



## I. INTRODUCTION

The world is changing at an ever-increasing pace. With these changes come greater demands for a 21<sup>st</sup> century workforce that has the skills and abilities required for in-demand occupations in high-growth industry sectors.

To ensure that all students graduate fully prepared for college *and* careers, K-12 administrators and teachers need to change the existing K-12 educational culture to expose students to career options that are relatable to their academic work. No longer does a high school diploma, or even a four-year college degree guarantee success in a person’s career or life. Today’s students need tangible connections between school and real-life situations to understand the importance of why they are learning these subjects in school.

Recent reports show that 35 years ago, only 12 percent of U.S. jobs required some postsecondary training or an associate’s degree, and only 16 percent required a bachelor’s degree or higher. In the next decade, nearly eight in 10 future job openings in the United States will require postsecondary education or training. At least 45 percent of those will be in “middle skill” occupations, which will require at least some postsecondary education and training, while 33 percent will be in high skilled occupations for which a bachelor’s degree, or more, will be required. Conversely, only 22 percent of future job openings will be considered “low skill” and available to those with a high school diploma or less. (Achieve, America Diploma Project)

This sea change means that schools must now integrate 21<sup>st</sup> century skills and relevant career experiences, coupled with demanding academics across the entire K-12 system. Together rigor, relevance and real-world applications provide the pathway that will best prepare students for college *and* careers.

To achieve this level of preparation for students, educators must hone in on the changes in the workplace and strive to make learning relevant to real world experiences, particularly in subjects that students often question as irrelevant — specifically math.

And while the upper grades were traditionally the time to start making these connections, more current thinking indicates the importance of exposing children to the college/career path in the younger grades, such as elementary and the early years of middle school. Each field trip to the fire station or the local bakery can be joined with a lesson in math and/or science.

## II. THE CHANGING WORKPLACE

The reality of a 21<sup>st</sup> century student's future is unlike anything that has been experienced before. Workplace needs, societal changes and global demands require new skills from the up-and-coming labor force. Experts, in both business and academia, believe the skills expected for many entry-level jobs are at a *higher* level than the current academic skills required for a high school education. Language arts and math standards, and tools used to assess students' achievement of these standards, do not always adequately measure student preparedness to meet present and future college and career needs.

Over the past 60 years, business needs have shifted from jobs requiring a mostly unskilled labor force (employees with just a high school degree, if that) to mostly skilled jobs requiring at least some college. Now, those job needs are shifting again.

By 2018, U.S. businesses will need 4.7 million new workers who have at least a postsecondary certificate. An estimated 90 percent of the fastest-growing jobs will require workers who have completed college. (Jan Bray, Bray Strategies)

### **Where students rank globally today**

According to the most recent results of the Program for International Student Assessment (PISA), an international assessment that measures the performance of 15 year olds in reading, math and science every three years, U.S. high school students ranked 36<sup>th</sup> among the world's most-developed countries in math, science and reading. This lack of preparedness to compete on a global scale is not limited to the PISA results. Consider this:

- 25 percent of students fail to graduate from high school in four years. That number is closer to 40 percent for Hispanic and African-American students.
- Only two out of every 10 Americans speak another language in addition to English.
- About 7,000 students drop out of high schools across the United States every day. In 2010, more than 1.3 million students didn't graduate from high school. Of those who stay in high school, graduate and go on to college, nearly 40 percent require remedial classes in college.

From a business leader and employer's perspective, these young people are functionally unemployable in a high-skills, competitive, global economy. Therefore, the challenge for educators is how to maximize college *and* career options for students, to include a mastery of

key knowledge, skills and characteristics that students can hone throughout their lives and careers.

### **III. WHAT GLOBAL BUSINESS AND INDUSTRY NEEDS: FACTORS FOR COLLEGE AND CAREER READINESS**

The United States has become ever more integrated into the global economy. Today’s jobs require workers who possess critical thinking and problem-solving skills, as well as more advanced technical and technological skills.

