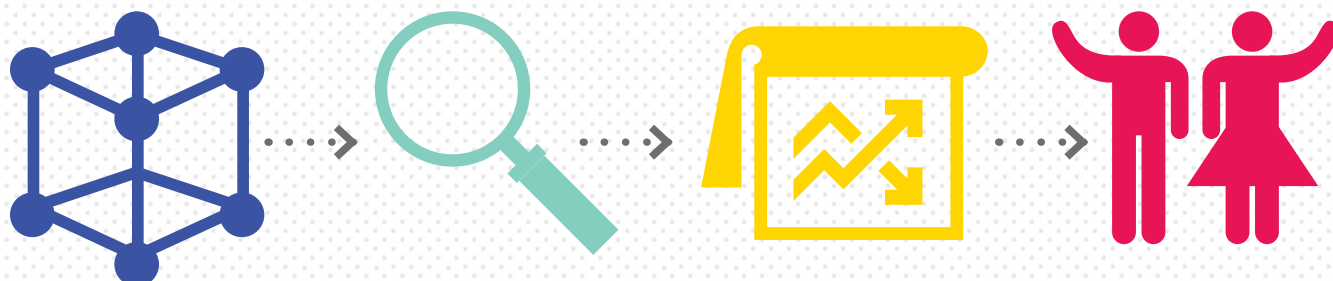


The New York Academy of Sciences

EDUCATION STANDARDS





Education of its current and future members is core to the mission of the Academy and in 2010, the Academy launched its education department with the mission to identify and facilitate ways in which its members could engage with the K12 education system.

In order to meet this mission, the Academy needed to create programs that could work in both formal and informal classrooms, with academic and industry professionals and an eye towards content that would engage and excited students but also prepare them for the world of work.

Most importantly, we needed a research -based document that would guide training and curriculum designers for the Afterschool STEM Mentoring Program as we studied how to scale it up to different locations and learning environments. In 2012, the State University of New York (SUNY) and the Academy received a 3-year grant from the National Science Foundation (DRL 1223303) to scale the program to six sites across New York State. This document has served as a framework for curricular choices to best serve the high poverty urban and rural students, anchored our training protocols for the scientists who would serve as mentors and provided guidance to school and out of school time program administrators that our

choices aligned with theirs for student achievement.

This document includes an overview of how we, in conjunction with Dr. Mary Beth Murray Wilson, created the standards, an overview of the six core competencies we identified, an annotated bibliography and the STEM readiness checklist to help choose curriculum that help students be successful in the 21st century.

The New York Academy of Sciences Education Standards can help program designers in formal and informal education settings compare their materials to the expectations of schools, universities and employers. We've distilled these expectations down to a simple STEM Readiness checklist for quick reference and use. This checklist can be used as an evaluation rubric when choosing materials or as a conversation starter with stakeholders. The Standards themselves provide significant detail and background research on the items in the checklist.

Competencies

COMPETENCIES	PERFORMANCE INDICATOR(S) Academy program participants will:
 SOCIAL COMPETENCY Social Competency is broadly defined as the ability to interact successfully with others.	• Students should work collaboratively and learn how to play different roles within a team • Students should be able to lead a team • Students should be able to work independently • Students should be able to work with and disagree with people who are different than they are and be able to provide and take constructive feedback • Students should be able to resolve conflict
 CRITICAL COMPETENCY Critical Competency has at its core critical thinking and other habits of mind.	• Students should be able to use multiple methods of solving problems with emphasis on novel techniques including the scientific method, computational thinking and design thinking • Students should understand what makes good science and compare and debate scientific claims • Students should be able to evaluate information from different sources • Students should be able to reflect upon their work and path • Students should recognize that there are barriers to success in STEM and be prepared with strategies to overcome them
 GLOBAL COMPETENCY Global Competency outlines a vision for global citizenship and interactions.	• Students should approach the world with an ethical framework • Students should see STEM as a force for good in the world, be driven by a sense of mission and find joy in their work • Students should be able to operate in multiple settings: (Work, academic, peer) and learn in different settings (in school and out) • Students should have an actionable intergenerational network
 CREATIVE COMPETENCY Creative Competency describes the way an individual explores and manages ideas.	• Students should be able to plan, manage, and execute a project (define goals, benchmarks, organize ideas and solutions) • Students should be able to define a scientific question and design and conduct a research project • Students should have executive function capabilities (risk assessment, time management) • Students should be able to demonstrate scientific imagination
 CONTENT/EXPERT COMPETENCY Content/Expert Competency includes acquisition of proficiency in a domain.	• Students should have a passion for STEM and identify an area of interest that they would like to learn more about • Students should be able to connect problems and solutions to a personal, local, and global context • Students should be able to perform a set of technical skills safely • Students should have a specific set of content knowledge in the STEM fields as defined by local, state and national standards • Students should be able to advise others on a STEM path and recognize their role as a STEM Ambassador
 COMMUNICATION COMPETENCY Communication Competency describes an individual's ability to transmit ideas.	• Students should have be able to use technology to enhance their work • Students should speak and write the language of STEM • Students should be able to communicate to different audiences • Students should communicate in multiple modalities about their own research and the nature of science

