leave the region as the islands became uninhabitable (Arenstam et al., 2006; Leatherman et al., 1995). It is only a matter of time before climate change pushes these problems far enough to mobilize society to directly respond to these dire circumstances.

8.3 Systematizing Innovation in Climate Change Education

We recognize that introducing new curricula into school systems without assessing the capacity for adaptation and scalability can have dire impacts on curriculum development. When we envisioned a climate curriculum with a leadership focus, we wanted to partner with an institution that not only would benefit from a program such as ours, but also was willing to sponsor a pilot effort to incorporate climate change education in their existing curriculum. We chose an independent Pre-K-Grade12 school as our partner institution due to its philosophy of learning through discovery, exploration, and active engagement, which aligned well with our projected curriculum.

Independent schools and charter schools often have more autonomy and mutability in their curricular decisions, and thus promote themselves as incubators of innovation (Stuart et al., 2017). However, even in many innovative school environments, curricula are still largely focused on environmental studies rather than climate change. We encourage education leaders to utilize these independent school models to pilot innovative curricula, including climate change education, in such environments—thus providing a context-based view of the impacts of climate change on local communities. This could include convincing a network of independent schools to pilot innovative climate change curricula together, therefore representing a test of the scalability potential and relevance of systems-change approaches of such curricula.

From Reimers' five perspectives for educational change, we recognize the need to develop skills to address climate issues using an institutional lens (Reimers, 2020). In interviewing science teachers at a partner school in Washington, DC, it was evident that curriculum from Pre-K to Grade 6 does not cover enough specific or substantive knowledge about climate change, especially instruction that is tailored toward the urgent needs of the DC region, such as precipitation concerns, and sea level changes related to rising temperatures. As a result, our curriculum will cultivate an understanding of local climate change issues and the competencies needed to mitigate climate change in elementary students. Ensuring various points of entry begins to develop a trajectory of comprehensive understanding. Creating multiple opportunities for climate change touchpoints is also ideal (Reimers, 2021). Through four key actors (media, government, the corporate sector, and individual/community engagement) that embody institutional systems, students develop skills to take on leadership roles and build their civic identity in a collaborative and interactive manner.

In developing a successful curriculum, considerations must include how to shape mindsets on the importance of learning about climate change, and how to raise awareness on mitigation actions. For best results, climate change would be prioritized as an institutional goal throughout the school. This process requires a level of psychological awareness from both the student and the teacher. Ideally, the culture of the school supports the idea of environmental stewardship, and a focus on environmental education creates an entry point. Centering climate change issues in a developmentally appropriate way fosters a growth mindset for students towards the topic. Gaining support for a cohesive curriculum requires a political approach to mobilize homeroom teachers, science teachers, extracurricular club advisors, after-school coordinators, and administration. Creating professional development opportunities to enhance the understanding of teachers about concepts and issues related to climate change is crucial for its success, particularly since this age group is not traditionally targeted in climate change education (Reimers, 2020).

Aspects of adaptive change can shift ideas and mindsets within each of the five frames. Sharing facts and background information about climate change builds a sense of recognition and urgency about the topic. Developing an understanding of the beliefs of educators, parents, and students towards climate change can also indicate the "ripeness," or readiness to invest in the idea (Heifetz et al., 2009). To measure this readiness, we intentionally thought about how to gauge student, family, and teacher attitudes throughout the program, which we pursued by distributing surveys to stakeholders. Framing the importance of teaching climate change as an ethical issue builds a sense of moral responsibility and may connect the action-oriented aspect of the curriculum to a school's mission. Building a core group of individuals who are invested in the importance of teaching climate change has two advantages. First, they can influence others who may not see the essential nature of creating a comprehensive curriculum across the school. Secondly, they can begin to share responsibility regarding the importance of educating others on various aspects of climate change knowledge, competencies, and dispositions. Developing an awareness of dissenting opinions is critical in maintaining forward momentum. Engaging those with opposing views by creating a space to share ideas and concerns develops an open dialogue, with the potential to raise the overall awareness on climate change (Heifetz et al., 2009). Consistent reflection helps to realign priorities and conversations, which allows systems to build the capacity necessary to address climate change issues.

8.4 Analysis of Current Climate Education Curriculum Models

In building our curriculum, we wanted to investigate best practices in existing climate curriculum models. A few major themes arose throughout our research which served to foster successful climate change curricular initiatives: integration across subject areas, presenting a balance of science facts with optimism, experiential learning activities, developing a web of support, connecting to the local community, using a variety of media and literary entry points, and proper teacher training to remove barriers of lack of knowledge about climate change. From this information, we decided to further examine participatory, community-focused, and interdisciplinary learning applicable to our local context to include within our curriculum.

When investigating climate change curriculum for upper elementary school students, it is important to consider the developmental appropriateness of the content. Current science curricula in the US includes science concepts that assume a higher level of understanding which many youths have not yet acquired (Monroe et al., 2019). By supplementing the current United States science learning framework—titled the Next Generation Science Standards (NGSS)—with social science concepts developed through the UN Sustainable Development Goals (SDGs), climate change curriculum becomes more accessible to younger students. A connection to global climate change is implied within the elementary level of the NGSS, as students explore the definition of climate, natural disasters, and human impact on the earth, although it is not explicitly stated as a standard until the middle school level (Next Generation Science Standards, n.d.). Extending beyond topics such as weather to systems thinking provides a means to support a developmentally appropriate manner of student acquisition of information, fostering a deeper level of understanding and a richer knowledge base (Roychoudhury et al., 2017; Van Zee et al., 2016). Through systems focused learning, students can see the scope of an issue more deeply and perform targeted problem-solving within various levels of the system. As effects of climate change veer into ideas supported in the SDGs—such as public health, human rights, and human welfare, particularly in marginalized communities—there are opportunities to base climate curriculum in the social science realm (Perkins et al., 2018; Seeley, 2019; Yorio, 2019). The SDGs provide an accessible entry point for students of all ages, thus creating a mindset of stewardship in the next generation by investing in future oriented thinking (Monroe et al., 2019; Holdsworth, 2019). The SDGs help move the students' awareness from a local to a global level and connect climate change issues to human rights (UN Environment Programme, n.d.). They have potential to be driving agents for new reforms, such as good practices designed by schools and organizations. By identifying problems first and then investigating solutions, students can make marked change in their communities (Sustainable Development Goals, n.d.).

8.4.1 Community-Focused Learning

Connecting a climate curriculum to its cultural context provides an opportunity to build investment in local issues, as well as to improve the lives of those affected in a region (Perkins et al., 2018; Monroe et al., 2019). When students start to examine issues locally, they can transfer them incrementally into a broader global understanding (VanZee 2016). Perkins et al. (2018) compared the pedagogy in five countries (Mexico, Brazil, Saudi Arabia, Germany, and China) towards climate change. Their findings prioritized each area's highest environmental needs to be integrated into the curriculum initiated from the 2015 Paris Agreement on climate change. Brazil focuses on greenhouse gases, global warming, and cultural differences, while China commits to innovative teaching methods, inquiry-based learning, and increasing personal motivation and awareness in students. Germany prioritizes understanding the cause-and-effect relationships resulting from climate change, thus encouraging lifestyle adjustments. Mexico highlights explaining the social factors surrounding climate change, while encouraging critical thinking and a multi-disciplinary approach to problem solving the issues. Saudi Arabia focuses on fostering classroom debate and enhancing critical thinking skills to raise awareness about climate change issues and policies (Perkins et al., 2018). Although each of these countries differ in approaches, a common theme is critical analysis and mitigation through activism (Perkins et al., 2018). Interactive, inquiry-based, and participatory curriculum most effectively develops a thoughtful approach to student agency (Perkins et al., 2018; Monroe et al., 2019; Roychoudhury et al., 2017).