Until recently, there has not been agreement among the preK-12, higher education, and business and industry sectors about the knowledge, skills, and abilities that high school graduates need. Each sector sets readiness expectations independently of one another, and doesn’t clearly communicate what those expectations are. (NCPPE/SREB, 2010) Accordingly, identifying or developing appropriate assessments to measure those skills has been challenging.

According to the report, “It Takes a Whole Society,” psychologists and child development experts agree that high school years should blend academics and applied learning to provide students with a window to the outside world. (Nellie Mae Education Foundation, 2012)

Moreover, many academicians contend that exposure to the workplace and connections between courses and careers should happen much sooner than high school, giving students a deeper understanding and awareness of the relevance between work and academics. Doing so, however, requires a shift in how students learn and are taught.

#### **Shift from knowledge acquisition and memorization to knowledge application and deep-level problem solving**

Properly preparing students for college and careers shifts the focus from knowledge acquisition and memorization (i.e., rote learning) to knowledge application and complex problem solving, which is often attained through a combination of academic and experiential learning. (Daggett, 2013) There is widespread agreement that lifelong learning and “learning how to learn” are key drivers of success in college, careers, and civic life.

#### **What it means to be a college- and career-ready student**

In the past, being college-ready meant a student had taken a series of Advanced Placement (AP) classes, received solid SAT or ACT scores and had a good grade-point average. Career-ready students, on the other hand, were focused on gaining technical skills, participating in a career technical education (CTE) program or working toward a certification.

As we move toward a more comprehensive educational experience for children those descriptors have changed. According to reports published by the American Diploma Project Network, *college and career readiness* refers to the content knowledge and skills that high school graduates must possess in English and mathematics — including, but not limited to,

reading, writing, communications, teamwork, critical thinking, and problem solving — to be successful in any and all future endeavors. (NJ Dept. of Education College And Career Readiness, 2012)

Today, being *college-ready* “means being prepared to enter and succeed in any postsecondary education or training experience, including study at two- and four-year institutions leading to a postsecondary credential (i.e., a certificate, license, associate’s or bachelor’s degree) without the need for remedial coursework.” Being *career-ready* “means that a high school graduate possesses not only the academic skills that employees need to be successful, but also the technical skills, i.e., those that are necessary for a specific job function, and 21st century employability skills, i.e., interpersonal skills, creativity and innovation, work ethics, personal responsibility, global and social awareness, etc., that are necessary for a successful career.” (NJ Dept. of Education College And Career Readiness, 2012)

To ensure students are successful, K-12 schools must apply the same factors: Students must be able to learn and apply new information, problem solve, communicate and collaborate with peers, and contribute to the greater good of society.

Career readiness also requires exceeding the level of learning many state standards and assessments dictate, as well as that of CTE and job-ready programs. It involves the highest levels of learning — applying knowledge to solve unpredictable real-world problems.

According to William Daggett, founder of the International Center for Leadership in Education (ICLE), career readiness has no defined endpoint. Today's students must be adaptive and committed to lifelong learning, and have a mastery of key knowledge and skills that can vary from one career to another over an occupational trajectory. Accomplishing this means a combination of rigor and relevance.