Summary

The New York Academy of Science Education Standards (NYASES) are an Academy-wide set of standards developed in partnership with Dr. Mary Elizabeth Wilson, EDU., Inc, to underlie all of the Academy's education programs. Their intended use is to: ground curricular conversations and decision-making, establish common language and ways to talk about Education across the Academy's constituents, and plan for and create curricular resources, evaluation instruments, and a badging system. The Academy's Standards are a deliverable for National Science Foundation Grant (DRL1223303).

Standards Development

Every school district has their own standards that are informed by local, state, national — and often international standards for content, skills, and processes that guide teaching and learning. To inform the development of the Academy's Standards, EDU, Inc. began with the Academy's "local" standards as defined by the Academy's Core Values, Mission, and current program/course offerings. The Academy's Core Values, emphasize creating links between science and society through its rich history of building new scientific communities, constructing innovative connections among an extensive scientific network, and driving path-breaking initiatives for scientific, social, and economic benefit. The Academy's three-pronged mission articulates its charge: to advance scientific research and knowledge, to help resolve the major global challenges facing society with science-based solutions, and to increase the number of scientifically informed individuals. The Academy's Core Values and Mission are realized through its many education programs.

Close examination of language used by the Academy to describe its many learning experiences for children, young adult, and adult learners guided the overall structure of the Academy's Standards to: Explore. Develop. Apply. Lead. Excerpts from Academy-provided learning experiences include: "...connection between science education and solving worldwide issues"; "...science, technology, engineering, and math (STEM)- literate citizens will shape the future of global progress and security" (Global); "provides career advice and opportunities to network and interact with investigators across many institutions and disciplines" (Social); "...including working across disciplines, learning to communicate the value of one's work to diverse audiences" (Communicative); "next generation of innovators" (Creative); and "expertise

in fields ranging from education and social science to neuroscience, neurobiology, and biotechnology" (Content). The Academy's equivalent of "local" standards are further defined in current program/course offerings descriptions. Through this analysis, five competencies (standards) were identified: Social Competency, Communicative Competency, Creative Competency, Global Competency and Content Competency. These competencies are supported by the related literature, existing standards documents, and further clarified by high frequency terminology used in the Academy's descriptions of its programs including: apply, develop, network, interact, explore, create, reflect, connect, design, observe, teamwork, think, discovery, innovation, research, and inspire. After consulting the Common Core State Standards (CCSS), the Buck Institute for Education's Standards for Problem Based Learning, the Next Generation Science Standards, Bloom's Taxonomy, Webb's Depth of Knowledge (DoK), BSCS, the Center for Professional Education for Teachers (ESPET) Global Capacities Framework, The American Association of Colleges and Universities, Harvard's Project Zero Agency by Design, and New York, New Jersey and Maryland respective state department of education standards, and others (see annotated bibliography) a sixth competency, Critical Competency, was added.

The language and structure of the Academy's Education Standards follow those identified and reviewed from available standards. The Academy's language and structure three components: *Competency* (the summary topic), *Attributes/Elements* (components of the competency) and *Performance Indicators* (statements of what participants will know and/or do).