Incorporating local environments and climate issues into a school experience is also an effective form of education for primary students, because it is familiar and accessible. Community-based pedagogy further helps young people to see what is valuable and worth preserving in their home communities (Smith & Sobel, 2014). As shown in other chapters in this book, such as reforms in India and Senegal, community-driven initiatives allow stakeholders in the community to experience the growth and development of students in the area. Even though some sources note that the public tends to be poorly involved and poorly informed about impacts of daily actions in relation to climate change (Jamal & Watt, 2011), we take lessons from Chaps. 2 and 6 about the efficacy of community-driven reforms.

We found two best practices of using community-based pedagogy in addressing environmental and climate issues; the first is Sunnyside Environmental School, a K-8 school in Portland, Oregon, and the second is the Mountain Air Program in Canmore, Canada. The Sunnyside Environmental School has created educational experiences directed towards this end since the fall of 1995. School leaders initially envisioned schools to be more responsive to students' needs for social interaction, hands-on learning experiences, and the opportunity to situate themselves in both the human and the natural contexts of their own lives. Graduates of the program are drawn to environmental fields and display a willingness to become politically involved. Similarly, the Mountain Air Program in the mountain resort of Canmore, Canada, involving schoolchildren and businesses to tackle clean air impacts from local transport, including taxis. Students work with an anti-idle program to produce a communication campaign, including radio segments and visual media, which develop students' participation in community affairs and their proficiency with engaging in media (Jamal & Watt, 2011). Both programs are model efforts because they show the link between climate-focused programs and students' willingness to participate through the four sectors, including government, corporations, community action, and media.

8.4.2 Participatory Learning

In this section, we explore the efficacy of participatory learning in climate change curricula. Through discussions, experiential learning, role plays and other collaborative interactions, a constructivist model develops students' knowledge base (Monroe et al., 2019). By actively participating in the learning process by debating ethical issues, students gain argumentation skills and slowly begin to take action to mitigate climate change (VanZee, 2016; Monroe et al., 2019). Such skills have the benefit of preparing students for future citizenship (Holdsworth, 2019) and to become politically active (Yorio, 2019). Erbil and Kocabas (2018) note that although democratic attitudes are not prioritized at an elementary level, cooperative learning methods enhance the understanding of democracy and develop responsible citizenship skills.

Multiple countries and organizations have extended learning for students to apply these skills outside the classroom. We studied two participatory approaches focused on experiential learning in nature and leadership development through a Model United Nations (MUN) framework. There are primary and secondary schools and educational programs worldwide that incorporate nature-based solutions in student learning; for example, the Green Project Hub at Bali's Green School requires students to follow a set of principles, including incorporating the SDGs and utilizing design thinking and project management skills to address a problem in the world (The Green School, 2020). The city of Genk, Belgium, uses three community gardening programs to engage local stakeholders and partner with education environments to build eco-friendly gardens and bolster bee populations (Kabisch et al., 2017). Within Washington, DC and the Chesapeake Bay, high school students from the Glenn's

Campus of the Chesapeake Bay Governor's School partnered with Friends of the Rappahannock (FOR) in 2015 to install riparian restoration projects in Urbanna, VA (Friends of the Rappahannock, 2015). With the help of FOR and Ready Reef Inc., students installed concrete oyster reefs in the Rappahannock River. Over time, they monitored shorelines and reinforced the banks of the river to control erosion and reestablish wetland vegetation (FOR, 2015). Creating artificial oyster reefs has been a successful intervention in protecting riparian environments and increasing oyster populations in the bay (Chesapeake Bay Foundation, 2020).

When considering where students might apply leadership skills in conversation about pressing climate issues, we joined our peers from Chap. 7 of this book (OC Climate Curriculum) to evaluate Model United Nations (MUN) curricula as an avenue for student leadership development. The MUN blends case-based instruction and investigation with aspects of problem-based learning (McIntosh, 2001). It also has been one of the most popular experiential learning methods. The lowest estimates show that roughly 400,000 students at all educational levels participate in simulations of the UN in more than 400 conferences held in 35 countries around the world (Crossley-Frolick, 2010). According to the learning outcomes assessment of the MUN, first-time participants increased their knowledge of the UN and the topic discussed in the model, developed a realistic orientation towards international relations, and emphasized the importance of individual agency in world affairs (Jesuit & Endless, 2018). Expanding a simulation-based program for elementary students like MUN would help younger students build global awareness and understand their role in larger systems.

8.4.3 Interdisciplinary Learning

Current interdisciplinary curricula leverage standards and cross-cutting concepts within subjects to apply climate and environment focused content within different fields. Few national curricula fully integrate climate change across integrated subject areas, but curricula like the NGSS and the Australian Curriculum both utilize multi-disciplinary skills and cross-cutting concepts to encourage connecting science learning to language and literature, mathematics, writing, and other subjects. Of notable importance is that the NGSS do not address sustainability and climate change specifically at the elementary level, but rather focus on Earth processes. In the curricula currently, third graders describe world regional climate and create a design solution to mitigate weather hazards. Fourth graders use the scientific process to better understand weathering and erosion, how fuel extraction impacts the environment, and create mitigation strategies for "earth processes" on humans. Fifth graders investigate water distribution and how communities rely on scientific evidence for environmental protection (Next Generation Science Standards for States-by-States, n.d). In June 2020, the state of New Jersey adopted an interdisciplinary curriculum specifically connected to climate change from grades K-12. In it, third graders investigate patterns of change in climate and weather conditions as well as cause and effect in natural disasters, fourth graders explore mitigation of natural hazards, and fifth graders examine human impact on the Earth. Here, math and literacy standards are suggested entry points for building the skillsets necessary to understand climate change (State of New Jersey Department of Education, 2020). The Australian Curriculum explicitly states the importance of sustainability: "All Australian Curriculum learning areas have a potential to contribute to the sustainability cross-curriculum priority" (ACARA, 2020). We found curricula from independent groups and nonprofit organizations like Climate Generation, Green Schools National Network, and the World Wildlife Foundation. Each set of lessons spans multiple grades and subject areas, and lessons are meant to supplement prescribed curriculum (even though the lessons are standards-based).

Using various formats to introduce climate change creates multiple opportunities for students to engage with the issues. Using a humanities- and social sciences-based approach brings in a human connection to the study of abstract scientific concepts. Personal stories and narratives present an opportunity to explore other perspectives and gain a deeper understanding of how the issues impact others and build a layer of concern. Additionally, creating a supportive community through educators, peers, non-profit organizations, local groups, and families builds collective knowledge, and supplies a cohesive environment for promoting climate change engagement (Siegner & Stapert, 2020). Providing a multi-media approach through various means (non-fiction, TED talks, documentaries, climate fiction, children's literature, etc.) cultivates a broader eco-awareness in students (Pellet, 2020). Through these differentiated entry points, knowledge about climate science is transmitted to the students, and a balance of positive messaging is necessary to counteract the realities of climate concerns (Bigelow, 2020). When educators are well-versed in climate science and have adequate training and resources, they are viewed as trusted partners in developing foundational knowledge in their students (Foss & Ko, 2019; Siegner & Stapert, 2020).

8.5 Integrating Best Practices

When developing a curriculum on climate change for third through fifth grades, examining how to heighten investment is a key feature. The NGSS, which have a focus on systems, allows students to build a deeper awareness of the interrelated aspects of climate change. Additionally, students at this age have a heightened sense of fairness, so human rights are a meaningful entry point. Individual engagement, government, media, and corporations/community are all aspects to leverage when building investment in mitigating climate change (Watts et al., 2019). Deepening knowledge is an essential first step of helping students understand the *why* behind climate change, thus setting the stage for student action.

