Creative Know How for a Novel, Complex World

Report 8 of the MyWays Student Success Series

Grace Belfiore and Dave Lash
for Next Generation Learning Challenges

October 2017

The MyWays™ Student Success Series

All reports in the series are available for download at myways.nextgenlearning.org/report.

About this report

Report 8, *Creative Know How — for a Novel, Complex World*, considers the Creative Know How domain of the MyWays Student Success Framework, including why the domain transforms "21st century skills" into the more agile Creative Know How, key principles for implementation, and the state of play in the field, as well as offering resources and essential one-page primers for each competency.

Report 8 is the third of five reports in Part B of the *MyWays Student Success Series*. **Part B, "Broader, Deeper Competencies for Student Success,"** provides a composite definition of student success in learning, work, and life, drawing on over 25 highly-regarded frameworks and the literature in the education, work, and human development fields.

The *MyWays Student Success Series* examines the through-line of four essential questions for next generation learning and provides research and practice-based support to help school designers and educators to answer these questions. The series consists of 12 reports organized into three parts, plus a Visual Summary and Introduction and Overview.

The **primary researchers and authors** of the *MyWays Student Success Series* are Dave Lash, Principal at Dave Lash & Company, and Grace Belfiore, D.Phil., Principal Consultant at Belfiore Education Consulting.

MyWays is a project of Next Generation Learning Challenges, an initiative of the non-profit EDUCAUSE. MyWays is supported through a grant from the William and Flora Hewlett Foundation with additional support from the Bill & Melinda Gates Foundation, the Barr Foundation, and the Oak Foundation.

NGLC NEXT GENERATION LEARNING CHALLENGES

nextgenlearning.org

Cover photo by Redd Angelo on Unsplash.

REPORT 8

Creative Know How – for a Novel, Complex World

Introduction

This domain has received growing attention since the development of the Partnership for 21st Century Learning (P21) framework in 2006. Like P21 and many other "skills" frameworks, the MyWays Creative Know How domain focuses on the competencies that better prepare students to pursue postsecondary learning, workplace achievements, and civic life — all of which are significantly more complex and uncertain now than for previous high school graduates. In response, this domain focuses not just on developing specific skills, but also on developing the agility to adapt those skills to a rapidly changing world. Hence the domain is not just know how, but *Creative* — or adaptive and agile — *Know How*. See our definition and the list of competencies in the box to the right.

In this report, we offer an overview of this domain by covering the following:

Creative Know How

Skills and abilities to analyze complex problems and construct solutions in real-life situations

Creative Know How competencies:
- **Critical Thinking & Problem Solving**
- **Creativity & Entrepreneurship**
- **Communication & Collaboration**
- **Information, Media, & Technology Skills**
- **Practical Life Skills**

- Why the Creative Know How domain is so important
- An overview of the five Creative Know How competencies
- Four key principles for addressing Creative Know How
- A brief summary of the state of play in Creative Know How learning and assessment
- A quick resource dive for Creative Know How (highlighting starter resources, competency frameworks, and school models that address this domain)
- Five one-page Creative Know How competency primers

Creative Know How covers a wide range of skills, from those, like communication with others, which have always been important, to the ability to work in tandem with highly intelligent machines in ways that serve humanity, where even the questions to be asked are far from clear. Daniel Pink, asked what he believed to be the most important skill in today's environment, responded, "My first instinct is adaptability. You need to be able to change and adapt. I think people have difficulty with that. Dealing with ambiguity has become profoundly important today..."[1] Which is why we invite you to keep your eye out within this report not just on the mastery and craftsmanship involved in the named competencies, but also on the spirit of innovation and improvisation with which they are approached.

Knowing How — Skills and Improvisation

"To be successful in the emerging society and economy, young people will need skills that previous generations did not. They will need to solve problems that do not have clear answers and that computers address poorly, if at all… It's not just jazz musicians who need to learn how to improvise."

— Elliot Washor & Charles Mojkowski, *Leaving to Learn*[2]

The Partnership for 21st Century Learning came out with its framework of 21st century skills more than a decade ago. While the skills it outlined were not new, the movement it launched succeeded in establishing the need for schools to address "know how" as well as knowledge. Ten years later, we are beginning to realize just how creative (or adaptive and transferable) that know how must be to prepare learners, in essence, for the unknown — for jobs not yet invented, the impact of artificial intelligence (AI), and ways of engaging with others that evolve every few years.

Already we see glimpses. Who was expecting this? **The major impact of robots and AI**
By 2033 (which happens to be when today's first graders will finish four-year degrees or apprenticeships), economists predict that tech innovation could convert 30% of existing occupations into services completed "on demand" through a mix of cognitive computing and human labor.[3] As Report 2 points out, with the rapid evolution of AI, these will include "thinking" as well as "doing" jobs — from med techs and paralegals to marketers and financial advisors. Indeed, IBM's Watson is already cracking medical cases that stump doctors. Those who want to stay relevant in their professions will need to focus both on motivating and interacting with human beings and on working with AI.[4]

Or, indeed, this? **The disruptive power of fake news**
Media literacy, a growing concern for over a decade, became a hot issue during the 2016 election. Increasing reports of "fake news" coincided with attention to research indicating just how ill-equipped young people are to critically evaluate information they encounter online and via social media. A team from Stanford led by Sam Wineburg and Sarah Cotcamp McGrew field-tested news-literacy tasks of varying difficulty. More than 80% of middle schoolers were unable to distinguish a "native advertisement" (ads masquerading as articles) from real news, and nearly 70% of high schoolers identified a Shell advertisement on climate change as a more reliable source of information than an *Atlantic* news article.[5]

Preparing for the increasing number of such hard-to-predict, consequential developments (see Tom Vander Ark's blog) will always be an art rather than a science. How to address the challenge of AI? Have a look at the Creative Know How competencies of Problem Solving, Creativity & Entrepreneurship, and Collaboration. To tackle false news? Cue Critical Thinking, Communication, Information & Media Skills, and Practical Life Skills.

On the bright side: while some worry that the focus on Creative Know How is overly driven by economic changes and vocational concerns, in fact, as Lauren Resnick has reflected, **"[t]oday's high-performance workplace calls for the same kind of person that Horace Mann and John Dewey sought: someone able to analyze a situation, make reasoned judgements, communicate well, engage with others to reason through differences of opinion, and intelligently employ the complex tools and technologies that can liberate or enslave, according to use... people who can learn new skills and knowledge as conditions change — lifelong learners, in short**. As a result, this is a moment of extraordinary opportunity in which business, labor, and education leaders can set **a new common course in which preparation for work and preparation for civic and personal life no longer need be in competition."[6]** We believe strongly that the five Creative Know How competencies are the kind of preparation she is urging.

Why Creative Know How is so important

The competencies in this domain are important for many reasons, including the fact that they are essential in addressing the range of issues and factors described in Part A, "Adolescence in the Age of Accelerations": the roadblocks to employment, the decisions needed to navigate the work/learn landscape, and the essentials in cultivating social capital, as well as the developmental challenges that learners face as they transition to an increasingly volatile world. Students might ask:

> **Do I have the adaptability, collaborative and entrepreneurial ability, and tech/media skills** to solve problems, develop new solutions, and create value — for myself, employers, and others — in a rapidly changing environment?

> **Can I work creatively and effectively with others**, of varying backgrounds and skill sets, and in face-to-face and digital settings — and help build and sustain teams, networks, and communities?

> **Am I able to muster my critical thinking, creativity, and communication skills** in pursuit of my postsecondary learning, early employment opportunities, and my uniquely personal opportunity engine?

> **Can I combine all these competencies with my knowledge of the real world around me** to make that world a better place?

Creative Know How competencies, continuously coupled with Habits of Success, Content Knowledge, and Wayfinding Abilities, empower us to escape old ways of doing things, solve current dilemmas, and invent new solutions. In many respects, the five Creative Know How competencies are the everyday power tools of the information age.

Essential to career bootstrapping

Navigating the work/learn landscape, and the 5-5-5 Realities in young people's paths, is a perplexing, "wicked problem" requiring extraordinary resourcefulness and ingenuity. Most postsecondary students are "working learners" today, but the jobs many find are of only marginal benefit to their careers. More and more under-30 workers are temporary, part-time, contingent, free-lance, or self-employed.[7] Skills related to entrepreneurial thinking and creativity are especially in demand in such a world. For more on the need for all workers, even those employed by others, to use entrepreneurial approaches to do their work and to advance their careers, see the discussion in Report 10 on author Tom Friedman's admonition: that *"more is on you."*[8] Creative Know How competencies play a pivotal role in crafting a personal career-building *opportunity engine* of work experience, marketable competencies, degrees and credentials, and social capital (see more on the opportunity engine in Reports 2 and 3).

Coveted by employers

Creative Know How encompasses most of the value-creating skills that employers, in the aggregate, say they want today. Sixty percent of employers say applicants lack interpersonal and communication skills. Seventy-six percent say 4C-related skills (critical thinking, communication, collaboration, and creativity — from the Partnership for 21st Century Skills) will become even more important over the next 3 to 5 years, and 93% say they are more important than college major.[9] As highlighted on the previous page,

these competencies are also vital to the challenges of automation and AI — solving problems without clear answers, those that computers and AI address poorly or not at all, and those that rely more largely on human-to-human interaction.