New York Academy of Sciences Education Standards

Program Standards Matrix

DEVELOP	EXPLORE		APPLY		LEAD
					
SOCIAL COMPETENCY	CRITICAL COMPETENCY	CREATIVE COMPETENCY	GLOBAL COMPETENCY	COMMUNICATIVE COMPETENCY	CONTENT COMPETENCY
INTERACT	REFLECT	INQUIRE/ QUESTION	SOLVE REAL WORLD PROBLEMS	PUBLISH	UNDERSTAND
COLLABORATE	INTERPRET	DESIGN	ENGAGE IN GLOBAL ISSUES	FOCUS	REMEMBER
FLEX	ANALYZE	IMAGINE	ENGAGE IN MULTIPLE PERSPECTIVES	PRESENT	RECOGNIZE
NETWORK	SYNTHESIZE	TOLERATE AMBIGUITY	WORK ACROSS DOMAINS	EXPRESS	INFLUENCE
PERSONAL	EVALUATE				INNOVATE
INTRA/ INTERPERSONAL					



Social Competency

Social Competency, a critical aspect of development, is broadly defined as the ability to interact successfully with peers and adults realizing that the specific skills, nuances or behaviors associated with social competence vary from one social context to another.

Generally, socially competent individuals: are knowledgeable of social expectations, roles, and routines across social contexts (school, home, groups or gatherings); interpret others' behavior(s) and "read" others' emotions and adjust their own behaviors in response; they "tune in" and can "take on" others' emotions and behaviors (empathy); and demonstrate the necessary confidence to interact socially and accept the risk of possible rejection. *Social Competency* is used in the NYAS' Education Standards rather than the more commonly used term "social skills";

because, in order to demonstrate social competence, the individual must assess the social context of the specific situation and consider the perspectives of others before taking action. Whereas "skills" suggests discrete actions/ behaviors associated successful social interaction. "Skills" do not include awareness of context-specific nuances or adjustments for decision-making. An individual may possess the skills (behaviors), but not recognize and know how to apply them in an appropriate way. *Social Competency* develops with practice in authentic social decision-making contexts. The NYASES include a central set of six attributes to describe Social Competency as realized through the Academy's many learning opportunities, they include: *Interact, Collaborate, Flex, Network, Personal* and *Intra/Interpersonal*.

ATTRIBUTE (Element)	PERFORMANCE INDICATOR(S) Academy program participants will:
INTERACT	Talk/communicate with other people in turn and have an effect on each other.
COLLABORATE	Engage another person or group in order to achieve or do something together; listen and work effectively and respectfully in a diverse group; share goals and accept responsibility for group work; value contributions from each group member; and match tasks to each group member's strength/ability.
FLEX	Demonstrate their ability to negotiate and compromise to realize shared goals; design and redesign solutions through debate, disagreement, discussion, and research.
NETWORK	Establish connections between group members, organizations, mentors, and scientists to advance individual and group ideas and opportunities.
PERSONAL	"Try on" and explore different group roles (leader/follower) and responsibilities; integrate individual experiences, and share personal understanding and resources with group members to inform decision-making.
INTRA/INTERPERSONAL	Aware and able to manage self (emotions, strengths, and targets for growth) during face-to-face, hybrid and virtual interactions; understand and positively manage the emotions of others in both face-to-face hybrid and virtual environments; invite others to share their strengths and abilities; and manage conflict effectively.



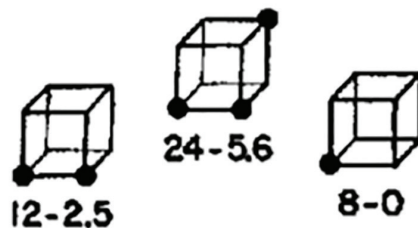
Critical Competency

NYASES' *Critical Competency*, has at its core *Critical Thinking*, a habit of mind, characterized by comprehensive exploration and analysis of ideas prior to developing or adopting an opinion or drawing a conclusion. *Critical Competency* can be demonstrated through analysis, the breakdown of complex topics, concepts or issues into component parts, to gain a better understanding, prior to

evaluating and synthesizing information from texts, data, and other sources. *Critical Competency* invites participants to reflect on their thinking, engage in metacognition, and make sense of their learning experiences. *Critical Competency* includes opportunities to: *Reflect, Interpret, Analyze, Synthesize* and *Evaluate*.