The SDGs provide a moral compass to guide student engagement within the instruction of social sciences when examining climate change. The overarching idea of climate action (SDG 13) becomes more comprehensive when supplemented with other SDGs, such as affordable clean energy, sustainable communities as well as responsible production, management, and consumption (United Nations n.d). Understanding the deep health effects of climate change caused by the inter-relationship between people and the land can inspire students to recognize the personal impact of climate change issues. By aligning these ideas with local contexts, students—alongside communities and corporate actors—are better able to see the personal relevance of regional issues related to climate change. We saw evidence of this through community organizations involving students in riparian restoration in the Chesapeake Bay (FOR, 2015). As students become more adept in recognizing community concerns, connecting with organizations that are remedying local climate topics can launch an urgency in why climate change should be addressed. Examining these ideas through participatory and collaborative learning opportunities enhances student engagement, as they discuss the greater issues and participate in simulations to demonstrate local outcomes of climate change. Students will build a foundation of knowledge and skills to apply towards becoming local agents of change. With a focus on community activism, students will be empowered to more direct and targeted action—a leverage point which is often missing in many climate change curriculums (Siegner & Stapert, 2020).

Addressing climate change issues requires critical engagement in four domains: the media, government, corporate sector, and individual engagement (Watts et al., 2019). Therefore, in addition to learning scientific knowledge, students need to build their civic identity and understand their responsibility to community and people. International programs, including those mentioned in China, Mexico, Saudi Arabia, and Australia, advance beyond the US in implementing participatory, community-focused, and interdisciplinary climate curricula. Therefore, we employed community-based pedagogy and simulations like MUN in our curriculum to build civic identity for elementary school students. Some critics think simulations such as MUN only promote surface learning without substantive depth (Haack, 2008; McIntosh, 2001). Yet supporters have found students gained an understanding of international relations, and thus emphasize the importance of individual agency in shaping world affairs (Jesuit & Endless, 2018). Concept familiarity and basic task understanding works well for building global awareness and civic identity in elementary students (Haack, 2008). Middle childhood is a key time to build a foundation for future civic engagement, as children at this age begin to demonstrate more complex understandings and interactions with their social world (Eccles, 1999; White, 2012). Civic engagement can involve partnerships with community and corporate organizations, or opportunities for critical reflection or pushback on community movements and organizations as institutions.

From the level of local decisions regarding climate change, concepts can be extended to the government sector. The 2015 Paris Accord is a model of cooperative influence, which creates a heightened sense of necessity to remedy climate change. Examining how countries prioritize and work towards a common goal can inspire students to use decision making skills to highlight what local issues need to be addressed. Debate, especially through a simulation in the classroom, can help them understand the various perspectives between stakeholders within the community. Additionally, they can develop their own voice and agency within the context of a larger classroom framework of simulations like MUN (Jesuit & Endless, 2018). Students will develop agency from creating small projects to engage the government, such as letter writing campaigns. Through these types of projects, students will be enabled to analyze the implications of local policies, and to examine various roles in the government that can support mitigation of climate issues. As they recognize the complexities of decision making at a government level, they can begin to see the emphasis of agency in greater world affairs.

The media sector is an effective vehicle for accessing information to build a knowledge base, as well as to share information with others. The media can provide a means for students to become engaged politically and publicly, help students to demonstrate local activism, and provide an outlet for applying the SDGs on a local scale. As we have already seen, the media was a significant climate-change leverage point for students at the Green School in Bali, the Sunnyside Environmental School in Oregon, and the Mountain Air Program. As students build knowledge at a local level, they develop incremental connections to global climate issues through news reports, internet sources, and other forms of media exposure.

Part II

8.6 Curriculum Framework

Our theory of action is as follows: if students understand the science behind climate change, recognize its impact on their local communities, and create community-oriented solutions leveraging the four sectors, then they can apply their learning into actions to address climate change issues. Ultimately, then, students can become collaborative leaders who prioritize climate change action.

The literature suggests that teaching climate issues is most effective when incorporated within multiple disciplines and aligned with learning goals such as the NGSS and SDGs, which highlight multidisciplinary concepts. As such, we chose participatory learning, community-focused learning, and interdisciplinary learning to align with student leadership development, knowing that students will demonstrate leadership skills through individual and community engagement, government, media, and corporate action. These practices help students gain cognitive, interpersonal, and intrapersonal skills, which will allow them to critically engage with local climate issues. The range of experiences offer students direct connections to how they can become autonomous actors not only in their future professional lives, but also as students.

In our climate curriculum model, we began by merging disciplines and the standards which students are expected to learn. Through combining learning from various subject areas, including science and social science, we developed learning objectives to strengthen students' cognitive and substantive knowledge, in addition to interpersonal and intrapersonal skills. Our pedagogical targets depend on community-focused, interdisciplinary, and participatory learning practices, which we have found encourage student leadership development, practical application of learning, and are relevant to climate change topics.

8.6.1 Curriculum Objectives

We have summarized the learning objectives for elementary students as such:

1. Using informational texts, observe and understand the impact of climate change on your neighborhood.
2. Understand and explain the roles of these four sectors (media, government, the corporate sector, and individual/community engagement) on climate change, and how each sector can respond to climate change.
3. Collaborate to craft a message about the urgency of climate change issues using various media. With some guidance and support from adults, use technology to produce and publish your message.
4. Craft written and verbal arguments to convey a point of view supported by evidence.
5. From the perspective of a sector leader, imagine and design a solution to reduce the impact of climate change on humans in your neighborhood.

In addition to the learning and knowledge objectives outlined above, we intend to encourage students to reflect on their own values and moral dispositions toward the environment. As Reimers (2021) states, "[I]f education is to influence how we relate to the environment, it must activate our moral imagination, our capacity for ethical and critical thinking and not just dispense us with more facts." In combining substantive understanding of local climate issues with individual changes in mindsets and habits, students will be equipped to cooperate with others to influence the systems that exacerbate and accelerate climate change (Reimers, 2021). These changes in habits might be universal, such as using less water or taking public transportation to decrease carbon emissions, or contextual, such as lobbying local city councils to pass environmentally friendly regulations. According to Dr. Siva Kumani, Director General of the International Baccalaureate, it is crucial to set high expectations for students to meet: "If you give students the chance to make change once, it will be easier to form a habit for future positive actions" (Kumari, 2021). Although Dr. Kumani was primarily referring to the Creativity, Action, and Service (CAS) requirement of the IB diploma program, the same principle applies to the participatory learning component of our climate change curriculum. We considered this approach as we designed our pre-program and post-program survey questions, which measure the degree to which climate change is already a priority for students and their families.

8.6.2 Delivery Options

Currently, the NGSS do not mention either the term “sustainability” or “climate change.” Thus, it is increasingly urgent for schools to address these needs through locally created curricula, such as in those implemented in New Jersey. The decentralized approach to standards in the United States seeks to please every stakeholder in the education sector, so we aim to provide a more localized approach to the school system of Washington, DC. Many of the non-national curricula we saw were developed and distributed by independent organizations and nonprofit entities, which could result in varied implementations depending on teacher interpretation of the lesson. Though the lessons crafted by these third-party organizations were comprehensive and included interdisciplinary learning activities, we also want to implement these lessons in a manner that would result in school-wide buy in—rather than just participation from individual teachers, who may select these third-party lessons according to what they want to teach. Since we want teachers to collaborate across disciplines, we encourage teachers to convene as a teaching cohort to share instructional practices in a Peer Learning Community setting. This would create structured opportunities to enhance their professional knowledge on climate change issues, critical for the success of this program.