Instrumental to self-development

Critical Thinking & Problem Solving, Creativity & Entrepreneurship, and Communication & Collaboration, in particular, shape who we are and how we interact with others and the world. The pursuit of Creative Know How through authentic, active means — through maker spaces, entrepreneurial initiatives, collaborative projects, the use of emerging media, or community problem solving through service learning — is a way to put learners out into the adult world, where they can access mentors, see potential paths for interests and careers, and take new steps in their web of development. (This aligns with Kurt Fischer's notion presented in Report 5, that opportunities expand as our know how advances: "Each one of us has our own web of development, where each new step we take opens up a whole new range of new possibilities that unfold according to our own individuality."[10])

Given the importance of meaningful work to both adolescent development and the work/learn cycle, we give Bryan Goodwin and Heather Hein of McREL the parting word on why Creative Know How is essential for our learners and our future:

> [P]erhaps the most important pivot we might make (with all due respect to Friedman) is to fret less about how our kids will compete in a flat, hot, and crowded world and *more about how they can contribute to that world by solving complex problems*. We might start by telling our kids to do their homework because their neighbors—locally and globally—are counting on them. [Emphasis added.][11]

An overview of the Creative Know How competencies

The five MyWays Creative Know How competencies map out the kinds of skills learners will need to successfully address the two most pressing challenges of the world they will live in: relentless novelty and deepening complexity. These skills can be developed only through real-world application and iterative practice in a variety of situations that promote transfer. The skills cluster into two groups. The *first three competencies* correlate well with the popular "4Cs" — often referred to as 21st century skills — with added emphasis on entrepreneurship for the "more is on you" nature of the gig economy:

Critical Thinking & Problem Solving

The ability to reason effectively, use systems thinking, and make judgments and decisions toward solving problems in educational, work, and life settings.

Addressing this competency includes helping students identify and define problems and propose solutions using: analytical thinking approaches, systems thinking approaches, and design thinking approaches (Design thinking is also included in the Creativity & Entrepreneurship competency).

Creativity & Entrepreneurship

The imagination, inventiveness, and experimentation to achieve new and productive ideas and solutions.

Addressing this competency includes helping students to: think creatively using design thinking and other approaches, work creatively with others, implement innovation, and develop entrepreneurial skills and mindsets to support new value creation.

Communication & Collaboration

Oral, written, and visual communication skills, as well as the ability to work effectively with diverse teams.

Addressing this competency includes helping students to: articulate thoughts orally, in writing, and non-verbally; listen effectively; use communication for a range of purposes; communicate in diverse environments; work effectively and with respect in diverse teams; show flexibility; assume shared responsibility; and value individual contributions.

See the final two competencies just below. For expanded descriptions, see the competency primers at the end of the report.

Following our research on the full range of competency frameworks and the changes occurring in the economic and social spheres, we were also compelled to include ***two further competency sets to complete the Creative Know How toolkit***. These competencies address two key areas. First, media and technology are increasingly central to work in any field and to the participation in social and civic life. Second, we know that the young-20s brain is still developing, and the disorderly "gig-economy" and "more is on you" nature of learning and work paths are likely to pose new challenges to navigate in terms of health, housing, and other practical aspects of living. We therefore include the following additional Know How skills that are important to the world in which our students will live:

Information, Media, & Technology Skills

The ability to access, evaluate, manage, create, and disseminate information and media using a wide variety of technology tools.

Addressing this competency includes helping students to: develop information and media literacy; create media products for appropriate expression in diverse environments; and develop technology literacy, including computational knowledge and the ability to leverage the capabilities of augmented and virtual reality, big data, robotics, artificial intelligence, and other emerging technologies.

Practical Life Skills

The ability to understand and manage personal finances, health and fitness, and emotional, spiritual, and other aspects of personal well-being to enable and support a productive, effective life.

Addressing this competency includes helping students to: manage personal finances including credit and debt; manage one's own health, nutrition, and exercise; attend to one's own emotional, spiritual, and other aspects of wellbeing; and address practical life tasks that are evolving fast, such as ways to shop, find housing, and get around.

For expanded descriptions of each competency, see the primers at the end of this report.

Note: Many competency frameworks add the "learning to learn" or self-directed learning competency to the 4Cs, but in MyWays this appears in the Habits of Success domain. And there is clearly some overlap between Creative Know How's Collaboration and the Social Skills included in Habits of Success. The emphasis in MyWays Creative Know How is on cognitive and interpersonal skills as they relate to productive work. Habits of Success focuses on metacognitive and intrapersonal skills, as well as social skills related to personal effectiveness. Of course, in the real world many aspects of the domains overlap and/or are engaged simultaneously in developing oneself, and working toward solutions.

Creative Know How competency primers

For more on each of these competencies, be sure to see the one-page primers at the end of this report. We have included a primer for each of the five competencies. As indicated in the sample provided here, these primers briefly cover**:**

- what the competency covers;
- where to look for guidance on addressing the competency; and
- additional resources.

The primers are intended to provide a brief introduction to the most important aspects of each competency. They offer only a taste of the research and activity in each area, but we've tried to ensure that they include many of the key issues and resources. We hope that our MyWays Community of Practice and other educators will help add to and update these resources over time.

Sample competency primer (See primers starting on page 20.)

These primers provide educators with ideas and resources to help them support their students in developing an adaptable, reflective, resourceful, and empathetic set of Creative Know How competencies. Before proceeding to look at some key principles for working with these competencies, we take a quick look at three iconic formulations of these skills (the oldest almost a decade old) that we found to be surprisingly current in featuring the kind of competencies necessary for the "age of accelerations."

Creative Know How, by Any Other Name (or Number)

This report deals with the five competencies incorporated in the Creative Know How domain, as well as the most common existing 21st century skills formulations — such as ConnectEd's College and Career Readiness Framework, P21's 4Cs, and the Four-Dimensional Education framework — that we drew upon when creating the MyWays Student Success Framework.

While carrying out our MyWays research, however, we came across a wide range of formulations for the success skills, from the wise to the quirky.

In particular, we were delighted to find gold when we reached back to two of the original clarion calls for a new skills goal-line: Tony Wagner's _The Global Achievement Gap: Why even our best schools don't teach the new survival skills our children need — and what we can do about it,_ and Bernie Trilling and Charles Fadel's _21st Century Skills: Learning for Life in Our Times_. We felt the same about the more recent but similarly iconic entry by Sir Ken Robinson, _Creative Schools: The Grassroots Revolution that's Transforming Education._

In the following chart, we maintained the original order of each list's skills because what struck us was not the detailed mapping between the lists, but the overall flavor and range of each one. Yes, the cross-mapping is evident, and it is clear why the field ended up with consensus around the 4Cs: Critical Thinking, Collaboration, Communication, and Creativity. What we found most interesting was what each list included that the others didn't.

Tony Wagner's 7 survival skills (2008)	P21's 7 Cs (2009)	Ken Robinson's 8 Cs (2015)
1. Critical thinking and problem solving	1. Critical thinking	1. Curiosity
2. Collaboration across networks and leading by influencing	2. Creativity and innovation	2. Creativity
3. Agility and adaptability	3. Collaboration (teamwork and leadership)	3. Criticism
4. Initiative and entrepreneurship	4. Cross-cultural understanding	4. Communication
5. Effective oral and written communication	5. Communication and media literacy	5. Collaboration
6. Accessing and analyzing information	6. Computing (information and communication technology literacy)	6. Compassion
7. Curiosity and imagination	7. Career and self-reliance	7. Composure
		8. Citizenship

Tony Wagner's list from almost a decade ago has a surprisingly 2017 feel to it, in many ways the best matched to the relentless novelty and deepening complexity of the "age of accelerations" described in the

previous reports. (Even the "survival skills" label seems to fit.) Agility and adaptability, initiative and entrepreneurship (this was one of the only other frameworks we saw that included entrepreneurship), and curiosity and imagination — the list more than comfortably accommodates the likes of design thinking, maker spaces, adapting to big data and AI, and other trends and challenges that have become more significant in recent years. "Collaboration across networks and leading by influence" also seems prescient, as moves to the gig economy, flattened hierarchies, and global virtual communities have also accelerated. For even more value from some of these skill choices, see the seven survival skills "as defined by business leaders in their own words." These employer concerns were also forward thinking.

Of note in P21's 7Cs list, from which the 4Cs were culled, is the existence of two competencies that roughly match two of the MyWays' Creative Know How competencies: computing, information, and communication technology (our Information, Media, & Technology Skills), and career and self-reliance (some overlap with our Practical Life Skills, while also spilling over into MyWays Wayfinding Abilities and Habits of Success).