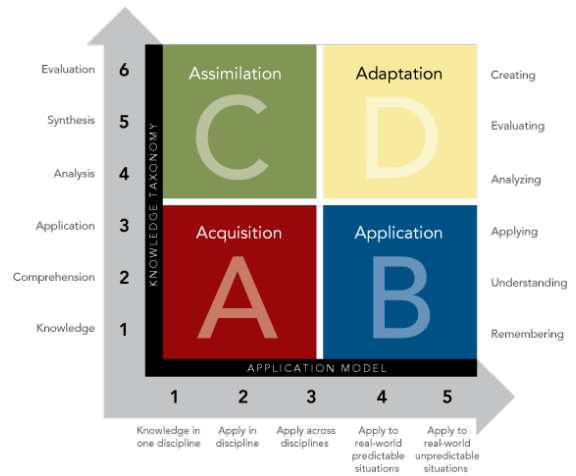
### **The Rigor/Relevance Framework**

This transformational shift is possible if educators employ the Rigor/Relevance Framework. Daggett of ICLE notes that students understand and retain knowledge best when they have the opportunity to apply it in a practical, relevant way. When students find their studies relevant, teachers can increase the rigor to meet students’ needs. Doing so requires that students think in multiple ways, using critical-, analytical- and practical-thinking skills, thus combining both academic rigor and relevant learning experiences for a more engaged interaction with the course work.

Daggett and ICLE developed the Rigor/Relevance Framework tool to help educators better examine curriculum standards, instruction and assessment, based on how students receive, analyze and process information.

Rigor refers to academic rigor, in which students can show a thorough understanding of challenging tasks by demonstrating reflective thought, analysis, evaluation, creativity or problem-solving skills. Relevance is how students apply the core skills and knowledge that they've attained in real world work situations to solve actual problems.

The Rigor/Relevance Framework operates on an X-Y axis. The Y-axis is the "thinking continuum," also known as the Knowledge Taxonomy, and is based and measured on six levels ranging at the low end of Knowledge/Awareness to the high end of Evaluation. The X-axis is the Application Model that measures a person's capability of applying that knowledge.



The Rigor/Relevance Framework also is divided into four quadrants. Each quadrant identifies a person's ability to acquire and apply knowledge, with Quadrant A being at the simplest form to Quadrant D indicating a student's competency to think in complex ways and apply the knowledge and skills they've acquired to a project or task. Learning happens in each quadrant. Academic standards and traditional state tests have historically been in Quadrant A. Career and technical education classes typically fall under Quadrant B. College prep (or college-ready) classes are found in Quadrant C. In Quadrant D is career-ready academic work.

According to Daggett, it's critical for today's schools to target instruction and develop assessments, in all subjects and programs, to focus on building students' learning and analytical skills within Quadrant D, which he says is a combination of college-ready *and* career-ready learning.

Daggett contends that the learning that happens in Quadrant D "provides the level of rigor and relevance needed to prepare students for success after high school because it enables students not only to gain knowledge, but also to develop real-world skills, such as inquiry, investigation, experimentation, decision-making and problem solving." (Daggett, 2012) When students are applying what they've learned and working through real-world problems they are not only applying the skills and knowledge they've acquired related to the specific project, but they are also drawing on knowledge from other subjects.

A	B	C	D
Students gather and store bits of knowledge and information. Students are primarily expected to remember or understand this knowledge.	Students use acquired knowledge to solve problems, design solutions, and complete work. The highest level of application is to apply knowledge to new and unpredictable situations.	Students extend and refine their acquired knowledge to be able to use that knowledge automatically and routinely to analyze and solve problems and create solutions.	Students have the competence to think in complex ways.

Learning in Quadrant D is demanding of both teachers and students. It requires the student to think and work. And it shifts from teacher-centered instruction to student-centered learning, requiring more “out-of-the-box” thinking and instruction from teachers.

To reach this point, schools need to provide students with hands-on learning opportunities in a true working environment so students can apply their knowledge outside of the classroom. Connecting classrooms to careers provides students with a practical, tangible way of seeing and understanding how the subjects they are learning in school fit in the real world. That relevance helps make things click for students and can help provide a newfound interest and increased motivation in school, especially as it applies to math.

#### **IV. PREPARING THE COLLEGE- AND CAREER-READY CLASSROOM**

Instruction for college and career readiness involves developing a mindset in students that’s focused as much on *how and why* students learn as on *what* they learn. As previously stated, the needed skills — college-ready rigor, relevance, relationships and self-reliance — are best developed in a project-based learning, hands-on environment with problem-based performance tasks and self-directed, engaged learning. Developing pathways to achieve that, and integrating relevant connections between academics and the real world, are essential factors in moving classrooms to a college- and career-ready position.

