CHAPTER 8

Four-Dimensional Education for Sustainable Societies

Charles Fadel and Jennifer S. Groff

Introduction

The rate of change in our lives today has pushed us to evolve and adapt our daily practices so quickly, that if one does not pause to reflect on them, it is easy to overlook just how much our world has changed. The past 50, 20, and even just the past 10 years has produced deep and profound changes in our world. Just 20 years ago, many educational systems were under intense scrutiny for not being effective and/or equitable for all learners. Many educational systems were not up to par—and to think, that was before these global dramatic shifts. The call and demand for radically improved, but more poignantly, *refocused* educational systems have never been higher. What does it mean to prepare young learners for a life in today's world? What do they need? What do we value? How can we deliver that? These are complex yet critically important questions to the future of education.

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Today, each of us faces a highly complex, rapidly changing world that affects our lives at a local level. The way we communicate, do business, even interface with our doctors and government officials is altering. Entire industries are deeply impacted by new technologies that continue to arrive at a rapidly increasing pace, with once long-held traditional job skills being phased out—leaving a growing generation of people to ask how they are to make a living. Our world is not as we once knew it, and the change has only just begun.

In this chapter, we will explore the impact of these global changes on the society, human development, and ultimately the core structures of an educational system to lead us forward in the twenty-first century.

Our VUCA World

In the twenty-first century, humanity faces considerable changes at many levels. As a global community, we are in the grips of the collective crisis of climate change, a problem with deeply complex variables, as we continue to explore possible solutions that impact all aspects our way of life, both personally and globally. We are now all too familiar with the interconnected instability of our global economy, and how the rapidly shifting nature of core industries, new technologies, cultures, and demographics in part due to foreign and domestic conflicts only threatens that stability further.

The winds of change have become fast and strong. The complexity of our interconnected nature of our world only continues to grow, giving us a VUCA world—a trendy acronym short for volatility, uncertainty, complexity, and ambiguity. It's trendy because it aptly captures many of the challenges facing us today. In a VUCA world, there are many interconnected parts and variables; there may be information available, but it may be difficult or overwhelming to process. The complexity makes causal relationships not clear, leading to "unknown unknowns".[1] This makes the problem unstable and possible solution actions unclear and uncertain.

As businesses, industries, and societies increasingly face these types of challenges, the question asked by all is, "*How can we better prepare learners for this world?*" And now, more urgently than ever, *humanity is searching for its sustainable future*.

Preparing Learners for a World Unknown

Yet despite these dramatic global shifts of the past few decades, education systems still have not seen dramatic change. There are many aspects of educational reform pursued today that were initiated before the 1980s, including improving early literacy development, equity and access, personalization and meeting all learners needs, and more. Yet even putting all those aspects aside, most of the educational systems are not able to prepare learners for a VUCA world because they have not fundamentally questioned and redesigned *what* is to be learned throughout their course of education. While "the three R's"[2] are important, they are just a small piece of what learners will need to be able to adapt and thrive in a complex, dynamic, unknown world.

In most developed countries, the general curriculum is still modeled after the Harvard "Committee of Ten"[3] curriculum from 1893—a curriculum developed in response to the sudden growth in societal and human capital needs. Yet our world today bears little resemblance to that of the nineteenth century. In the complex, ambiguous world of today, where we cannot predict the needs and challenges 20 years from now, we must rethink how we prepare today's learners—and that must start with *redesigning the curriculum for what humanity presently values for its future*.

Redesigning the Curriculum for Today's World

Preparing learners for a complex, dynamic world means going beyond just preparing for the basics. Over the past decade, we have seen a growing realization and consensus on this in education, as many constituencies have advocated for the integration of "21st Century Skills,[4]" also commonly known as the "Four Cs"[5] into the general curriculum. Unfortunately, as many educational systems subsequently found, simply aiming to infuse these skills into the existing curriculum has proved challenging and ultimately not able to produce the outcomes desired for a number of reasons, but foremost because the structure of the existing general curriculum was not able to effectively accept and support these skills and outcomes. Moreover, preparing learners for the unknown world of tomorrow requires going beyond just the "Four C's". In short, it requires a fundamental reconceptualization and redesign of the core curriculum.