To disseminate our curriculum, we will likely need a partner to aid us in making curricula widely applicable to schools in different contexts. Whether through an independent publisher or a sponsor organization, we have considered the implications of expanding this curriculum to other schools outside of our client’s school system. We are currently looking into developing more lessons, piloting our lessons through multiple environments, making lesson frameworks more flexible for educators in different contexts, and expanding the curriculum from grades 3–5 to K-12 to establish institutional changes and commitments to climate change beyond habit shifting. In addition to communicating with executives from the Zinn Education Project and Rethinking Schools Initiative, we have identified and considered other resource providers, including Envoys and the International Baccalaureate program, as potential partners to assist us in streamlining and publishing our curriculum to be distributed on a larger scale.

Current elementary science curricula (including at our partner school) are mostly knowledge-, rather than critical-thinking, based. From our analysis, climate change instruction is the most effective for third through fifth graders when it is delivered via a critical, collaborative framework (such as the Zinn Education Project). It is essential that students use these critical thinking skills to understand abstract topics, such as the greenhouse effect and greenhouse gases, anthropogenic phenomenon, and the consequences of human activities on ecology, society, culture, and economics in a developmentally appropriate manner is essential (UNESCO, 2017). Concerns of the impact of each of these topics on the world must be balanced with hope for the future on what students can do to make a difference in society.

8.7 Logical Framework

Following our theory of action, we analyzed the factors that would be key in implementing our curriculum. In our work to strategically analyze the formation of our program theory and implementation theory, we created a logical framework to identify the latent assumptions and risks that underlie our program, our implementation plan, our achievement indicators, and our program evaluation tools.

8.7.1 Assumptions and Risks

Our theory of action is contingent on some assumptions that we have identified, namely time for teachers to teach our lessons, communication channels, and the willingness for teachers to collaborate across disciplines (ensuring student buy-in and participation within our shifting political climate). We also sought to mitigate these assumptions by collecting more data through pre-program surveys and qualitative research. Based on interviews with faculty, our partner school appears to be well-resourced and staffed. Though it has the resources and staff to implement our curriculum, we do assume that teachers would have time and ability to pilot a program during the pandemic, where most teaching is virtual or scaled back. We have talked to teachers who are enthusiastic about the program, but change also requires teachers who have the time to be able to coordinate and collaborate. After all, our curriculum requires interdisciplinary instruction and collaborative evaluation (such as portfolios and anecdotal data collection to assess student growth). To address this assumption, we intend for teachers to share the workload of this curriculum due to the interdisciplinary nature of the content. Indeed, we expect teachers to collaborate with each other for instruction and assessment, but this collaboration would also lead to creation of an authentic learning community across classrooms.

The method of learning, whether virtual or in-person, brings us to another assumption; student buy-in. We talked to teachers who are willing to offer a climate workshop using one of our lessons to students and gauge student interest. Otherwise, we would measure student buy-in within our curriculum by using periodic surveys. Since the curriculum is student-driven and contingent on participants continuing their involvement and interest in climate leadership, it is key to measure whether students are enthusiastic in their participation in this curriculum. Finally, we assume with the shift in national leadership, this school and others might be more willing to invest in a curriculum explicitly focused on climate change. Especially in our nation’s capital, there may be a higher connection to the policies endorsed by Biden’s Presidential administration.

8.7.2 Implementation Plan

Initially implementing our program within our partner school, we will test how the curriculum works in building leadership and civic awareness towards climate change mitigation in elementary students. While piloting the curriculum, we will also reach out to other informal platforms to build the capacity of the curriculum for future scalability. After evaluating the implementation effects of the curriculum within our partner school, one that is well-resourced and highly innovative, we will adjust the scalability implications. With context adaptation ideas provided, we aim to have more schools adopt this curriculum.

Step 1: Our first step in implementing our climate change curriculum is to earn buy-in from school administrators and teachers. This must be accomplished through the following tasks: presenting the overall objectives to the school administration team to confirm their interest and decide channels for implementation, presenting the curriculum and lesson plan template to teachers to hear their feedback and ideas, and involving science teachers from middle schools, high schools, and universities (where climate change is well covered) for feedback of climate change instruction in elementary school.

Step 2: The next step is to assemble a team, which requires choosing teachers to pilot the program for the school year (whether this involves incorporating climate change education into the prescribed classroom curriculum or engaging extracurricular programs like science clubs) and expanding the team to scale the curriculum to other grade levels in following years. Members of the pilot team can act as mentors or instructional advisors for teachers implementing the curriculum in later school years.

Step 3: This step requires composing teacher development. For teachers to be successful, we propose surveying teachers to understand their current knowledge of content within the curriculum. This can lead to the creation of a Peer Learning Community for program teachers to congregate in a space for professional development from professors at local universities, speakers, and local workshops. In addition, teachers who piloted the program can provide instructional leadership to their peers.

Step 4: The following step is pilot implementation, during which teachers will complete the following tasks: collaborate with pilot science teachers to determine projects and capstone lessons, incorporate curriculum activities into classroom lesson plans, test curricular activities and ideas in their pilot class, document student learning (ex. photos of students' participation, projects), and work with students to publish their projects.

Step 5: After implementing instruction and curricular activities, educators will assess students' learning outcomes in the pilot classes. Teachers will evaluate students' learning outcomes in science knowledge, four-sector knowledge, leadership skills, and collaborative skills through project observations, observe students' behavior changes in living sustainably, and survey parents and caregivers to measure their changes of awareness, sustainable habits, and climate-friendly actions at home.

Step 6: To gauge the program's effectiveness, school leaders and teachers will need to evaluate the implementation of the curriculum and adapt it as needed. The tasks necessary to complete this step will include interviewing pilot teachers to receive feedback on curriculum and resources, interviewing students for feedback on learning outcomes and learning experiences, collecting evidence of best practices, and updating the curriculum and learning activities based on feedback.

Step 7: Finally, we outlined a step to scale the curriculum within the school. Teachers will share student projects and relay their takeaways from the pilot classes across the elementary school to expand buy-in, discuss whole-school implementation with the elementary school administration team, and identify best practices through qualitative and quantitative data collection. Teachers and school leaders will also adopt modules of the curriculum to align with other programs at the school, such as environmental extracurricular clubs, upper elementary environmental education courses, and the experience to develop leadership attributes including communication, empathy, vision, and potential to influence.

8.7.3 Achievement Indicators and Evaluation

Our curriculum is designed to support students to become leaders, who will be able to prioritize climate action within their communities. We will know our curriculum's long-term success if students within the program engage in the four sectors to drive community impact in the future. Whether through policy changes, participation in climate-focused action movements (such as Fridays for Future and the Sunrise Movement), climate-driven media engagement, or driving eco-friendly business practices, we aim for students to continue climate-conscious behavioral habits and develop leadership skills regarding climate issues throughout their time at the school. These behaviors directly connect to our theory of change, as our implementation theory encompasses activities to drive student outcomes.

In the short term, we decided to keep program measurement aligned to activities that teachers at the school already do, so we can maximize their time and evaluate our curriculum as the program progresses. Our achievement indicators for students and curriculum evaluation use similar methods of assessment to that of project-based learning. We will rely on teachers participating in the program, who can reflect periodically and evaluate the curriculum by using surveys. Pre-program and post-program surveys will be especially effective in gauging whether teachers believed the curriculum to be effective and successful. By tracking student data, including attendance, student work (including portfolios, writing samples, and assessments), and student participation, we can measure the outputs of our curriculum and evaluate whether our curriculum is effectively producing student leaders who prioritize action on climate change. Since our program is also compatible with CCSS, NGSS, and the SDGs, which teachers are familiar with at the school, we can also create rubrics and assessments that measure standards-aligned student achievement, as well.