In Ken Robinson's list, it was not surprising to find both curiosity and creativity, given that he's a creativity guru. (Tony Wagner also stepped into this space in 2012 with his excellent book *Creating Innovators: The Making of Young People Who Will Change the World*. He also highlighted curiosity, as well as adding associative/integrative thinking, and a bias toward action and experimentation — both of which align with the design thinking/permanent beta bias in MyWays.) But perhaps more surprising is Robinson's foresighted cluster of compassion, composure, and citizenship; recent events all over the Western world suggest we may want to pay greater attention to helping our youth develop these competencies for the future.

Key principles for addressing Creative Know How

Given the existence of a range of 21st century skills frameworks, what are the distinguishing features of the MyWays Creative Know How domain? Our research tells us that efforts to support Creative Know How should incorporate **four key principles, helping students to**:

1. **Develop and transfer competencies in novel, real-world contexts**, incorporating a variety of complex and rapidly changing situations.

2. **Work on skills and knowledge in integrated ways** — learners need to apply skills to and through content knowledge, learning both more deeply, in a virtuous cycle.

3. **Focus explicitly on these skills** — naming, practicing, and reflecting on them, as well as being coached on them and receiving ongoing and effective feedback.

4. **Explore the ways in which Creative Know How competencies are intimately interrelated** with each other and with the Habits of Success.

Many learning models not only identify the Creative Know How skills as goals, but understand and address a subset of these principles. The field is at the stage where actualizing all five of these principles appropriately and effectively is still a challenge, however, and practitioners are keen to both explore them further and share practice and tools.

KEY PRINCIPLE 1: Develop and transfer competencies in novel, real-world contexts, incorporating a variety of complex and rapidly changing situations.

In Part A, we explored the 5-5-5 Realities: the 5 Roadblocks to Bootstrapping a Career, the 5 Decisions in Navigating the Work/Learn Landscape, and the 5 Adversities in Cultivating Social Capital. All of these realities highlight the acceleration of change in these aspects of young adult lives. In his keynote address at the 2017 LearnLaunch conference, Tom Vander Ark of *Getting Smart* underlined how drastic and relentless this change is likely to be. After six months of investigating the state and direction of machine learning and AI, he concluded that the future is likely to bring significant changes and surprises, and that what educators really need to "get kids ready for" is "novelty and complexity." This echoes the concerns of thought leaders from Wagner to Robinson to Fadel, all of whom refer to the impact on education of some version of volatility, uncertainty, complexity, and ambiguity (VUCA).[12]

The concepts of novelty and complexity, and VUCA, have for some time been useful in describing the ways in which applying knowledge and skills in the "messy" realm of the real world differ from learning in a more bounded, inauthentic school setting. Recently, however, the evolution of cognitive computing, the Internet of Things, the flexible workforce, globalization, and other major paradigm shifts have taken VUCA and its cousin concepts to a whole new level.

Vander Ark suggests, for instance, that the 4C skills of the early 2000s might now be replaced by a different type of "4Cs" that instead describe the nature of the world we live in: "connected, contested, complex, and competitive." The result is, as Peter Drucker concluded, that "since we live in an age of innovation, a practical education must prepare a person for work that does not yet exist and cannot yet be clearly defined."[13]

Promoters of 21st century skills have always aimed to enhance transfer into novel, authentic situations that a learner might encounter in adult life. Now, as we are realizing that we can't even predict what those situations will be, attention to this approach is even more important. For this reason, Creative Know How requires us to focus on the following: student agency; real-world authentic learning; the availability of diverse opportunities to apply and improve competencies in iterative ways; a focus on contextual reasoning and conditional knowledge (which "….includes knowing when and why to apply various actions")[14]; and, of course, the goal of transfer itself (knowing how to apply those actions). Research has shown that "educational environments that emphasize students' active roles, that enhance students' self-regulation, and that encourage communication and reflection skills, and are social and relevant to the learner (character qualities), successfully enhance the transfer of learning to new situations."[15] As Fadel concludes,

> In fact, the elusive goal of education transfer—applying what one learns in one setting to another different context—can be thought of as preparation for future learning. This view

redefines learning transfer as the productive use of skills and motivations, to prepare students to learn in novel, real-world situations, or in resource-rich environments…[16]

Developing Creative Know How Through Authentic Experience

Da Vinci Communications High School, a Next Generation Learning Challenges grantee, is one of three Da Vinci high schools (along with Da Vinci Science and Da Vinci Design) serving racially and socio-economically diverse students in Los Angeles. The school provides a student-centered approach through project-based classroom learning, integrated online learning, college courses, internships, and other "real world" experiences. Kim Merritt is Director of Da Vinci X, a 13th year program in partnership with UCLA Extension for Da Vinci students who wish to complete general education college coursework at Da Vinci while gaining internship experience (all at no cost to their families). Merritt recently forwarded the letter shown here, which reports on student intern activities at 72andSunny, an award-winning advertising agency with whom the school has a deep partnership. (Student names have been changed.)

As the letter shows, this kind of real-world experience offers a wealth of opportunities to work on Creative Know How. Da Vinci students were applying creativity and communication skills in a major way in the creation of client decks, as well as in opportunities to practice and present them. Photo, video, and production work gave them a strong insight into media and technology skills. Because most of this activity takes place in groups, they engage in Collaboration, and use lots of problem solving in both client decks and production.

Da Vinci students are also trained, taught, and assessed on these skills, whether in school-based projects or in industry-based products. In either environment, students receive grades and feedback on their collaboration and communication abilities and performance. In addition to on-the-job presentations, students reflect and present on these skills during a formal 20-minute "Presentation of Learning" each semester. With multiple such opportunities over the years, it is easy to see how Da Vinci learners benefit from this "acceleration lane" to their futures.

Hi Natasha and Kim,

The students just ended a great week with our Brand and PAL team.
MONDAY: We kicked the week off with a tissue session with Kelly Schoeffel (Director of Brand Innovation who initially briefed the interns) where each group presented their decks. It went GREAT! Kelly had some feedback for both groups but ultimately was really impressed with what they had all come up with.

TUESDAY-WEDNESDAY: The Brand team took them through Brand 101 and they learned exactly what a Brand person does here at 72andSunny. They learned a lot about presentation skills and got to practice their presentations a handful of times. All of the students talked and looked so confident. I was surprised to see how comfortable Emilia and Kyla were while presenting. They're the two quieter ones but you wouldn't tell during presentations.

THURSDAY: To close out the week they went on a trip to the LA River to see it in person and to take some photos and videos that relate to their projects. Kelly suggested they do this as it would really impress the client. When they came back from their trip they showed Abby and me the footage they got and they said it was really helpful and really cool that they got to check it out. It gave them a better visual of what their project could actually look like.

Next week we'll be diving into all things production! They'll learn about Art Production, Interactive Production, Film Production, and Experiential Production. They'll work with our producers to take a deliverable from their campaign and actually get started on the process of producing it.

We're also working on finding Kyla a new mentor. Her original mentor got pulled into a pretty demanding project and it was hard for him to find time to meet with her. We'll have her meet with her new mentor next week. Have a great weekend!

Cara   72andSunny // Brand Coordinator

KEY PRINCIPLE 2: **Work on skills and knowledge in integrated ways — learners need to apply skills to and through content knowledge, learning both more deeply, in a virtuous cycle.**

In *Four-Dimensional Education*, Fadel wisely notes the following:

"A long-standing debate in education hinges on an assumption that teaching skills will detract from teaching content knowledge. We believe this is a… false dichotomy. Studies have shown that when knowledge is learned passively, without engaging skills, it is often only learned at a superficial level (the knowledge may be memorized but not understood, not easily reusable, or short-lived), and therefore not readily transferred to new environments. Deep understanding and application to the real world will occur only by applying skills to content knowledge, so that each enhances the other."

Knowledge and skills, he adds, "develop together in a virtuous cycle." For example, knowledge "becomes the source of creativity, the subject of critical thought and communications, and the impetus for collaboration."[17]

For a glimpse of how this cycle can work, see the P21 Skills Maps (excerpt to the right), which illustrate the intersection between 21st century skills and the traditional Content Knowledge subjects of math, science, social studies, geography, English, languages, and the arts. These maps, developed with key national organizations that represent each core academic subject, provide concrete examples of learning experiences and outcomes at 4th, 8th, and 12th grade levels that integrates skills development in "authentic ways that enhance — not replace — robust science [or other subject] content."[18] Skill development in any one instance is embedded in the content-based learning activity, while the opportunity for transfer is increased by practicing the skill in multiple, varied learning experiences, and by explicit coaching and reflection that adds a meta-cognitive element to learning the skill (see Key Principle 3, below).