How do we fundamentally redesign the curriculum for today's, and tomorrow's, world? This has been the driving question of the Center for Curriculum Redesign (CCR),[6] an international NGO who has partnered with global organizations to lead this work. Through this collaborative work, we have developed guiding tenets to answer such a question and ultimately a framework to inform the redesign of curriculum.

Tenets of a Twenty-First Century Curriculum

In our now complex and ambiguous world, a fundamental redesign of the general curriculum to prepare learners for an unknown future can itself be an ambiguous challenge. Therefore, to guide this work, we have developed several tenets based on analysis of current dynamics and trends that help shape our thinking of redesign:

Adaptive. The curriculum must be fluid and evolving; able to more easily adapt and respond to emerging trends and needs in the world so that it stays current and dynamic over time. If a curriculum is not adaptive, it becomes rigid. There is no such thing as a perfect curriculum that does not need updating, because the world continues to change and the goals of an optimal curriculum changes with it. Moreover, it must be able to take place outside of the classroom and virtually, on computer screens, from anywhere in the world. Increasingly, learning is going beyond the school walls, and learners must be enabled to move through the curriculum in all modalities.

Balanced. When trying to make sense of our complex education needs, the immense variety of perspectives on the conditions of education today, and the plethora of theories and practices related to learning, it is not uncommon to fall victim to a mindset of false choices, such as: "Which is better?"—teaching knowledge, or teaching skills? Should education focus on the humanities, or on science, technology, engineering, and mathematics (STEM)? Should schools develop character qualities or help students pass important high-stakes tests? These arguments push and pull the curriculum into unhealthy dimensions unable to support all learners and learning goals.

Flexible. While the curriculum must able to adapt to a rapidly changing world, it also must be able to be flexible to individual learner interests, needs, and goals, as well as local needs at the classroom and community level. As such, the curriculum cannot be overly prescriptive or directive.

The Four Dimensions: Framework for a Twenty-First Century Curriculum

Curriculum, as it is traditionally conceived, consists mostly of content knowledge that students must learn. In the modern world, progress is adding more and more pieces of knowledge at faster and faster rates, piling onto students' already overburdened plates. According to E.O. Wilson, "We are drowning in information, while starving for wisdom. The world henceforth will be run by synthesizers, people able to put together the right information at the right time, think critically about it, and make important choices wisely".[7]

A deep curriculum redesign requires exploration through all dimensions of knowledge, skills, character, and meta-learning competencies. These are outlined in the CCR framework[8] below (see Fig. 8.1).

Knowledge. Though a core pillar of any curriculum, content knowledge can no longer be the sole central element of a curriculum's structure. The misalignment caused by too strong of an emphasis on content knowledge is evidenced in many ways today, including lack of real-world relevance that manifests in low student engagement and motivation. Traditional subjects (Maths, Language, etc.) are of course essential,

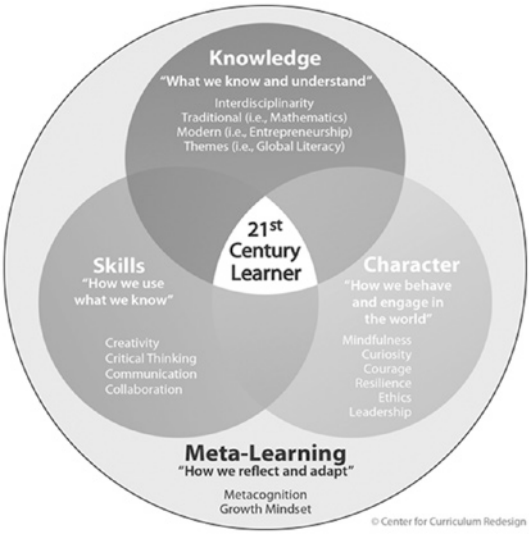

Fig. 8.1 The foundational framework of the Center for Curriculum Redesign

but must be a part of the means to an end in terms of larger individual competencies. Additionally, traditional disciplines must be augmented by "modern disciplines" such as Robotics, Entrepreneurship, Biotechnology, and many more. Tough choices must be made about what to pare back in order to allow for more appropriate areas of focus; for instance, in Maths, today's world demands a stronger emphasis on statistics and probabilities, and less on trigonometry (first heavily emphasized due to the large demand for land surveyors). Likewise, choices about content knowledge will also need to be made around the concomitant depth that it is able to cultivate with the other three dimensions of the framework (Skills, Character, and Meta-Learning).