Ultimately, we will deem this program a success if students fully engage with the lessons and produce work that shows they have internalized these lessons, as well as if teachers and administrators reflect positively on their involvement and implementation of the curriculum prior to and after the program. Administrators may have varying perceptions of education priorities, particularly within the pandemic, but in the long term our curriculum helps develop students who live into the values that the school exemplifies. Knowing how children can inform and influence the knowledge, attitudes, or behaviors related to climate change of their parents, we also want to measure our curriculum's impact on students' parents and caregivers via surveying (Lawson et al., 2019). Our pre-program and post-program surveys for students, teachers, and students' caregivers have already given us valuable information about stakeholders' attitudes toward climate change, and we look forward to seeing whether and how our curriculum impacts survey responses after we complete the curriculum.

Numerous studies have shown that youth are increasingly concerned about climate change and want to prioritize learning more about it. Some studies indicate that students feel it is a more important subject than traditional school subjects (Magas, 2020; Children want, 2011). We confirmed this through student and caregiver surveys at our partner school. On a scale of 1–10, with 1 being "not important at all" and 10 being "highly important," we observed a 20-point difference between students and their caregivers who viewed climate change as a higher priority in the 9 and 10 range. Ultimately, students rated overall significantly higher rankings for the importance of learning about climate change. Therefore, there is potential for more students to influence their parents' ideas and urgency about the topic. We inquired about other aspects related to our curriculum such as environmental stewardship, global awareness/citizenship, service learning, writing, and collaborative projects, and skills in our survey as well.

We posed similar wonderings in a survey to an upper elementary class at our partner school (using a non-nationally representative sample) and found that 87.5% of the students surveyed ranked climate change as a 9 or 10 out of 10 in importance, and 96.8% of the students ranked it at 7 or higher. When ranking reading skills, 78.2% of students rated them as a 9 or 10, and 91.6% of students ranked reading skills at 7 or higher. Mathematical problem solving was viewed slightly higher, with 75% of the students ranking math at a 9 or 10, and 91.6% of the students viewing math skills as a 7 or above in importance. Climate change still ranked higher overall, confirming that climate change is of high interest to the students surveyed.

After considering how intergenerational learning between students and parents can change mindsets, we decided to survey parents as well (Lawson et al., 2019). Compared to 78.2% of students, 94.4% of parents viewed reading skills as a 9 or 10 out of 10, and 100% of parents ranked reading above a 6 on our scale. Compared to 75% of students, 83.4% of parents viewed math problem solving skills as a 9 or 10 on our scale, and 100% ranked it as 7 or above. The largest difference by far was seen in perceptions of climate change; while 87.5% of students prioritized climate change, only 66.7% of parents ranked climate change education at a 9 or 10. However, 100% of parents did rank it as a 7 or above. There was a 20-point difference between students and parents who viewed climate change as a higher priority in the 9 and 10 range, with students rating overall higher rankings for climate.

To effectively build teacher knowledge on specific issues related to our curriculum through professional development, we surveyed teachers involved in the initial curriculum pilot. According to teacher responses at our partner school, they feel confident building leadership competencies, participatory learning, and project-based learning. Conversely, teachers reported needing more support in policy creation steps, Model UN structure, and knowledge of climate refugees. They would therefore need more training in these areas, and of course other school contexts would need to identify the capacity of their own teachers and staff. Other areas where professional development could be helpful are in local climate issues, the greenhouse effect, and anthropogenic phenomena.

8.8 Scalability

We considered the scalability of our program outside of the context of our partner school, as well. Our niche reform reflects a need to address climate change and leadership within the context of the school by including multiple entry points. Yet our research shows a much broader need for participative, community-based, leadership-focused climate change curriculum content within other elementary schools extending beyond the Washington, DC area throughout the United States. To address this larger, more systemic problem, we have identified implications and applicable approaches to design a curriculum reform that would offer our curriculum to schools on a wider scale.

Our most prevalent barriers toward systemic scalability include limited teacher autonomy and capacity within other schools, limited school resources, limited school, and community cultural buy-in, and varieties between geographical contexts. Though school resource levels and teacher autonomy are critical considerations, we see geographical contexts and political landscapes as the most significant barriers towards adopting this climate change curriculum; a school community in liberal-leaning Washington D.C. that regularly witnesses the impacts of sea level rise may be more likely to buy-in to this program, but a school in rural, conservative Wisconsin may not due to the lack of visibility of climate change effects and polarized nature of climate change in the United States (Hornsey et al., 2016; Veloz et al., 2012). Given this concept, ideology and geographic context may likely be a hindrance in global adoption of climate change curricula as well.

After piloting the curriculum through in-class lessons and extracurricular science clubs, feedback helps upgrade it beyond that of a highly resourced environment with high teacher autonomy. In settings with limited teacher autonomy and capacity, informal learning resources such as science clubs, educational videos, or book clubs provide entry points to adopt the curriculum outside the classroom. Another consideration includes professional training on best teaching practices, which should be collected from piloted experiences and a developed package of resources. Policymakers, the public, and other climate change institutions can promote national standards on climate change education in elementary schools and provide potential to expand from niche reform to systemic change. Scaffolded teacher co-creation occurs through a framework to adapt lessons to the student needs, school resources, and differentiated activities within a school context.

In environments with limited school resources or cultural buy in, collaboration is essential. Differentiated climate change packages for high and low-resourced schools developed with science teachers match the school's vision and educational priorities. Funding potential arises through partnerships with organizations supporting climate change. Partnering with researchers to develop locally relevant curriculum content supports contextually driven climate change education. Incorporating climate change leadership and competency into twenty-first century skills could provide an entry point for global educational institutions to encourage schools to adopt the curriculum. We have seen in Chaps. 2 and 3, referencing India and Egypt, the eagerness of countries around the world to incorporate twenty-first century skills in education reforms, and we think the next step is to channel twenty-first century skill-building to address the realities and threats of climate change.

Ultimately, we are hopeful that our research and work to pilot this curriculum at our partner school provides a complete, coherent, and compelling argument to implement a system-wide shift to include climate change curriculum within the United States and beyond. In addressing funding for our curriculum, it can be said that its benefits expand beyond school resources. The curriculum is an efficient and cost-effective measure to address climate change issues, by investing in student action and their influence on parents, community, and beyond. In examining the impact of the pandemic on government priorities, many areas are shifting funding to issues related to COVID-19 and reducing the fiscal resources devoted to climate change (United Nations Environmental Program, 2020). Our curriculum presents an investment in the future: students are empowered to immediately apply their knowledge to projects of activism and community engagement thus raising their voice and impact beyond the school walls.

8.9 Conclusion

Despite the slow nature of education reform, the pressing threats of climate change will not abate. Knowing our students will be the ones facing the ramifications of our changing climate, within this curriculum we are proposing a radical shift in the way we frame education to the leaders of tomorrow. Children are more capable than we realize, and we have seen powerful examples of young people leading movements to act on climate change. Children are more open to showing concern and a desire to mitigate climate change; the research shows that using a successful climate change curriculum, families will have more conversations about related issues, and begin to make changes to their household practices (Lawson et al., 2019). We need to counterbalance the worries we have for our world with a sense of hope in our future leaders; children are acutely aware and interested in climate change issues, so it is up to school leaders to harness this interest and channel it into action. As John Dewey says, "If we teach today's students as we taught yesterday's, we rob them of tomorrow."