> **8th Grade**
>
> OUTCOME: Students are able to describe how science and engineering involve creative processes that include generating and testing ideas, making observations, and formulating explanations; and can apply these processes in their own investigations.
>
> EXAMPLE: Student teams design plans for a device that will assist people with disabilities and create 3-D sketches of their device using simple computer aided design software. The class develops criteria for peer review and then teams pass their plans to another team that makes
>
> SCIENCE
> Creativity and Innovation

P21, 21st Century Skills Science Map

The interrelationship of content knowledge and skills is also evident in Summit Public Schools' use of disciplinary "look fors" to, as they explain in their *Look For Guide*, "create a bridge between the content-neutral Cognitive Skills Rubric and the unique cognitive demands and pedagogical priorities of each of the four major disciplines." The Look Fors are described as "an additional set of tools that allow Summit teachers to honor the network-wide focus on meaningful skills while recognizing that those skills sometimes manifest differently in different content areas."[19]

KEY PRINCIPLE 3: **Focus explicitly on these skills — naming, practicing, and reflecting on them, as well as being coached on them and receiving ongoing and effective feedback.**

In the words of Ralph Waldo Emerson, "Skill to do comes of doing."[20] Creative Know How skills are intellectual "muscles" that can be genuinely strengthened only through doing and practice (not exclusively through study — much like, say, taking good photos or kicking a football). Yet just "collaborating" or "problem solving" as part of learning experiences, like just throwing a football around with your cousins, is unlikely to lead either to optimal progress in mastering the competency or to a better chance of transferring that skill into novel situations.

Educators helping students to develop Creative Know How need to help the learners recognize, develop vocabulary for, and *practice* the skill, as well as to provide them with ongoing and effective feedback on these efforts. They also need to coach and model the skill, exposing learners to a novice-to-expert progression that moves from structured rules through analysis to intuition; from tinkering through focused practice to fluid expression; and from controlled context through near transfer to far transfer. For more on the novice-to-expert progression, see the "Levers for capability and agency" section in Report 11, *Learning Design for Broader and Deeper Competencies*. Summit Public Schools' teacher roles provide a good example of the ways in which educators can guide the explicit skills work involved in this key principle. See this exploration of a Summit teacher's role, which includes elements of coach, mentor, tutor, curator, facilitator, and analyst.

Derived from **ethnography of how people learn to play jazz**: Moves from rule-based, structured acquisition to intuitive, nuanced application to novel tasks in new contexts

Educational Policy Improvement Center for the National Center for Innovation in Education, *Prototype & Policy: Operationalizing Skills and Dispositions* (unpublished deck). Freddie Hubbard photo *by* Tom Marcello, CC-BY-SA 2.0

Finally, in Creative Know How, learners need the means to collect evidence of process as much as product. Most importantly, learners need a structure to help them reflect on their progress in Creative Know How competencies, because reflection and meta-cognition are particularly important in enhancing transfer. Some examples of systems that respond to these needs area are Brooklyn LAB's Cortex, a student information and learning management system that incorporates the MyWays Student Success Framework (video, 5m), Summit's Basecamp Personalized Learning Platform, and the Project Foundry and LiFT platforms, both of which are designed to support experiential learning in the Wider Learning Ecosystem. (See a brief case study of a student using SchoolHack's LiFT to help him develop broader, deeper competencies through the alternative pathways provided by the state of Vermont, under Key Principle 2 in Report 10, *Wayfinding Abilities – for Destinations Unknown*.)

KEY PRINCIPLE 4: **Explore the ways in which Creative Know How competencies are intimately interrelated with each other and with the Habits of Success.**

Within competencies consisting of linked skills, such as Critical Thinking & Problem Solving, or Creativity & Entrepreneurship, the pairs are intimately interrelated, even as they feature elements of their own. Indeed, even across the five competencies in each domain, and the twenty competencies across domains, there is overlap in some aspects. While the framework is useful for designing goals and tracking attention and progress, it is not always possible or desirable to try to tease out the threads of one competency from the other for the purposes of learning or, in particular, assessment. (For an example of this, see the "Habits of a Fifth Grader" box in Report 7.) Like any framework or model, MyWays' value lies in its use for planning and tracking the availability of learning experiences within which students can develop, practice, and reflect on their progress in the various competencies.

A particularly strong synergy exists between Creative Know How and the Habits of Success. Because both can be developed and practiced only within active, authentic learning, their competencies are often interwoven. The Habits of Success, for example, including those competencies related to students' social-emotional health, directly impact students' creativity, their critical thinking skills, and how they collaborate. We should also highlight that self-directed learning, a competency often grouped with 21st century skills in other frameworks, appears in the MyWays Habits of Success domain. We placed it there because self-directed learning is central to the Habits of Success, which focus on "behaviors and practices that enable students to own their learning and cultivate personal effectiveness." Of course, placement in a conceptual model in no way separates competencies in the real world of learning and work.

Converging Ideas on How to Approach Creative Know How

In his book, *Future Wise: Educating Our Children for a Changing World*, Harvard Project Zero's David Perkins stresses the importance of weaving the development of Creative Know How (which he calls "big know how") into content learning. He also identifies a number of other critical elements for addressing Creative Know How. In this Huffington Post interview, Perkins encouraged teachers and framework developers to address the 4Cs as follows:

- **Approach the Cs through "infusion,"** weaving them into the teaching and learning of content.

- **Be explicit about strategies**. Research shows that students learn such skills better through making good practices explicit rather than just exercising them tacitly.

- **Take a dispositional approach**. Don't just foster the skills' development but also enthusiasm, commitment, sensitivity to occasions. Make such expectations part of the classroom culture.

- **Teach for transfer**. Declare an expectation for transfer, invite students to consider where else the Cs might apply within and beyond school, ask students to log stories of application.

- **Coordinate across the subject matters**. Use the same C approach in multiple subject matters yourself or by coordinating with teachers who teach the other subject matters. This reinforces the C and fosters transfer. (Research on transdisciplinary learning is robust and currently under-appreciated.)

Perkins' elements intersect with Hewlett Deeper Learning's approach to its set of 21st century learning skills, which overlap significantly with Creative Know How's Critical Thinking & Problem Solving, and Communication & Collaboration, along with Learning How to Learn, and Developing Academic Mindsets (in MyWays Habits of Success), and Mastering Core Academic Content (in MyWays Content Knowledge). Monica Martinez, who analyzed eight public high schools embracing Deeper Learning, found that they emphasized six core strategies that intersect both Perkins' elements and our key principles:

- **Empower**: Activate students to lead their own learning.
- **Keep It Real**: Provide meaning to student learning experiences.
- **Contextualize**: Connect experiences and subjects.
- **Reach:** Extend learning beyond the school.
- **Inspire**: Customize learning to each student.
- **Wire:** Make technology the servant not the master.

The state of play in Creative Know How

Many of the comprehensive competency frameworks we studied featured Creative Know How prominently. The movement to add 21st century skills to traditional content began the drive toward a broader, deeper competency goal-line. Across the four MyWays domains, the extent of consensus on the competencies included, the evidence for learning/instructional strategies, and the maturity level of assessment options varies — in some cases substantially. Creative Know How is relatively well-developed compared to Habits of Success and Wayfinding Abilities, but still has a way to go, particularly with regard to assessment. Following are a few notes to inform your thinking and prompt you to investigate further as you design learning models and experiences to address this domain.

The state of competency definition and related learning strategies

Summary: The three MyWays competencies that cover the 4Cs, as well as the broader set of Creative Know How competencies, are generally well-defined, backed by research, and supported with a selection of tools such as standards, rubrics, and learning progressions**.** For more on each, see the competency primers at the end of this report.

- **The research base** for Creative Know How is relatively well-developed, although this varies among individual competencies. For a summary of research in the field, see P21's 4Cs Research Series web page. Click on each of the cover graphics to get a bird's-eye view of current research in practice; consensus on terminology; successful interventions to bring the 4Cs to life in the classroom; practitioner and expert perspectives from the field; assessment recommendations for educators to track student growth and progress; gaps in current research and recommendations; best practice perspectives from experts in the field; and an annotated bibliography and additional resources.

- **Learning strategies** that support development of Creative Know How most commonly include project-based, work-based, community-based, or other active learning approaches that occur in real-world or complex simulated situations (which MyWays calls Whole Learning. See more in Report 11 on learning design). Through these approaches, students' productive work experiences provide the opportunity for Creative Know How skill development, application, and transfer. For concrete examples of this, see the resources boxes later in this report, including information on the Buck Institute's 4Cs rubrics, specifically designed for use in project-based learning. See also the "Converging Ideas" box above for Perkins' suggestions for how to implement Creative Know How learning strategies. The 4Cs Research Series provides further insights into learning strategies, interventions from other sectors not yet widely used in schools, and programs that have proven successful in out-of-school time settings. For approaches targeted at the Information, Media, & Technical Skills, and Practical Life Skills competencies, see the relevant competency primers.

The state of assessment

Summary: Evidence collection through performance assessment (curriculum-embedded and bounded) and other approaches are maturing; however, issues relating to transfer and reliability are complex and still being addressed. The growing use of project-based/performance assessment for Content Knowledge provides growing opportunity to collect evidence on the development of Creative Know How skills as part of the same processes, performances, and outputs.