As a result, *interdisciplinarity* is viewed as a strong binding mechanism for traditional and modern disciplines alike, and the practices these disciplines require for the Skills, Character, and Meta-Learning dimensions. For example, new interdisciplinary fields that are already relevant to tomorrow's world may be Robotics, Biosystems, Social systems, Wellness, Entrepreneurship, Media, Journalism, etc.

Skills. Key "higher-order skills" such as the "Four C's" are essential for deeper learning of content knowledge, as well as for being able to demonstrate understanding through performance.[9] As discussed earlier, there is a reasonable global consensus on what critical Skills are at the broadest level,[10] and how different pedagogies can affect skills acquisition. Yet the current amount and structure of content in the curriculum, as well as a lack of support for educators to be able to implement robust pedagogies for these deeper learning experiences, has largely kept these Skills out of everyday learning experiences. A curriculum redesign must look at how to situate these Skills with the Knowledge, Character, and Meta-learning competencies desired.

Character.[11] We use the term Character to refer to how we engage in the world. Character education is about the acquisition and strengthening of virtues, values, and the capacity to make wise choices for a well-rounded life and a thriving society. In order to engage and thrive in an increasingly challenging world, and support the positive growth of civic society, Character is a crucial structure in a redesigned curriculum for the twenty-first Century. This is true for one critical reason: there are ethical and character implications to all of the global challenges we face today (environmental issues, corruption, terrorism, income inequality, and on and on). Likewise, increasingly new and emerging technologies bring with them deep ethical implications (such as cloning, gene-editing,

etc.). As such, Character is a dimension prevalent in many global aspects today. As UNESCO has underscored, "There is every reason to place renewed emphasis on the moral and cultural dimensions of education… this process must begin with self-understanding through… knowledge, meditation and the practice of self-criticism".[12] Research has shown that students' capacities, beyond academic learning of knowledge and skills, are important predictors of achievement and can be essential to success in work and civic life.[13] This includes much of the emerging research on "non-cognitive skills". While certain knowledge and skills may or may not be used in future jobs, character qualities will invariably be applicable to a wide range of professions and to everyday family and community life.

How does one "unpack" Character in order to build a curriculum framework? There are many constructs and concepts that relate to Character, organized in various ways. In order to facilitate this work, CCR has conducted a systemic review and synthesis of more than 30 of these constructs to ultimately identify and summarize the 6 essential qualities in the CCR Character framework:

Mindfulness
Curiosity
Courage
Resilience
Ethics
Leadership

Each of these qualities is a composite of a large number of qualities and concepts,[14] which are discussed in Fig. 8.2.

Meta-learning. In order to deepen and enhance the learning in these three dimensions—Knowledge, Skills, and Character qualities—there is an important additional fourth dimension needed for a fully comprehensive twenty-first century education: meta-learning (often called learning to learn or the internal processes by which we reflect on and adapt our learning). It is not enough to implicitly include this fourth dimension in all the other dimensions—its significance must be highlighted explicitly, so that we are constantly reminded to incorporate meta-learning strategies into the knowledge, skills, and character portions of our learning experiences, learning how to strive to improve no matter what goals we set for ourselves.

Essential Qualities	Associated Qualities and Concepts
Mindfulness	wisdom, self-awareness, self-management self-actualization, observation, reflection, consciousness, compassion, gratitude, empathy, caring, growth, vision, insight, equanimity, happiness, presence, authenticity, listening, sharing, interconnectedness, interdependence, oneness, acceptance, beauty, sensibility, patience, tranquility, balance, spirituality, existentiality, social awareness, cross-cultural awareness, etc.
Curiosity	open-mindedness, exploration, passion, self-direction, motivation, initiative, innovation, enthusiasm, wonder, appreciation, spontaneity etc.
Courage	bravery, determination, fortitude, confidence, risk taking, persistence, toughness, zest, optimism, inspiration, energy, vigor, zeal, cheerfulness, humor etc.
Resilience	perseverance, grit, tenacity, resourcefulness, spunk, self-discipline, effort, diligence, commitment, self-control, self-esteem, confidence, stability, adaptability, dealing with ambiguity, flexibility, feedback, etc.
Ethics	benevolence, humaneness, integrity, respect, justice, equity, fairness, kindness, altruism, inclusiveness, tolerance, acceptance, loyalty, honesty, truthfulness, authenticity, genuineness, trustworthiness, decency, consideration, forgiveness, virtue, love, helpfulness, generosity, charity, devotion, belonging, civic-mindedness, citizenship, equality, etc.
Leadership	responsibility, abnegation, accountability, dependability, reliability, conscientiousness, selflessness, humbleness, modesty, relationship skills, self-reflection, inspiration, organization, delegation,
	mentorship, commitment, heroism, charisma, followership, engagement, leading by example, goal-orientation, focus, results orientation, precision, execution, efficiency, negotiation, consistency, socialization, social intelligence, diversity, decorum, etc.