To inspire future change, we must be tenacious. We must try innovative approaches, novel curricula, and new objectives for students. It is only through this tenacity that we will inspire students to take an active role in addressing climate change moving forward—otherwise we will, in fact, rob them of tomorrow.

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Chapter 9
Conclusion

Fernando M. Reimers, Uche Amaechi, Alysha Banerji, and Margaret Wang

Beyond the immeasurable devastation the COVID-19 pandemic has wreaked in terms of public health, society, and the economy, it has made clear the need for ambitious educational reform in a rapidly changing world. Such need will be greater in the Global South, where most students live, and where the educational impact of the pandemic has been greatest. Advancing educational change to build back better will require knowledge about how to implement reforms at scale, especially as these reforms take place in resource-constrained environments. The study of past efforts with similar goals in the Global South can provide such knowledge.

Alongside previous studies of implementation, the reforms studied in this book show that the implementation of education reform is a process of evolution, adaptation, and learning. This process can be characterized along four dimensions: the goals of the reform, the forces supporting the reform, the strategy, and the mindsets about change undergirding the reform. We discuss each of these dimensions below.

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9.1 What Goals Animate These Reforms?

The reforms discussed in this book are all, to some extent, driven by the impact of globalization. Throughout the analyses in India, Taiwan, Egypt, Vietnam, Senegal, Orange County, and Washington, DC, three pathways can be identified: (1) new demands for job skills in an increasing globalized and competitive world, (2) alignment with international educational standards and goals, and (3) a recognition of the global nature of daunting challenges like climate change. Though distinct, these aims are also intersecting. For example, in India, the Multi-Skill Foundation Course aims to make vocational skills and courses more attractive to students, motivating them to persist in school completion. In addition, the program aims to increase the employability of students through the development of twenty-first century skills and attitudes—including problem solving, teamwork, and effective communication.

In the chapter on Vietnam, the goals of education are tightly linked to economic growth. Investment in education is motivated by social and economic development and is thus intended to facilitate a labor market shift toward high-skill jobs. To do this, the newly introduced curriculum aims to encourage teachers to transition from content development to the development of "characteristics and competencies," and from a "knowledge-based curriculum" to a "competency-based curriculum."

The reforms in Taiwan and Egypt are similarly competency-based. In addition to universalizing access to education, the 12-Year Basic Education reform in Taiwan aims to develop twenty-first century skills, aligned with economic participation, civic engagement, life purpose and lifelong learning. Building on the goals of previous curricular reform, the 12-Year reform refines and clarifies the set of competencies in the 9-Year reform curriculum, to support lifelong learning. Specifically, the four core goals of the 12-Year reform are: (1) to inspire teachers to unleash their full potential, (2) to teach and develop students' knowledge about life, to promote students' career development; and (3) to inculcate students' civic responsibility.

The chapter written about Egypt centers around the EDU 2.0 reforms. These reforms aim to promote critical thinking, knowledge-based inquiry, and lifelong learning. They are grounded in principles from a UNICEF-developed framework, and center around fourteen skills that should be acquired by each child in their pre-tertiary education. They include twelve skills from UNICEF Life Skills and Citizenship Education (LSCE) framework, and two additional skills—accountability and productivity—which are included by the Egyptian Ministry of Education and Technical Education (MoETE) specifically for the Egyptian context.

The Cases des Tout-Petits reform in Senegal stands out in this book for its explicit acknowledgement of the close relationship between education and public health. Though it predates the COVID-19 pandemic, the goals of this reform link public health and early education outcomes and may be of renewed interest to policy makers.

Chapters 7 and 8 provide examples of curricular reforms at the classroom level, in response to an urgent need for education about and to mitigate climate change. Chapter seven discusses the process of adapting global goals around sustainable development to the context of Orange County, California, with the specific mission of encouraging students to adopt environmentally conscious behavior that can result in the reduction of local carbon emissions by at least 10% in 10 years. Relatedly, Chap. 8 on Washington DC, highlights curriculum aimed at shaping collaborative leaders. According to the authors' analysis, strong leadership allows teachers to prioritize climate change action through effective science education, enabling students to recognize climate change impact on local communities, and by creating community-oriented solutions.

9.2 What Strategy Did These Reforms Follow?

In some countries, government entities designed and led the reforms in a top-down fashion in response to these stimuli. In others, the reforms had a more decentralized and bottom-up provenance—as they were led in part by local entities, international and domestic non-governmental organizations.

9.2.1 Bottom-Up

The MSFC reform in India was started in response to the developing need for skilled workers in the Indian economy, and the observed mismatch between that need and the skills and experience students were gaining in school. Lend-A-Hand India, an NGO, started the initiative as a grassroots bottom-up effort in a small number of schools, and began collaborating with state and national governments as it sought to scale its efforts and impact. Initially the reform was implemented in 600 schools in the state of Maharashtra and was then ultimately extended to over 10,000 schools across India.

The proposed climate change-focused curricular reforms in Orange County and Washington, DC were similarly bottom-up efforts, which leveraged the interests of local educators and schools. The bottom-up approach used in Orange County directly referenced UNESCO's statement on the purpose of climate change education and sought to create awareness and interest for the curricular assets via its Best Delegates website. In Washington, DC, the authors planned to introduce the curriculum in independent schools connected to the authors (before potentially expanding the curriculum to other schools).

9.2.2 Top Down

While some of the reforms in this book started as grassroots, bottom-up efforts, others were clearly top-down government efforts. In the latter case, these reforms were driven by the governments' aim to improve the quality of their education systems and align them with international standards. Vietnam's Resolution 29, supported by the World Bank, builds on prior waves of twentieth century reforms, and focuses on updating outdated teaching methods to develop new educational approaches to equip students with twenty-first century skills. Similarly, the Senegalese reform drew inspiration from previous national reforms, as well as the prioritization of early childhood education in the Millennium Development Goals. In Taiwan, the Ministry of Education, in collaboration with the National Education Research Association, drew on international trends in expansion of basic education to improve their educational system's ability to holistically develop each child. Likewise, the Egyptian Ministry of Education worked closely with international organizations such as UNICEF, UNESCO, and the World Bank to improve the quality of Egyptian education by developing competencies based on a life skills framework developed by UNICEF.

These chapters emphasize the role of government as key to scaling. For example, in India, there was a two-school initial pilot created solely by a nonprofit organization through a bottom-up approach. While this was successful, policymakers in India were not able to scale nationally until they started working with Maharashtra state government (a process which took 5 years alone). As with Taiwan, the reform emphasized capacity building to ensure that the curriculum would be implemented efficiently. Similarly, Vietnam's reform, which started wide scale rather than staggered, also relied on the Ministry of Education and Training. Due to the decentralized nature of the local education system, the reform did not necessarily translate between the central to local governments. While government can play an important tole in bringing reforms to scale, the institutional context is imperative in order to coordinate and align government stakeholders to further scale a reform.

Taken together, although the reforms reviewed in this book differed in style of implementation—whether generated through grassroots efforts or government mandates—they shared similar influences. Namely, each of the reforms emphasized the impact of increasing globalization on economic competition, broader educational standards, and the daunting tragedy-of-the-commons challenges that affect us all.

9.2.3 Theory of Action and Strategy

A clear theory of action is essential to any successful strategy. Theories of action frame strategies, increase stakeholder buy-in, and improve fidelity to implementation. Whether we are discussing a top-down government mandated reform—such as the cases of Vietnam or Taiwan—or more bottom-up initiatives—such as the cases of Washington, DC, Orange County, or India—the buy-in and engagement of relevant stakeholders influences reforms' success. The top-down/bottom-up nature of reforms does not, however, necessarily align with the level of clarity and communication of the reforms' underlying theories.