The current range of assessment approaches includes the following:

- **Predominant reliance on rich, curriculum-embedded performance assessments (PA)**, including the use of the following tools:

  o Validated performance frameworks and/or tasks created by educators and networks or pulled from rich task databases (SCALE/SCOPE/CCSSO's Performance Assessment Resource Bank has a few Creative Know How PA items; EdLeader21 has announced a forthcoming 4Cs Performance Assessment Bank)

  o Rubrics, learning progressions, completed exemplars, portfolio and exhibition protocols, and other tools (see more information and links in the Practice Resources box below on New Tech Network's student learning outcomes and rubrics; Summit's discipline-specific skills rubrics and look fors; P21's rubrics; EdLeader21's rubrics for the 4Cs; and the Buck Institute's rubrics for assessment of 4Cs).

- **Innovative approaches, such as embedded assessments,** which can capture student processes in competencies ranging from problem solving to creativity (see, for example, the mention of clickstream analysis of ways of working in this Summit blog on assessment for the four components of their model, and this article on Newton's Playground, which measures creativity and conscientiousness as well as the learning of physics concepts through game-playing).

- **The use of multiple, varied measures**, such as the combination of self-report, situational judgment, and forced-choice methods offered within ProExam's Tessera Noncognitive Assessment System.

- **Bounded, on-demand performance tasks,** such as those including, most recently, collaborative problem solving, in the Program for International Student Assessment (PISA), NextGen Science assessments, the Common Core PARCC & Smarter Balanced assessments, and the Council for Aid to Education's CWRA+, a middle and high school level assessment that uses document-based real-world problem solving tasks to measure critical thinking skills.

Ongoing challenges in the assessment of Creative Know How include issues of **transfer** (such as which learning approaches improve the likelihood of transfer, especially across subject areas and widely varying circumstances), **educator capacity-building** in the assessment of Creative Know How skills, and the **development of performance- and portfolio-based digital platforms** that are flexible enough to house and track the kind of evidence required for Creative Know How skills, including evidence of processes and student reflection, as well as output and performance. (See examples in Key Principle 3 above.)

For more on Creative Know How assessments, see the Creative Know How one-page competency primers at the end of this report; also Report 12, *Assessment for Broader, Deeper Learning*; and two recent external publications: the Center for Curriculum Redesign's *Evolving Assessments for a 21st Century Education* and the National Academies Division on Behavioral and Social Sciences and Education's *Supporting Students' College Success: The Role of Assessing Intrapersonal and Interpersonal Competencies*

A quick dive into Creative Know How resources

Because the purpose of the MyWays Student Success Framework is to provide a rosetta stone for thinking about the broader, deeper, future-ready goal-line for today's learners, we have focused on describing that goal-line in conceptual terms. We also believe deeply that school designers, educators, and individual learners need to invest in constructing and evolving their own goal-lines within the broader framework described.

In doing this work, educators may find the following resources helpful:

<div style="background:#e8e4dc;padding:1em;">

Starter Resources for Creative Know How

- Trilling and Fadel, *21st Century Skills – Learning for Life in Our Times*

- Robinson, *Creative Schools: The Grassroots Revolution That's Transforming Education*

- Partnership for 21st Century Learning, Framework and 4Cs Research Series

- Fadel, Bialik, and Trilling, *Four-Dimensional Education: Competencies Learners Need to Succeed*

- Center for Curriculum Redesign, Evolving Assessments for the 21st Century (covers Creative Know How and Habits of Success)

- Robinson, "Changing Education Paradigms," (video, 11 m), and P21, "Introduction to 21st Century Learning," (video, 7m)

</div>

Relevant Competency Frameworks

Competency frameworks that emphasize this domain include the following (the first five are featured in the MyWays alignment matrix in the *Introduction and Overview of the MyWays Student Success Series*):

- ConnectEd, College and Career Readiness Framework

- Center for Curriculum Redesign, Four-Dimensional Education Framework

- Partnership for 21st Century Learning, P21 Framework

- Council of Chief State School Officers, Framework for College, Career, and Citizenship Readiness

- UChicago Consortium, Foundations of Young Adult Success

- Advance CTE, The Common Career Technical Core, Career Ready Practices

- US Department of Education, Employability Skills Framework

Models that Emphasize Creative Know How

The following models are strong on this domain:

- EL Education — a mature model developed out of Outward Bound and Harvard Graduate School of Education, EL has a strong emphasis on the mastery of skills and high-quality work through real-world learning, discovery, and inquiry.

- Summit Public Schools — skills rubrics and look fors; their cognitive skills are more closely tied to ELA and math subject skills.

- New Tech Network (NTN) — one of the key pillars in this project-based learning model is its focus on "outcomes that matter." NTN's learning outcomes and rubrics related to thinking, agency, collaboration, and oral and written communication are used in performance assessments.

- Two Rivers Public Charter Schools — Two Rivers is developing and testing rubrics and short assessments aimed at demonstrating transference in five constructs within critical thinking and problem solving (for more, see Learn with Two Rivers).

- St. Vrain Valley School District — a suburban public school district in Colorado with a trailblazing STEM program (see this 3m video) powered by i3 and Race to the Top grants, and based in design thinking and problem solving.

- Lindsay Unified School District — a Central Valley, California, district with 100% free lunch and 52% English language learners that transformed itself into a competency-based system that aims to create life-long learners, including in the economic, cultural, global, civic, and other spheres of life that correlate with Creative Know How.

- Da Vinci Communications High School — students are trained, taught, and assessed on 21st century skills in addition to content knowledge. Students complete projects in groups and with industry experts, and receive grades and feedback on their collaboration and communication abilities and performance.

We know from our beta piloting work with next generation educators that those interested in and inspired by the MyWays Student Success Framework are also thirsty for practitioner tools, as well as other implementation descriptions and documentation. In some cases, practitioners may be tempted to latch onto tools (such as the MyWays Whole-Student Competency Plot of the 20 competencies) and use them without the internal mindset-changing and learning-model-revising work required for successful implementation; we caution against this! We also realize that many thoughtful developers and practitioners simply want and need to see more concrete exemplars and tools in order to better understand the broader, deeper goal-line and to help them work through their own approach. As the MyWays Community of Practice grows, more pathways for use of the tools will arise, along with deeper levels of support and advice on building good practice around your own locally customized version of the MyWays framework.

In addition to the resources listed above, the one-page primers on each of the five Creative Know How competencies that follow provide links to existing tools, such as standards, rubrics, or learning progressions. Such tools can help educators decide what to include or exclude in next generation student competency goal-lines and how best to shape them. Note that MyWays and Next Generation Learning Challenges do not endorse any specific tools for assessment or curriculum planning – particularly in ways that are incompatible with authentic Whole Learning (see Report 12, *Assessment for Broader, Deeper Learning* for more on this approach). This set of EdSurge resources offers case studies of schools using MyWays, and Next Generation Learning Challenges' report, *Measures that Matter Most*, reviews some of the tools used by next generation schools to measure their progress in addressing the broader, deeper range of competencies.

The 4Cs set of competencies (critical thinking, communications, collaboration, and creativity) is a special case because, as a set, they are far more developed than most competencies in domains other than Content Knowledge. We therefore include below a sampling of some of the 4Cs rubrics, skills maps, learning targets, and performance assessments available for practitioner use.

Practice Resources for the 4Cs and More

1. **EdLeader21's 4C's Rubrics**

   This is a nationally vetted set of rubrics for the 4Cs from EdLeader21. The master set of 4Cs rubrics covers grades 3–4, 7–8, and 11–12 can be purchased from EdLeader21, but you can see adapted versions in links from this blog by Ken Kay, EdLeader21's CEO, who noted that, "The rubrics are a great resource on their own, but you and your teachers can also adapt them to your needs. For example, some of our districts have modified the rubrics and associated learning targets to make them student-friendly."

2. **The Buck Institute rubrics for assessing the 4Cs in a PBL context**

   These rubrics describe what 4Cs good practice looks like, specifically in the project-based learning (PBL) context, with different sequenced rubrics for K–2, 3–5, and 6–12. Critical Thinking and the "Process" section of Creativity & Innovation are organized by the four phases of a typical project. The Presentation Rubric is used only in a project's last phase, when students share their work with a public audience. Collaboration is relevant to all phases. See this blog for more on how to use these rubrics.

3. **P21 21st Century Skills Maps**

   These 21st Century Skills Maps address how to implement learning models that integrate the 4Cs into core academic content mastery. 4Cs skills maps are available for math, science, social studies, geography, English, languages, and arts; ICT skills maps are available for social studies, English, and math. Each skills map provides examples of the types of skills that are appropriate for 4th, 8th, and 12th grade levels.

4. **EdLeader21's 4Cs Performance Assessment Bank (forthcoming)**

   According to the [EdLeader website](#), "For EdLeader21 members, the lack of easily accessible, easily deployable assessment tools focused on the 4Cs is an ongoing issue. Most of our members have expressed interest in the development of assessment instruments that will help measure 4Cs student performance. The 4Cs Performance Assessment Bank project aims to establish a 4Cs-aligned bank of performance tasks that can be customized locally; EdLeader21 members may develop their own tasks for inclusion in this bank (using common design guidelines). The focus will be on... formative instruction and assessment."