Fig. 8.2 Essential qualities of character (Source *Center for Curriculum Redesign*)

Perhaps, the most important reason for developing metacognition is that it can improve the application of knowledge, skills, and character qualities in realms beyond the immediate context in which they were learned.[15] This can result in the transfer of competencies across disciplines—important for students preparing for real-life situations where clear-cut divisions of disciplines fall away and one must select competencies from the entire gamut of their experience to effectively apply them to the challenges at hand. Transfer can also be necessary within a discipline, such as when a particular idea or skill was learned with one example, but students must know how to apply it to another task to complete their homework or exams, or to a different context. Transfer is the ultimate goal of all education, as students are expected to internalize what they learn in school and apply it to life.

CCR's Meta-Learning framework is composed of:

Growth Mindset: Positing that talents and abilities can be developed through effort, good teaching, and persistence. This directly relates to Carol Dweck's work at Stanford University.

Metacognition (including Reflection): "Awareness and understanding of one's own thought processes". Metacognition is essential for activating transference, building expertise, and establishing lifelong learning habits. Metacognition for learning, often called "learning to learn", involves the learner reflecting on all three of the key learning processes in the CCR framework as they perform these learning tasks: gaining knowledge and understanding, building skills, and developing character qualities.

Redesign for a Modern Curriculum

Developing a modern curriculum with this framework as a guiding frame will require a fundamental redesign. Why redesign? Education has traditionally taken the approach of *reform*—identifying one or more aspects that need improving and inserting programs or policies to improve those aspects. However, in a complex system, these interventions and attempts at incremental change generally don't have deep impact because complex systems adapt or push out small interventions to maintain the status quo. In the case of curriculum, we can see this with the tweaks and modifications made over the years to integrate new elements such as higher order skills or twenty-first Century Skills. These may then show up in some

way in the classroom, but overall classroom practice for deeper learning really has not changed.

In order to develop and provide today's learners with a modern curriculum, one that prepares them for our VUCA world, requires a deep and fundamental *redesign* of all aspects of the curriculum—most critically, because *these four dimensions can't just be added in and taught independently from one another.* These four dimensions cannot be identified and taught in isolation as elements of knowledge; for in doing so, a learner may gain some intellectual understanding of them but will gain no ability to meaningfully apply them to their life and the real world. Rather, these four dimensions must be deeply interwoven to create robust learning experiences. In short, a modern curriculum can no longer be linear tables of knowledge and some skills that students must be exposed to at certain grade levels—a modern curriculum must be richly interwoven in a way that reflects the complexity of today's world, where Knowledge is a vehicle by which Skills, Character, and Meta-learning are experienced, integrated, and applied.

The Role of Themes

Crosscutting themes are an important tool that has long been used in curriculum design in order to achieve such goals of integration. Themes represent common strands of learning that run through many of the disciplines—traditional and modern—and which matter to many jurisdictions and cultures. There are a number of key themes that are relevant to our modern world, and must be learned as interwoven into Knowledge disciplines:

Global Literacy: understanding the interconnected nature of our global community, as seen from multiple perspectives.

Information Literacy: facility in developing an informed orientation in a landscape of data, able to evaluate source credibility, and a dynamic position able to remain open to new evidence.

Environmental Literacy: understanding of the environment and the circumstances and conditions affecting it, including society's impact on the natural world, and the skills to investigate/analyze these issues and problem-solve within this domain—*critical to a sustainable humanity.*

Digital Literacy: facility with modern digital tools when working in a spectrum of domains.

Systems Thinking: facility in the nature of types of dynamics and properties of complex systems.

Design Thinking: facility with the processes and approaches of design when tackling a problem.