##### **Creating pathways to prosperity**

The [National Career Clusters Framework has developed 16 career clusters](#), which range from finance and manufacturing to health science and information technology. These career clusters represent more than 79 career pathways that can help students successfully navigate their way throughout their college years and/or career trajectories.

The career clusters also serve as a useful guide in developing academic programs that connect secondary and postsecondary curricula, and for creating individual student study plans for a range of career options. The career clusters and their related pathways help students discover their interests and then choose an education path to lead to their success in high school, college and their future careers. For example, the “Manufacturing” cluster contains six pathways, each of which includes a specific Knowledge & Skills Statement (related academic standards) and a study plan with sample courses students should take in high school and beyond to be successful in that pathway.

##### **Implementing key pathways for stronger academic/learning systems**

According to a poll by the nonprofit organization ConnectED, nine out of 10 high school students believe that tying classes to their future and real-world careers would inspire them to work harder in school. Students who complete work-based/project-based learning programs tend to pass high school exit exams at higher rates, are more likely to meet college entrance requirements, and earn higher annual incomes after graduation. (ConnectED, 2012)

Providing that essential combination of content and career-relatedness requires a commitment from both educators and employers. For example, in Carroll County, Ga., a school district-business partnership with Southwire, a major manufacturing company in the region, has resulted in a new school built by the company housed within one of the company's manufacturing facilities. The goal is to reduce the dropout rate and provide students with hands-on experience. Staffed by school district and Southwire employees, the school integrates rigorous classroom academics with hands-on, real-life advanced manufacturing work-based learning. In addition to gaining work experience, skills and their high school diploma, students earn a salary from their time with the company. (Pathways to Prosperity, 2014)

### **Bringing rigor and relevance in today's STEM classrooms**

When it comes to science, technology, engineering and math (STEM), many schools and educators struggle with how best to provide real-world connections for students — how to begin, where to find resources, how to develop lessons, and how to connect to standards. As a result, educators are left hearing the familiar refrain: “Why do I need to study this? When am I ever going to use ratios/geometry/algebra/probability?”

Seeing the need among schools to make STEM, and particularly math, more intriguing and *real* to students, WIN Learning, a software firm focused on career and college readiness initiatives, developed WIN Math: Career-Infused Digital Instruction. WIN Math is an innovative web-based program that provides standards-based, research proven, rigorous project-based learning programs to support 21<sup>st</sup> century college- and career-ready students.

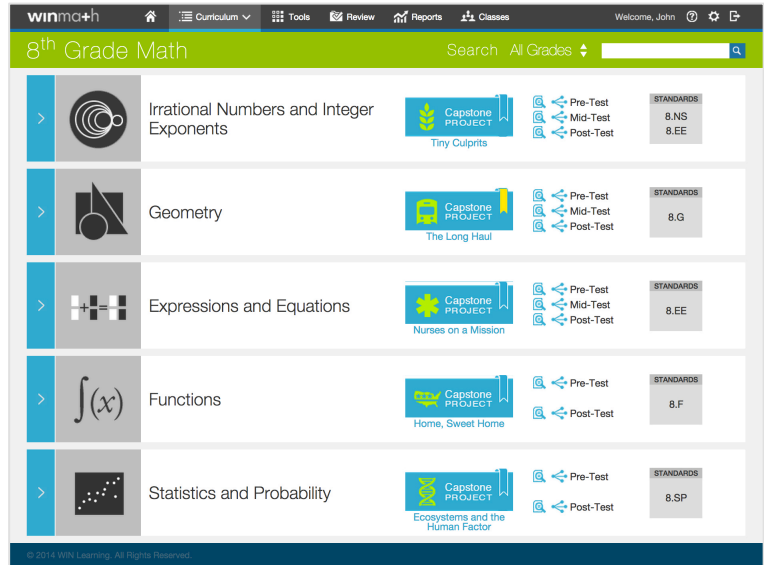
The development team at WIN Learning focused first on mathematics because it is:

- Among the most sought after skills highlighted in labor market analyses of high-demand and high-interest jobs
- A key subject need in the national push to increase STEM learning in U.S. schools to produce more highly qualified employees
- One of the main subjects people will use everyday of their lives regardless of their profession (or because of their profession)

## **V. WIN MATH AND THE RIGOR AND RELEVANCE OF PROJECT-BASED LEARNING**

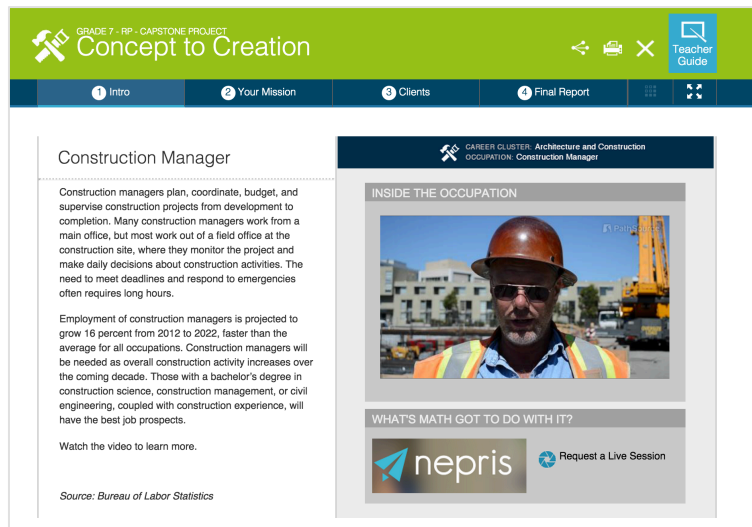
WIN Math uses career-infused math instruction that goes beyond rote learning of facts. It provides the rigor and relevance of Quadrant D from the Rigor/Relevance Framework to make math real and engaging for middle and high school students. It essentially shows students how math fits in to day-to-day jobs from engineering and carpentry to health care, architecture and more.

Each learning module aligns curriculum standards to 16 different career clusters and portrays relevant aspects of each career. The curricula, designed for students in grades 5-8 who are on grade level, or high school students who are below grade level, is organized into 21 units addressing each career cluster with special emphasis on high-demand careers. Working individually and collaboratively, students tackle challenges and produce products, such as marketing plans, presentation reports, or performance charts, all similar to what might be required in a workplace setting.



Using WIN Math, teachers facilitate instruction through a blended learning model, introducing the objective, career context, warm-up, and engagement activities students need to complete the project or lesson. Once finished, students report back their findings, presentations or tasks. Teachers are provided with step-by-step Teacher Guides and lesson planning tools with all the information necessary—from context-related videos and links to approaches for projects—to plan and deliver a lesson in a career context.

For example, if a seventh-grade class is learning ratios, proportions and angles, the teacher can use WIN Math’s lesson on architecture and construction and connect the concept to tasks and knowledge needed in those related fields and within the similarly named career cluster. As part of the lesson, students could visit an architectural firm and construction company. Using the WIN system they can also view one of the career context videos, or conduct a live video feed with real industry professionals about the project and their jobs. They can then tackle a relevant project to develop a blueprint and/or build a staircase for a client.





Doing either of these projects — blueprints or constructing a staircase — requires a number of skills and abilities that fall in Quadrant D learning:

- Working with clients (assessing their needs, asking questions to get all the necessary information, etc.)
- Managing a project (working in a group to solve the problem)
- Using math to complete a task or job (e.g., using angles and ratios, estimation, probability, measuring and calculating weight, height, length, depth, etc.)
- Presenting a project as a group to the client (teamwork and collaboration)
- Thinking through possible hypothetical situations in order to respond to questions

Students are engaged and motivated as they work collectively on their culminating Capstone Project. They are assessed against a rubric that examines each of the 21<sup>st</sup> century skills and abilities mentioned above, in addition to the math concepts the students had to use. In the end, students gain a deeper understanding and appreciation for why they need to learn about angles, probability, etc., and where this may fit into their lives. It would be similar for how proportions and fractions are used in culinary careers; or estimation and algebra in plumbing or carpentry jobs; or inductive and deductive reasoning in economics. The age-old question, “Why do I need to learn this?” is answered in a way that makes sense to students. Every math example, lesson and task is connected to a career that shows how that math is an integral part of the real world of work and students’ career interests.