Bottom-up initiatives such as in Washington, DC and India had theories of action that were as clear as those in more top-down reforms such as those in Taiwan. The authors of the DC study stated the theory of action as:

> If students understand the science knowledge of climate change, recognize its impact on their local communities, and create community-oriented solutions leveraging the four sectors, then they can apply their learning into actions to address climate change issues. Ultimately, students will become collaborative leaders who prioritize climate change action.

In addition to having a clear theory undergird the initiative, the DC team also reached out to key potential stakeholders in the design process. The MSFC, originally a bottom-up initiative that later scaled through government collaboration managed its growth with a clear theory of action that remained consistent throughout its evolution:

> If students participate in MSFC courses they will be more likely to remain in school, increase their dignity of labor and ultimately become more employable.

The Taiwan initiative also articulated a clear theory:

> If entrance exams are eliminated, tracking in secondary education is restructured, and the development of talent for each student is supported via a competency-based curriculum, then access to upper secondary education would be expanded.

The Senegalese and Egyptian reforms also had clear theories of action. The Senegalese reform, Cases des Tout-Petits, connected investments in children's communities, cultural awareness and early development with children's ability to later become positive contributors to the Senegalese economy. The Egyptian reform similarly connected education quality to multidisciplinary curriculum, technology integration, continuous professional development, access and infrastructure, and reformed assessments. However, the authors of the Egypt analysis were unable to find written documentation that clearly articulated the reform's goals, theory and strategy and deemed the theory's communication to be deficient, potentially compromising collaboration with inter-governmental agencies.

Although many of the reforms discussed in the preceding chapters presented clear theories of action, not all did. While the authors of Chap. 5 on Vietnam were able to infer an underlying theory for the reform coupling comprehensive education sector reform with socioeconomic development, a clear theory did not appear to be explicitly written into the reform. Similarly, in Chap. 7 on the bottom-up curriculum creation in Orange County, the authors noted a lack of clarity regarding how curriculum would be communicated to teachers, or how other important stakeholders would be engaged in the process. The authors found a "build it and they will come" approach to the initiative's underlying theory lacking and provided suggestions for publicizing the curriculum and effectively engaging stakeholders.

The reforms studied in this book displayed varying levels of clarity with respect to their underlying theories of action and the level of communication and engagement with relevant stakeholders. That this clarity or lack thereof was somewhat decoupled from the reform's structure—bottom-up or top-down—suggests that the coherence of a reform is not necessarily determined by the champion's authority or level of control. This is a finding that would portend well for bottom-up initiatives and demand clarity from government-driven initiatives.

9.2.4 Strategy and Coherence

One of the purposes of education strategy is to foster coherence among the various components of an education reform. This serves to leverage synergies among various education processes, such as between a novel curriculum, student assessment, and teacher professional development. Among the reforms studied in this book, only the reform in Taiwan appears to have intentionally been designed to promote such coherence.

The Taiwanese reform takes a decidedly 'systems level' approach, which simultaneously relies on eight 'policy levers' and that seeks to ensure they are coherently aligned:

1. Curriculum development entails the creation of individual school-based curriculum development committees, integrated school-adjusted curriculum plans, improvement-focused curriculum evaluation mechanisms, and resources for experimentation and innovation with school autonomy.
2. Teaching implementation includes teacher preparation, support for adaptive and innovative activities, and the practice of varied teaching models to foster a positive learning atmosphere and increase learner motivation.
3. Learning assessment and application places an increased focus on the use of formative and varied assessment types in class to help teachers adjust their methods to benefit learner outcomes. It also suggests the use of tutoring and remedial services dependent on student needs.
4. Teaching resources require materials, equipment, and budget for teachers to develop innovative pedagogical methods. Curriculum and materials need to reflect multiculturalism and appreciation for diversity; local authorities can adjust curriculum to local needs. The MOE is tasked with creating collaboration channels between teachers, schools, researchers, and the community.
5. Teacher professional development outlines a need for professional learning communities for preparation, observation, and research inside and outside their classrooms, emphasizing a change toward a positive peer learning culture and interpersonal and financial support systems. Professionalism is developed through content integration and regular relevant workshops.
6. Administrative support highlights the need for competent authorities to provide adequate assistance to teachers to accomplish curriculum goals and implementation steps through preemptive funding, informational seminars, and responsive evaluation surveys for targeted support.
7. Participation of parents and nongovernmental organizations validates the necessity of whole-community support of student learning by engaging the parents in the school environment and utilizing community resources to offer real-life learning opportunities.
8. Supplementary provisions stated that progressive implementation would begin in August 2018 (which was postponed until August 2019), and local authorities have jurisdiction over providing appropriate education and activities for

special education, art and vocational activities, indigenous curriculum, and experimental education.

In contrast, India's approach of vocational programs was offered in schools as a vocational alternative but was not necessarily integrated with other courses in the school. As a result, the program was implemented in a 'silo' and failed to influence other school subjects, which could have all aligned on the goals of developing twenty-first century skills.

Similarly, it is unclear that there was an explicit effort to create coherence among the various elements of the reform in Egypt or Senegal. Coherence was a recognized challenge in Vietnam prior to the reform, a challenge the reform attempted to address in several ways. In fact, a lack of administrative coherence was one of the key challenges which led to the need for reform. This includes provisions on decentralization between central and local levels, and providing autonomy for educational institutions, especially in higher education. To align higher educational institutions and the labor market, and to facilitate the economic development aims of Resolution 29, one of the (8) key solutions of the reform is: "Strengthening the linkage between universities and the labor market as well as scientific research and technology transfer to meet societal needs." Other policies aimed at coherence include "rearranging and connecting the network of vocational and higher education institutions, choosing uniform standards for training levels and qualifications, and orienting institutions of higher education towards scientific and technical research, application and practice." (p. 11) The new curriculum introduced in 2016 also aims to create curricular coherence by "[E]nsuring vertical connectivity between the levels in the same subject, horizontal connection between subjects in the same class level and aligning to the physiological development of learners.

Coherence remains a challenge in the Vietnamese reform to this day. According to a World Bank higher education assessment (2020), "[T]he higher education system in Vietnam is highly fragmented across many dimensions, including: (1) Vietnam does not have a single body responsible for the entire tertiary education and research system, (2) the existence of several hundred public research institutes operating independently from the universities, (3) multiple by-laws issued in recent years are seen as contributing to the complexity, fragmentation and inconsistencies of the regulatory framework, (4) the role played by MOET in initiating reforms and setting the long-term vision is undermined by inadequate capacity, resources and information, (5) no unified higher education information management system (HEMIS), which hinders evidence-based decision-making from all stakeholders." (p. 22–23).

9.3 What Perspectives on Educational Change Did the Reforms Reflect?

Each reform is based on a series of implicit or explicit ideas about how change happens. These frameworks serve to design a reform, to examine its completeness and coherence, and to communicate it to others. It is possible for a reform to depend on multiple frameworks. The authors of the chapters in this book used five conceptual perspectives for their analysis: cultural, professional, psychological, institutional, and political (Reimers, 2020). This section reviews how these perspectives are reflected in the reforms studied in the book.

9.3.1 The Cultural Perspective

The cultural perspective highlights the relationship between the educational change process and societal hopes, demands, and values. The reform from Senegal shows that change efforts can integrate traditional societal norms with expectations for change. While the CTP reform aimed to promote cultural awareness around public health practices, it did so while integrating Senegalese culture. The CTP reform was made more successful by emphasizing the importance of ethnic and religious background, designing huts inspired by Senegal ancestral civilizations, conducting instruction in local language, integrating Quranic education, and enlisting parents and grandparents to teach Senegalese values.