The following resources are not specifically 4Cs, but they cover many of the same competencies:

5. **The Center for Innovation in Education (CIE) and Educational Policy Improvement Center (EPIC)'s Essential Skills and Dispositions Developmental Frameworks**

   This [set of developmental frameworks](#) covers collaboration, communication, creativity, and self-direction in learning. The frameworks define five components inherent to each skill and describe performance for each component across a beginner to emerging expert progression, informed by research on the development of expertise. Unlike discipline-specific learning progressions and rubrics, the developmental progressions reflect components essential to the skill itself and describe growth dependent on many years of active exploration, experimentation, setbacks, and reflection.

6. **New Tech Network's learning outcomes, rubrics, and college-ready assessments**

   New Tech Network (NTN), working with Envision and the Stanford Center for Assessment, Learning, and Equity (SCALE), created [open-source learning outcomes and rubrics](#) related to: knowledge and thinking in different core subject areas; agency; collaboration; and oral and written communication. These tools are used in NTN's curriculum-embedded performance assessments called [College Readiness Assessments.](#) The network also offers a three-part Student Literacy [video series](#) (10–15m each) that guides users through the delivery of workshops focused on the creation of high-quality tasks, looking at student work, and the use of the knowledge and thinking rubrics (including the difference between grading and scoring).

7. **Two Rivers' Public Charter Schools resources**

   Two Rivers Public Charter School, a high-performing [EL Education School](#), hosts its own excellent professional sharing site, [Learn with Two Rivers](#). Its tasks and rubrics that address critical thinking, problem solving/"expert thinking," collaboration, and communication are currently being curated in this separate [Deeper Learning Assessment folder](#).

8. **Bonus: The Institute for the Future of Learning's open source tool repository**

   As part of the Institute for the Future of Learning project (producer of the excellent *Assessing the Learning that Matters Most*), Julie Wilson created a database of learning progressions, rubrics, and tasks on the 4Cs, as well as self-assessment and SEL. The tools were provided by EL Education, New Tech Network, High Tech High, Mount Vernon, Two Rivers, Sanborn (NH) Regional School District, Catalina Foothills, Science Research Academy, and Edutopia KIPP Socratic Seminar — more than 75 documents in all. The tools are searchable by topic, school model, and grade level, and can be found on this [beta website](#).

The Creative Know How one-page competency primers

The one page primers that follow provide a brief introduction to the most important aspects of each competency, with pointers to why the competency is important (given students' developmental needs and the challenges of today's rapidly changing world), further description of what the competency entails, where to look for inspiration and guidance, and additional resources. These primers provide only a taste of the research and activity in each area. We hope that our MyWays Community of Practice and other educators will help add to and update these resources over time. To meet the Community of Practice members and share your ideas see our [Community of Practice page](#) on the MyWays website. To receive MyWays updates, join our [mailing list](#).

Critical Thinking & Problem Solving

"College is too late to teach problem-solving and other skills they'll need to be a successful employee someday. But high school is a great place for developing those skills.... At the end of the day, these students have learned how to learn. They know how to break down a problem and solve it using their own skill sets, as well as being able to identify what skills are needed but not available in their group, and then they find a way to learn that needed skill."

—Ron Fortunato, of A World Bridge, which offers real-world, real-time, high-tech projects for HS students[21]

Brief description:

- This MyWays competency is defined as the "ability to analyze and reason effectively, and use systems thinking and design thinking, toward solving problems in varied settings."

- Addressing this competency includes helping students[22]:

  - Identify and define problems and propose creative and appropriate solutions.

  - Develop analytical thinking approaches, including applying logical reasoning, as well as analytical, reflective, evaluative, and metacognitive skills.
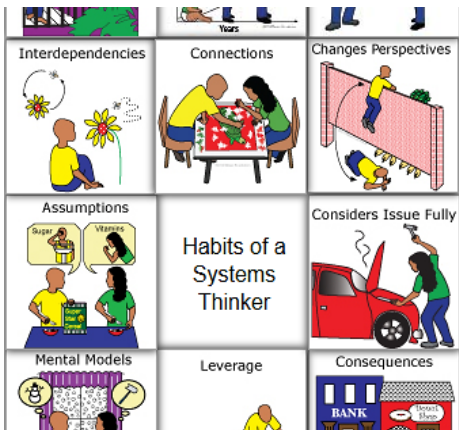
Waters Foundation (interactive version)

  - Develop systems thinking approaches, including consideration of a holistic perspective, connections, relationships, integrated concepts, and emphasis on synthesis.

  - Develop design thinking approaches to problem solving, focused on principles of human-centered design, embrace of ambiguity, iterative redesign, and tangibility.

- Note: Design thinking is also included in the Creativity & Entrepreneurship competency.

Where to look for ideas:

- **Project-based, inquiry-based learning, service learning, and other active, deeper learning models** that provide complex learning challenges promote higher-level thinking and problem solving. For a model based on design thinking, see the One Stone Story.

- **Youth development (YD) programs** that link students to authentic learning do the same. See The Possibility Project, Wyman TOP, and other exemplary YD programs featured in the "Problem Solving Practices" section of Preparing Youth to Thrive, as well as in A World Bridge and Educurious.

- **Two Rivers Public Schools** is building out five components of Critical Thinking & Problem Solving. Rubrics and assessments for effective reasoning and problem solving are in its Deeper Learning Assessment folder now; creativity, schema development, evaluation, and metacognition are due soon. See more at Learn with Two Rivers and in this EdSurge MyWays series article.

- **In countries like Switzerland,** where secondary education includes apprenticeships, youth and employers cite the "knotty, unexpected, and complicated problems that arise every day in every workplace" as "precisely the sort of thing that can only be learned on the job."[23]

- **Higher education and the professions** are also incorporating aspects of critical thinking and problem solving into their curricula; see Making Design Thinking Part of Medical Education.

Additional resources as food for thought:

- P21, *What We Know About Critical Thinking* (The 4Cs Research Series).

- EdLeader21, *The Leader's Guide to 21st Century Education* ("Appendix 3 — Critical Thinking Resources").

- The Critical Thinking Community's website and resources, and the Waters Foundation's Systems Thinking in Education website and resources.

- Stanford d.school's K12 Lab Network, including the K12 Lab Wiki for many helpful resources on design thinking.

- Charles Fadel et al.*, Four-Dimensional Education*.

- For a collection of Critical Thinking & Problem Solving tools such as learning objectives, rubrics, skills integration maps, and performance assessments, see the 4Cs Practice Resources box earlier in this report.

FOR MORE RESOURCES, see the MyWays website.

Creativity & Entrepreneurship

"The future belongs to a very different kind of person with a very different kind of mind — creators and empathizers, pattern recognizers and meaning makers. These people... will now reap society's richest rewards and share its greatest joys."

—Daniel Pink, A Whole New Mind[24]

"Creativity is as important in education as literacy and we should treat it with the same status."

—Sir Kenneth Robinson, in his famous TED talk "Do Schools Kill Creativity?"[25]

Brief description:

- This MyWays competency is defined as "the imagination, inventiveness, and experimentation to achieve new and productive ideas and solutions."

- Addressing this competency includes helping students[26]:

  - Think creatively, using a range of idea-creation techniques, and elaborating, refining, and evaluating the resulting ideas, including through design thinking.

  - Work creatively with others, be open and responsive to new ideas, and see failure as a way to learn.

  - Implement innovation, including taking risks and following through in the real world.

  - Develop additional entrepreneurial skills and mindsets, including the necessary business and financial concepts and processes, as well as Habits of Success that support new value creation.

Where to look for ideas:

- **Address creativity within core subject areas**. For starter strategies, see these Edutopia blogs from an English teacher and a science teacher.

- **Promote creativity through the arts**. The visual and performing arts provide a natural way to help students develop creativity and agency, which can then extend to other parts of their lives. See the Boston Arts Academy, Kettle Moraine's competency-based KM Perform high school and this article on making + art for creativity.

- **School models** include Philadelphia's Workshop School; the Incubator School in Los Angeles (and this NPR report on it); the Boston Collaboratory School; and Design Tech HS. Also see this review of global and US models.

- **Co-curricular activities can excel at developing creativity and entrepreneurship.** Odyssey of the Mind and Destination Imagination (2m video) develop creativity through STEM, service learning, and fine arts.

OECD Progression in Student Creativity in School

Entrepreneurism is fostered in programs like DECA, 4H, and Junior Achievement. See also creativity challenges and HS entrepreneurship clubs.

- On sparking creativity through design thinking, see this introductory video (2m) for LAUNCH, a design thinking process adapted for K-12 by A.J. Juliani and John Spencer. In LAUNCH's added final step, students "launch" their work to an authentic audience.

- **International models.** OECD's *Entrepreneurship in Education: What, Why, When, How* features progression models from the UK, Denmark, Sweden.

Additional resources as food for thought:

- **Creativity resources:** P21, *What We Know About Creativity* (The 4Cs Research Series); EdLeader21, *The Leader's Guide to 21st Century Education* ("Appendix 3 — Creativity Resources"); and the National Education Association's *An Educator's Guide to the "Four Cs"* (the "Creativity and Innovation" section).