## VI. CONCLUSION

With ever-changing demands for a 21<sup>st</sup> century workforce, students must be prepared with the skills necessary to compete in a global economy. Exposing middle and high school students (even elementary school students) to careers in a real-life context — and showing them how math is used in these careers— helps them to better grasp the concepts they are learning and recognize the benefits of their course work.

To boost students’ understanding of — and appreciation for — math, they need to see the concepts as they relate to the workplace and to the larger society in which they will live and work. And the sooner students are able to make that connection, the better. Exposing students to careers at the earlier grade levels is key to enhancing a college- and career-ready mindset.

By integrating academic knowledge with technical knowledge to solve real-world problems, students begin to understand the connection between their first period social science class, second period English class, and third period math class. They see how all these areas are interrelated.

As standards are raised to meet the goals of college and career readiness, schools need new tools to align classroom teaching and learning with these rigorous expectations. With an eye on

connecting students' knowledge and skills to jobs of the future, WIN Math engages learners with relevant connections to real-world business and industry skills and recognized career clusters. Math matters, and with WIN Math's step-by-step lesson plans for teachers, career context videos, and its digital learning and teaching platform, students see the connection and in a context that gets them thinking about why their academic work matters to their lives today and to their futures after high school.

**Media Contact:**

Leslie Eicher, APR  
Eicher Communications  
314-965-1776  
Leslie@EicherCommunications.com

**Company Contact:**

John Costilla, VP Marketing & Business Development  
WIN Learning  
940-312-3867  
JCostilla@WINLearning.com



## REFERENCES

International Center for Leadership in Education: <http://www.leadered.com/index.php>

National Association of State Directors of Career Technical Education Consortium (NASDCTEc): <http://www.careertech.org/career-clusters>

Redefining College and Career Readiness for the 21<sup>st</sup> Century, Bill Daggett, Ed.D. (June 2013)

Council on Foreign Relations Task Force Report, "U.S. Education and National Security" (2012): [www.cfr.org/united-states/us-education-reform-national-security/p27618](http://www.cfr.org/united-states/us-education-reform-national-security/p27618)

Tips for Using Rigor and Relevance Tips for Using Rigor, Relevance and Relationships to Improve Student Achievement: [http://www.education.com/reference/article/Ref\\_Rigor\\_Relevance/](http://www.education.com/reference/article/Ref_Rigor_Relevance/) (Initially published by the American Association of School Administrators)

National Center for Public Policy and Higher Education (NCPPE) & Southern Regional Education Board (SREB). Beyond The Rhetoric: Improving College Readiness Through Coherent State Policy, 2010

College and Career Readiness: What Do We Mean?, ConnectED (April 2012)

The Pathways to Prosperity Network: A State Progress Report, 2012-2014. (2014)

The Evolving Career Readiness Landscape: Factors Leading to Successful Outcomes, Jan Bray, Bray Strategies

Career Ready: Redefining Rigor and Relevance, William Daggett, 2012

Final Report of the New Jersey Department of Education College And Career Readiness Task Force, April 2012

It Takes A Whole Society: Opening Up The Learning Landscape In The High School Years. Nellie Mae Education Foundation, 2012

Career-Ready Schools: What Are They Doing Differently?, Bill Daggett, Ed.D., 2012

"Making STEM Real", Gary Hoachlander and Dave Yanofsky, *Educational Leadership*, March 2011 (Vol. 68, No. 6)