Enabling a Twenty-First Century Curriculum Today, for a Sustainable Tomorrow

The urgency to provide a meaningful and effective education for all has never been greater. In order to do that, we must fundamentally rethink what learners need, and as a result, fundamentally redesign core structures of our education system. Inherently, this requires that first and foremost start with the curriculum. To this point, historical inertia has largely been *the* deciding factor when it comes to curriculum design—i.e., "that's how we've done it before". We can no longer allow this to continue. To change policy at the system level, most countries face political life-cycle instabilities that make it hard for systems to innovate in an ambitious way. Similarly, many curricular decisions are made by subject-matter experts—e.g., math decisions are made by math experts—in relative isolation from the demands of the real world (and the users of the discipline itself), and thus tend to take an incremental, isolated approach.

John Dewey proposed that "education is the work of supplying the conditions which will enable the psychological functions to mature in the freest and fullest manner".[16] The framework presented offers a comprehensive construct to begin the redesign process and overcome this inertia. As our world continues to expand and transform in unpredictable ways, facing complex challenges with unknown solutions, it is only through preparing our youngest citizens today, do we have the hope of a sustainable future. Deep, meaningful learning experiences *for every learner*, around global themes that cultivate critical skills, awareness of one's self, and the character necessary to navigate complex, ethical challenges are key to our global sustainability.

In a rapidly changing world, it is easy to get focused on today's requirements, needs, and demands. Yet adequately preparing for the future means actively creating it: the future is not the inevitable, or something we are pulled into. There is a feedback loop between what the future could be and what we want it to be—we must deliberately choose

to construct the reality we wish to experience. We may see global trends and their effects creating the ever-present future on the horizon, but it is up to us to choose to actively engage in co-constructing that future.

Notes

1. Bennet, N., & Lemoine, G. J. (2014). What VUCA Really Means for You. *Harvard Business Review*. Available at https://hbr.org/2014/01/what-vuca-really-means-for-you.
2. A term used to refer to reading, writing and arithmetic.
3. Knowledge discipline standards in secondary education in the United States were first established in 1893 by the Committee of Ten, led by Charles Eliot, the president of Harvard University and sponsored by the National Education Association. He convened ten committees of education experts, led mostly by college presidents and deans, and charged them with defining the standardized curriculum requirements for all public secondary schools.
4. Per Trilling, B., & Fadel, C. (2009). *21st Century Skills: Learning for Life in Our Times*. See http://21stcenturyskillsbook.com.
5. A term used to encompass a varying number of skills, but often considered at the very least the "Four C's": *Communication*, *Collaboration*, *Critical Thinking* and *Creativity*.
6. For more information, see www.curriculumredesign.org.
7. Wilson, W. (1999). *Consilience: The Unity of Knowledge*. New York: Vintage, p. 294.
8. http://curriculumredesign.org/our-work/four-dimensional-21st-century-education-learning-competencies-future-2030.
9. The Conference Board's "Are they really ready to work?"; AMA "Critical skills survey"; PIAAC program (OECD).
10. www.oecd.org/site/piaac/mainelementsofthesurveyofadultskills.htm.
11. Just as for "Skills", there is no perfect word that covers all meanings of "Character" in all languages; for instance, it may be "personality" in some. So, by "Character" we mean all of related terminology such as: "Agency, Attitudes, Behaviors, Dispositions, Mindsets, Personality, Temperament, Values". CCR objects to the use of the improper "non-cognitive" or "soft skills" and much prefers the OECD's use of "Social and Emotional Skills".
12. UNESCO. (1996). *Learning: The Treasure Within*. Report from the International Commission on Education in the Twenty-First Century.
13. For a review, see Camille A. Farrington et al. (2012). *Teaching Adolescents to Become Learners: The Role of Noncognitive Factors in Shaping School*

Performance—A Critical Literature Review. Consortium on Chicago School Research.
14. For more information on these Essential Qualities and the synthesis that produced them, see Fadel, C., Bialik, M., & Trilling, B. (2015). *Four-Dimensional Education: The Competencies Learners Need to Succeed*. Center for Curriculum Redesign.
15. Schraw, G., & Moshman, D. (1995). Metacognitive Theories. *Educational Psychology Papers and Publications*, Paper 40.
16. Dewey, J., as cited in Kohlberg, L., & Hersh, R. H. (1977). Moral Development: A Review of the Theory. *Theory into Practice, 16*(2), 53–59.