- **Entrepreneurship resources:** Entre-Ed, the National Consortium for Entrepreneurship Education, offers national content standards that are also in the Department of Labor Competency Model tools; also see the Youth Entrepreneurship Framework.

- **For a collection of Creativity tools** such as learning objectives, rubrics, skills integration maps, and performance assessments, see the 4Cs Practice Resources box earlier in this report.

FOR MORE RESOURCES, see the MyWays website.

Communication & Collaboration

"Amir knows that he has to keep working on the habit of collaboration. He reports, "My next step for the future is to not distract my crew. If I have a question, just ask, but don't get off topic with it.

And I would love to keep sharing ideas. I love getting my voice out and heard."

—Amir, student at the K-8 EL Education Odyssey School in Denver, Colorado[27]

Brief description:

- This MyWays competency is defined as "oral, written, and visual communication skills, as well as the ability to work effectively with diverse teams."

- Addressing this competency includes helping students[28]:

  - Articulate thoughts orally, in writing, non-verbally.

  - Listen effectively to decipher meaning.

  - Use communication for a range of purposes, including to inform, instruct, motivate, and persuade.

  - Communicate in diverse environments.

  - Work effectively and respectfully in diverse teams.

  - Show flexibility, willingness to help, and the ability to compromise to reach common goals.

  - Assume shared responsibility and value individual team member contributions.

- Communication & Collaboration are intertwined with Information, Media & IT literacy, as well as with Problem Solving. (See this EdSurge article on the 2015 addition of collaborative problem solving to the international PISA assessment; in the exam, students use a chat pool to talk to team members and solve a problem together).

Where to look for ideas:

- **Begin addressing Communication & Collaboration** through the CCSS speaking and listening anchor standard.

- **This discussion of "Procedures for Classroom Talk"** focuses on English language learners and touches on accountable talk and effective collaborative discussions.

- **Da Vinci Communications HS** has a wealth of leading practices here, including its Critical Friends' Group Protocol and other materials. Students discuss collaboration in this Da Vinci video (10m).

- **The EL Education case study** on Amir's project (see earlier quote) focuses on collaboration, agency, reflection, and peer feedback. Here is an excerpt from Amir's critique:

Don't Just Talk About Character; Teach Habits

- **The Internationals Network for Public Schools** leverages both communication and collaboration by teaching recent immigrants through experiential projects in which they need to work together and make themselves understood to get things done. See a description of the magic in this *CompetencyWorks* blog by Chris Sturgis.

Additional resources as food for thought:

- P21, *What We Know About Communication* and *What we Know About Collaboration* (The 4Cs Research Series); P21, *Skills for Today: What We Know About Teaching and Assessing Collaboration;* EdLeader21, *The Leader's Guide to 21st Century Education* ("Appendix 3 — Communication & Collaboration Resources"); and the National Education Association's *An Educator's Guide to the "Four Cs"* ("Communication & Collaboration" section).

Developmental Progressions from CIE and EPIC's *ES&D frameworks*

- For a full set of beginner to expert progressions for subskills within communication and collaboration, see CIE and EPIC's Essential Skills and Dispositions (ES&D) developmental frameworks.

- The 4Cs Practice Resources box earlier in this report includes learning objectives, rubrics, skills integration maps, and performance assessments on creativity.

FOR MORE RESOURCES, see the MyWays website.

Information, Media, & Technology Skills

"As computers successfully take over routine tasks, humans are left with the jobs they do best, often using computers as assistive tools to take their products to new heights, instead of being replaced by them."

—Charles Fadel, *Four-Dimensional Education*[29]

Brief description:

- This MyWays competency is defined as "the ability to access, evaluate, manage, create, and disseminate information and media using a wide variety of technology tools."

- Addressing this competency includes helping students[30]:

  - Develop information and media literacy, including: analyzing media messages to understand how and why they are constructed, how individuals interpret them with different points of view, how media influences behavior, and ethical/legal issues.

  - Create media products, including: understanding and using the most appropriate creation tools and effectively using the tools for appropriate expression in diverse, multicultural environments.

  - Develop technology literacy, including computational thinking (rather than programming languages), and the ability to understand and leverage the growing capabilities of augmented reality, virtual reality, big data, robots, artificial intelligence, and novel technologies as they appear.

  - Note on equity: Disadvantaged youth and those with learning limitations, who could most benefit from access to technology, are still the least likely to have that access.[31] Educators must address this need so that technology does not serve to widen the gap further.

Where to look for ideas:

- On developing info and media literacy: See the links in "media literacy" resources below for a range of standards, lesson plans, and other resources from PBS, Common Sense Media, Newsela, and media literacy organizations. For an alternative, see Tribeworthy, a "crowd contested" site linked to the Global Critical Media Literacy Project that lets students review news articles for bias, credibility, logic, etc., and contribute to a pubic rating.

- On **creating media and tech products:** Getting Smart flags Kearny High School of Digital Media & Design for its student-centered PBL stressing productive Habits of Mind. Extracurriculars — such as student film festivals, school and cable TV production opportunities, First Lego League, and robotics — offer excellent opportunities.

Aitrends

- On promoting tech literacy:

  - Look at Excel Public Charter School's Computational Thinking curriculum, which focuses on solving problems, designing systems, and understanding human behavior by drawing on computer science concepts, including a lesson on featuring a LeBron James play and various other topics (3m video).

  - Tackle tech literacy through real work; see Generation Yes, which aims to scale the successful student-run HS help desk model (also found in individual schools like Burlington HS). Such an understanding of tech application and human-tech interaction is invaluable.

  - Finally, there isn't much opportunity for students to work directly with AI today, but this three-step list offers guidelines on what educators can do to start implementing AI education in schools right away.

Additional resources as food for thought:

- On **media literacy:** See these EdWeek articles on media literacy and fake news for a roundup of numerous resources on tackling these topics; also, this EdWeek blog overviews the National Council of Teachers of English Framework on information literacy.

- On **media creation:** Listen to George Lucas discuss teaching visual literacy and communications (video, 4m) and discover the learning outcomes possible from visual media arts, even for students with disabilities.

- On **tech literacy**: For more on computational thinking, see this Edutopia blog, and this free online Google course to help educators integrate computational thinking into their humanities, math, science, and computing curricula.

FOR MORE RESOURCES, see the MyWays website.

Practical Life Skills

"It's mostly life skills, the kinds of things most people learn about by messing up. I'm pretty stoked to learn that.

It's weird that in the school system they don't teach something that everyone should know."

—Ford, 17, on his High Tech High 12th grade end of year program (He's particularly interested in personal finance.)[32]

Brief description:

- This MyWays competency is defined as the "ability to understand and manage personal finances, health and fitness, and emotional, spiritual, and other aspects of personal wellbeing to enable and support a productive, effective life."

- Addressing this competency includes helping students[33]:

    - Manage personal finances, including: spending, saving, credit, and debt; employment and income; investing; risk and insurance; financial decision-making.

    - Manage one's own health and fitness, including: obtaining, interpreting, and using basic health information and services to enhance health; obtain and act on diet, nutrition, exercise, risk avoidance, and stress reduction guidelines; establish and monitor health goals.

    - Attend to one's own emotional and spiritual needs, and to other aspects of wellbeing, including: mindfulness, heartfeltness, and positive mental health.

    - Address practical tasks that are rapidly evolving, including how to shop, find housing, and get around.

Where to look for ideas:

- **High Tech High 12th graders** take end of year courses in cooking on a budget, sewing, personal finance (how credit card balances work, renting an apartment, etc.).

- **Da Vinci Communications HS** started a "Grit Course" focused on practical skills needed for the transition from HS; their students call it "Adulting class." Students from across the economic spectrum are looking for similar guidance, as evident in this NPR piece and the box below.

- **Practical can start early:** DC Public Schools is teaching its 2,000 second graders to ride a bike, promoting exercise, safety, and independence through this life-long skill. Magnolia Montessori for All's elementary students

> Urban Dictionary defines "**adulting**" as "to do grown up things and hold responsibilities such as a 9-5 job, a mortgage/rent, a car payment, or anything else that makes one think of grown ups." In the past year, the term "**adulting**" has increased in usage by 700 percent on Twitter. Jun 20, 2016

Urban Dictionary

Note to Urban Dictionary: your definition of what grownups do needs updating. See the kinds of gig work, variable work schedules, mix of working and learning, and Uber-oriented lifestyles that responsible young (and even not-so-young) workers are living these days, as described in the Part A reports in this series.

are responsible for planning and leading small-group Field Studies in their local communities. Their chaperone guide is a delightful window into how to build resourcefulness.

- **Financial, HR, and training literacy for the Gig economy** includes personal finance competencies and programs (see the "Additional resources" links below). To see how even these approaches need to be updated, see *Serving Workers in the Gig Economy: Emerging Resources for the On-Demand Workforce*, especially the list of responsibilities now on individual shoulders on p. 3.