A cultural perspective also sheds light on how societal values and the shared understanding of what schooling looks like. The cultural perspective places expectations on pedagogical practices and instruction and takes those expectations into account even when change challenges the traditional ‘culture of education’. For example, in the MSFC course in India, students’ work with their teachers and communities to engage with projects that address needs identified by their local communities. Additionally, the reform focused on empowering citizens to support the current needs of the economy, including building skills such as teamwork, communication, and problem solving within vocational schools. This approach supported the normalization of cross-gender communication and promoted a shift in views on gender roles even though the theory of change did not explicitly delineate the promotion of these cultural shifts. Similarly, in Vietnam, the reform shifted the high stakes, competitive exam culture and rote learning to project based learning, innovation, and collaboration. This was done to promote investment and access for vulnerable communities.

A cultural perspective can also help understand the resistance to a reform that neglects societal values or underestimates the challenges it represents to preexisting mindsets. In Taiwan, the top-down reform did not align with the pedagogical expectations of schools, the existing culture of education. The student-driven and inquiry-based approaches were seen as imported and departed from traditional pedagogy.

There was a similar experience with the reform in Egypt as a competency-based curriculum, which led to less participation from key stakeholders such as teachers and parents.

A cultural perspective can also illuminate the extent to which an education reform is intruding in spaces considered ‘off limits’ and private, such as family values and religion. As teaching about climate change is a politically divisive subject in some parts of the United States, the chapters about Washington, DC and Orange County emphasize the importance of relying on a cultural perspective to thoughtfully support shifts in mindsets about climate change education.

9.3.2 The Psychological Perspective

The psychological perspective relies on the science of learning to design curriculum and pedagogy. The OECD’s Defining and Selecting Competencies project (DeSeCo) relies on a psychological perspective to identify important competencies, knowledge, and skills; as do other frameworks used by international education organizations, such as UNICEF. The reform in Vietnam exemplifies the importance of considering the way that teachers can teach students and gain such competencies. The “one curriculum-many textbooks” aspect of the reform was integrated to help teachers unleash creativity and for teachers to have the freedom to create more effective teaching plans. Supporting teachers can be further explored with a professional perspective.

A psychological perspective can be deployed to help promote cultural mindset shifts. As discussed in the previous section, cultural norms often determine what students should learn in school. Because teaching about climate change represents a cultural mindset shift in the US, the authors of Chap. 7 about Orange County emphasize the importance of integrating a psychological perspective to support a change in those cultural norms. For example, they emphasize the importance of linking new behavior with one’s identity, which necessitates the exploration of one’s identity within the curriculum based on neuroscience research. Bloom’s taxonomy and the psychology of emotions is also integrated in their middle school curriculum, which is also further rationalized for developmental appropriateness.

Finally, Chap. 6 on Senegal highlights an important element of a psychological perspective. While the psychological perspective emphasizes the science of learning, this is often done through a developmental and cognitive psychology lens. Cognitive development interacts with biological development, the anatomy of the brain, and of the body, provide the foundations for the mind. Supporting the healthy development of children requires also supporting their health and nutrition, in addition to cognitive stimulation. The reforms in Senegal were based on this basic developmental principle.

9.3.3 *The Professional Perspective*

The professional perspective focuses on the role of expert knowledge as a foundation for instructional practice. All the reforms examined in this book underscored the centrality of a professional perspective to understand the implementation process. While all reforms demonstrate a recognition of the importance of addressing expertise, they do it in two different ways: by building teacher capacity to meet new demands, or by adjusting demands to existing levels of teacher capacity.

A most obvious way to align teacher expertise with the demands of instructional practice is the creation of structures and programs that support the professional development of teachers so they can meet new demands, though the programs don't always deliver as expected. For example, while the reform in Egypt included a digital teacher platform called Professional Learning Journey and a detailed teacher guide for the new curriculum, the main challenges identified with the reform involved teacher capacity. This could have been partly attributed to the limited professional development, which was around 3 days a semester. Similarly, in Senegal, the analysis revealed that teachers with low levels of education were the reason for low levels of student achievement. On the other hand, the strength of the reform in India was the clear focus on building teacher capacity through mentorship programs, mobile applications, clear expectations, and regular assessments among other strategies. While a professional perspective is evident in these reforms, not all structures and processes implemented to support practice are effective.

Alternatively, the professional perspective can be used to adjust the demands of instructional practice to existing levels of teacher capacity, ensuring that the demands of reform are not "over the teachers' heads." For instance, the authors of Chap. 7 proposing climate change education in Orange County consider developing the curriculum to match what is already being taught so that teachers would not need a lot of professional development.

9.3.4 *The Institutional Perspective*

The institutional perspective focuses on coherence and alignment among the various components of the education system, including curriculum, school structures, governance, staff, assessments, and funding (Reimers, 2020). This perspective is especially critical for large scale, systemic reforms, where the components of the reform can become 'siloed' causing them to be out of step with each other. The reform in India illustrates that organizations outside of the typical education system can play a considerable role in scaling education reforms and providing similar institutional support. For example, the MSFC program was scaled to serve over a million students in several thousands of schools across several states through a collaboration between Lend a Hand, the Maharashtra government, and the Ministry of Skill Development and Entrepreneurship.

For smaller scale, incremental reforms, an explicit institutional perspective may be less necessary as the evolutionary nature of implementation can produce the necessary mutual adaptation and coherence among the elements of change, given the small number of people involved. For instance, while the authors of Chap. 8 on curriculum change in Washington, DC acknowledge that teaching about climate change should be eventually institutionalized at a system level in schools, they adopt an incremental, bottom-up approach to gradually cultivate teacher, student, and parents buy-in to first foster a culture of environmental stewardship. The authors of Chap. 7 on Orange County also acknowledge that their curriculum does begin enacting institutional changes, but that the creation of a low entry point will promote teachers and students to be advocates and eventually influence the institutional systems needed to scale such climate change curriculum.

9.3.5 The Political Perspective

The political perspective considers a reform as it affects the interests of various stakeholders. Chapter 5 on Vietnam emphasizes the range of stakeholders to consider. For example, the introduction of "one curriculum—many textbooks" highlights the need for stakeholder cooperation from micro-level stakeholders such as textbook publishing companies to macro-level stakeholders such as foreign training institutions to support government-funded overseas training.

Furthermore, Chap. 7 on Orange County highlights another strategy for successful education reform considering the political perspective, an incremental, grassroots perspective, that eschews political debates regarding climate change. This approach is mindful of the potential clashes between stakeholders in such debates, demonstrating the use of a political frame, and relies on a bottom-up strategy that will build understanding and support gradually, intentionally avoiding political controversy.

Finally, Chap. 4 on Taiwan emphasizes the importance of considering the political context when analyzing reform. While Taiwan promoted a top-down reform with little input from teachers or from the public, the government is sustaining a long-term education reform and is committed to protecting it from political discontinuity. However, this is a strategy that may be more effective in Vietnam and Taiwan, where the political structure is top down and where there are relative long policy cycles.

9.4 Conclusion

In conclusion, as the awareness that we need ambitious education reforms to overcome the devastation and the loss caused by the COVID-19 pandemic grows, relying on how education reform has been approached in the Global South before the pandemic can be valuable. The cases examined in this book show that the implementation of reform is a fluid process, a process of learning and adaptation; and one defined by the goals of reform, the sources of support, the strategy and the mindsets to think about change. Considering these four elements when designing policy, and when monitoring implementation, may be a useful way to accelerate such process of adaptation and learning, and with it a way to support implementation of large scale change itself.

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