- **Nutrition, exercise, and well-being:** A helpful blog by a Summit Public Schools teacher about facilitating mindfulness for the first time (with links to a list of benefits). Edutopia offers mindfulness resources, including school-wide and afterschool programs and a video (7m) on how meditation is lowering truancy and suspensions.

- **The Johns Hopkins Center for a Livable Future** offers a free curriculum for teaching the food system to empower students to make healthy and responsible food choices.

Additional resources as food for thought:

- **For Personal Finance:** See JumpStart national standards in K-12 Personal Finance and the Education HS Financial Planning Program (HSFPP) Standards and Outcomes, which align with JumpStart and five other national standards sets (links to all are on the HSFPP website).

- **For health, fitness, and well-being**: See Shape America's standards, including the Whole School, Whole Community, Whole Child model from the Center for Disease Control and Prevention (CDC) and the ASCD.

FOR MORE RESOURCES, see the MyWays website.

Endnotes for Report 8

[1] Daniel Pink, in a 2012 interview with Bill Sheridan.

[2] Elliot Washor and Charles Mojkowski, *Leaving to Learn: How Out of School Learning Increases Student Engagement and Reduces Dropout Rates*, Heinemann, 2013, pp. 58,   73

[3] Mary Gray and Siddharth Suri, "The Humans Working Behind the AI Curtain," *Harvard Business Review*, January 9, 2017.

[4] Megan Beck and Barry Libert, "The Rise of AI Makes Emotional Intelligence More Important," *Harvard Business Review*, February 15, 2017.

[5] This paragraph summarizes reports on the Stanford study and other research from Benjamin Herold, "'Fake News,' Bogus Tweets Raise Stakes for Media Literacy," *Education Week*, December 8, 2016, and Chris Berdik, How to Teach High-School Students to Spot Fake News, *Slate*, December 21, 2016. For the Executive Summary of the Stanford report, see Evaluating Information: The Cornerstone of Civic Online Reasoning, Stanford History Education Group.

[6] Lauren Resnick, "Getting to Work: Thoughts on the Function and Form of School-to-Work Transition," in *Transitions in Work and Learning: Implications for Assessment*, edited by Alan Lesgold, Michael Feuer, and Allison M. Black, National Academies Press, 1997, p 258.

[7] See Report 2 for more information. Also: Robert Kuttner, "Why Liberals Have to be Radicals," *The Amercian Prospect*, July 21, 2015. Also: Gerard Friedman, "Dog Walking and College Teaching: The Rise of the American Gig Economy," *Dollars and Sense*, March/April 2014, pp. 28-9.

[8] Thomas L. Friedman, *Thank You for Being Late: An Optimist's Guide to Thriving in the Age of Accelerations*, Farrar, Strauss and Giroux, 2016, p. 229.

[9] Martha C. White, "The Real Reason New College Grads Can't Get Hired," *Time*, Nov 10, 2013; National Education Association, *Preparing 21st Century Students for A Global Society: An Educator's Guide to the "Four Cs,"* 2011, p. 6; see also Hart Research Associates, *It Takes More Than a Major: Employer Priorities for College Learning and Student Success,* The Association of American Colleges and Universities 2013.

[10] Kurt Fischer, in a conversation with Todd Rose, cited in Rose, *The End of Average: How We Succeed in a World that Values Sameness*, HarperOne, 2016, p138.

[11] Bryan Goodwin and Heather Hein, "Research Matters/What Skills Do Students Really Need for a Global Economy?," *Educational Leadership*, Vol 74, no 4, December 2016/January 2017 (a theme issue on The Global Ready Student), p. 84.

[12] See, for example, Charles Fadel, Maya Bialik, and Bernie Trilling, *Four-Dimensional Education: The Competencies Learners Need to Succeed,* CreateSpace Independent Publishing, 2015, p. 13. Use of the VUCA acronym derives from a U.S military study of the 1990s analyzing the implications of rapid change brought about by the "information age." For a business take on VUCA see Nathan Bennett and G. James Lemoine, "What VUCA really means for you," *Harvard Business Review*, January-February, 2014; and for the psychological perspective, see Michael Woodward's interview of Dr. David Smith, "How to Thrive in a VUCA World: The Psychology of Navigating Volatile, Uncertain, Complex, and Ambiguous Times," Spotting Opportunity blog, *Psychology Today,* July 31, 2017. Both of these approaches share a lot of characteristics with core concepts embedded in the four MyWays competency domains, as well as the kind of adaptability, big-picture view, and design thinking underlying MyWays learning design.

[13] Tom VanderArk cited the new 4Cs in his talk at LearnLaunch 2017, and discusses them, along with a few more Cs, in Five Trends Demand Smart States, Vander Ark on Innovation blog, *Education Week*, June 1, 2015; Peter Drucker, quoted in Trilling and Fadel, *21st Century Skills: Learning for Life in Our Times*, Jossey-Bass, 2012, p. 151.

[14] Grant Wiggins, in "On Reading, Part 5: A Key Flaw in using the Gradual Release of Responsibility model," *Granted, and...* blog, March 30, 2015, quoting the "seminal work" from S. Paris, M. Lipson & K. Wixon, "Becoming a strategic reader," *Contemporary Educational Psychology*, 8(1), 293-316.

[15] Fadel, Bialik, and Trilling, *Four-Dimensional Education*, p 105.

[16] Ibid.

[17] Ibid., pp. 106, 121.

[18] P21 Skills Map for Science http://www.p21.org/storage/documents/21stcskillsmap_science.pdf, p. 2.

[19] Summit Public Schools: Notes on Look Fors, p. 1.

[20] Ralph Waldo Emerson, "Old Age," *The Atlantic Monthly*, January, 1862 from the Atlantic archives.

[21] Quoted in Catherine Wedgwood, Building a World Bridge to College, Career, and Life Readiness, blog, *Getting Smart,* March 30, 2017. See also the World Bridge website.

[22] The Critical Thinking and Problem Solving competency description draws on treatments of critical thinking, problem solving, systems thinking, and design thinking, including those in EdLeader21's book by Ken Kay and Valerie Greenhill, *The Leader's Guide to 21st Century Education: 7 Steps for Schools and Districts*, Pearson Education, 2013; Fadel, Bialik, and Trilling, *Four-Dimensional Education*; and the Partnership for 21st Century Learning (P21)'s, *What We Know About Critical Thinking*, part of The 4Cs Research Series, 2015.

[23] Nancy Hoffman, *Let's Get Real: Deeper Learning and the Power of the Workplace*, Students at the Center Deeper Learning Research Series, 2015, p. 6.

[24] Daniel Pink, *A Whole New Mind: Why right-brainers will rule the world*, 2006, p. 1.

[25] Ken Robinson, "Do Schools Kill Creativity?" TED Talk, May 16, 2011.

[26] The Creativity and Entrepreneurship competency description draws on treatments of creativity, entrepreneurism, innovation, and design thinking, including those in EdLeader21's Kay and Greenhill, *The Leader's Guide to 21st Century Education*; Fadel, Bialik, and Trilling's *Four-Dimensional Education*; and P21, *What We Know About Creativity,* part of the 4Cs Research Series — as well as from entrepreneurship competencies covered in the frameworks and reports listed under entrepreneurship in this primer's "Additional resources" section.

[27] Liza T. Eaton and Cyndi D. Gueswel, "Don't Just Talk Character: Teach Habits," *UnBoxed: A Journal of Adult Learning in Schools*, Issue 10, Spring 2013.

[28] The Communication and Collaboration competency description draws on treatments of communication and collaboration, including those in Fadel, Bialik, and Trilling's *Four-Dimensional Education* and P21's *What We Know About Communication* and *What we Know About Collaboration*, parts of the 4Cs Research Series.

[29] Fadel, Bialek, and Trilling, *Four-Dimensional Education*, p. 27.

[30] The Information, Media, & Technology Skills competency description draws on treatments of information, media, and technology in the National Education Association's Preparing 21st Century Students for a Global Society: An Educator's Guide to the "Four Cs," 2012; Fadel, Bialek, and Trilling's *Four-Dimensional Education*; and the media literacy, tech literacy, and computational thinking sources listed under this primer's "Additional resources" section.

[31] Stephanie Malia Krauss, Karen J. Pittman, and Caitlin Johnson, *Ready by Design: The Science (and Art) of Youth Readiness*, The Readiness Project, 2016.

[32] Quoted in Matt Krupnick, "High Schools try to make better use of something often wasted: Senior Year," *The Hechinger Report*, May 11, 2016.

[33] The Practical Life Skills competency description draws on treatments of practical life skills, personal finance competencies, health and fitness competencies, and well-being and mental health competencies including: for personal finance - JumpStart national standards in K-12 Personal Finance and the Education HS Financial Planning Program (HSFPP) Standards &Outcomes, aligned with JumpStart and five other other standards (see links on HSFPP website); for health, fitness, and well-being - Shape America's standards, including the Centers for Disease Control and Prevention (CDC) and ASCD's Whole School, Whole Community, Whole Child model (WCCC), and Shape America's excellent Position Statement on WCCC.