Reflect, Interpret, Analyze, Synthesize, Evaluate

ATTRIBUTE (Element)	PERFORMANCE INDICATOR(S)
	Academy program participants will:
REFLECT	Think about thinking to reconsider, determine and maximize cognitive function using varied tools, techniques and strategies.
INTERPRET	Explain the meaning of ideas through accurate use of understandable and appropriate terminology, models, or images.
ANALYZE	Deconstruct an idea, question, data or problem into parts using appropriate strategies, data sources, comparable examples, underlying assumptions, and supporting evidence to derive meaning.
SYNTHESIZE	Demonstrate flexibility in integrating personal and multi source information to construct new/combined knowledge.
EVALUATE	Make judgments and decisions based on credibility, accuracy, and possible bias of ideas, texts and methods used, and cite evidence to discriminate and filter information and support/justify conclusions.

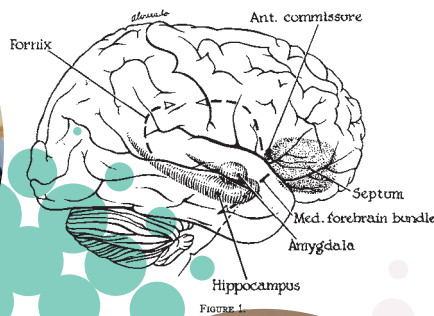


Creative Competency

Creative Competency describes the ways individuals explore, combine and synthesize ideas, images, or expertise in new ways. Characterized by innovative, inventive, divergent thinking, and risk taking, *Creative Competency* becomes increasingly robust in tandem with the individual's deepening foundational knowledge of content/domains.

At the highest levels of *Creative Competency*, individuals push boundaries in new ways as they explore, design and imagine atypical approaches to solutions. *Creative Competency* includes opportunities to: *Inquire/Question*, *Design*, *Imagine*, and *Tolerate Ambiguity*.

ATTRIBUTE (Element)	PERFORMANCE INDICATOR(S)
	Academy program participants will:
INQUIRE/QUESTION	Ask varied and well-defined questions driven by observation, curiosity, and application of theories/models to probe and clarify varied perspectives leading to better solutions to new and existing problems.
DESIGN	Construct purposeful models, prototypes and plans using a range of tools, methods and information in response to identified needs.
IMAGINE	Propose a range of possibilities, visualize new directions/approaches (including alternate, divergent, and contradictory ideas) to problem solve; "see," represent, or describe a problem or challenge in different ways.
TOLERATE AMBIGUITY	Explore new possibilities for approaching vaguely defined or unfamiliar problems with the potential for multiple solutions; embrace changing conditions or situations.



Global Competency

The NYAS' *Global Competency* outlines a vision for global citizenship and related attributes young people need to thrive in today's world and that of the future. Global Competency includes the following attributes: *Solve Real World Problems*, *Engage in Global Issues*, *Engage in Multiple Perspectives*, and *Work Across Domains*. *Global Competency* leads to developing informed and responsible people who view themselves as members of a world-wide community, embrace diversity, seek to understand the impact of their actions on global communities, and address the world's most pressing issues collaboratively and through varied perspectives.

Global Competency, based on the principle that the world is a collection of complex and interdependent systems, when coupled with the Academy's learning opportunities assist youths in expanding their knowledge of natural, physical, social, scientific, cultural, economic, and political systems, promoting sustainability and development to advance equity. *Global Competency* cannot be achieved in a single learning experience, rather it is acquired cumulatively across participation in varied opportunities.

ATTRIBUTE (Element)	PERFORMANCE INDICATOR(S) Academy program participants will:
SOLVE REAL WORLD PROBLEMS	Understand the complex issues and implications of a real-world problems, including those caused as a result of human interaction with the environment, and work to gather, synthesize and apply knowledge to provide alternative solutions.
ENGAGE IN GLOBAL ISSUES	Own and manage personal responsibility as a citizen of the world and actively seeks to understanding of how one's actions have global impact.
ENGAGE IN MULTIPLE PERSPECTIVES	Develop the capacity to consider multiple perspectives and experiences different from one's own to understand how one's place in the world both informs and potentially limits one's world view (alternate theories, possibilities, bias, etc.); demonstrate empathy and "try-on" and approximate the experiences of others; examine issues/circumstances in today's world from varied perspectives (Western and non-Western perspective).
WORK ACROSS DOMAINS	Demonstrate ecological knowledge and understanding of natural systems and their interface with social systems; analyze and show understanding of the integral relationships between ethical, economic, political/government systems, scientific and cultural issues, beliefs and values of world cultures affecting the world and their implications for life.

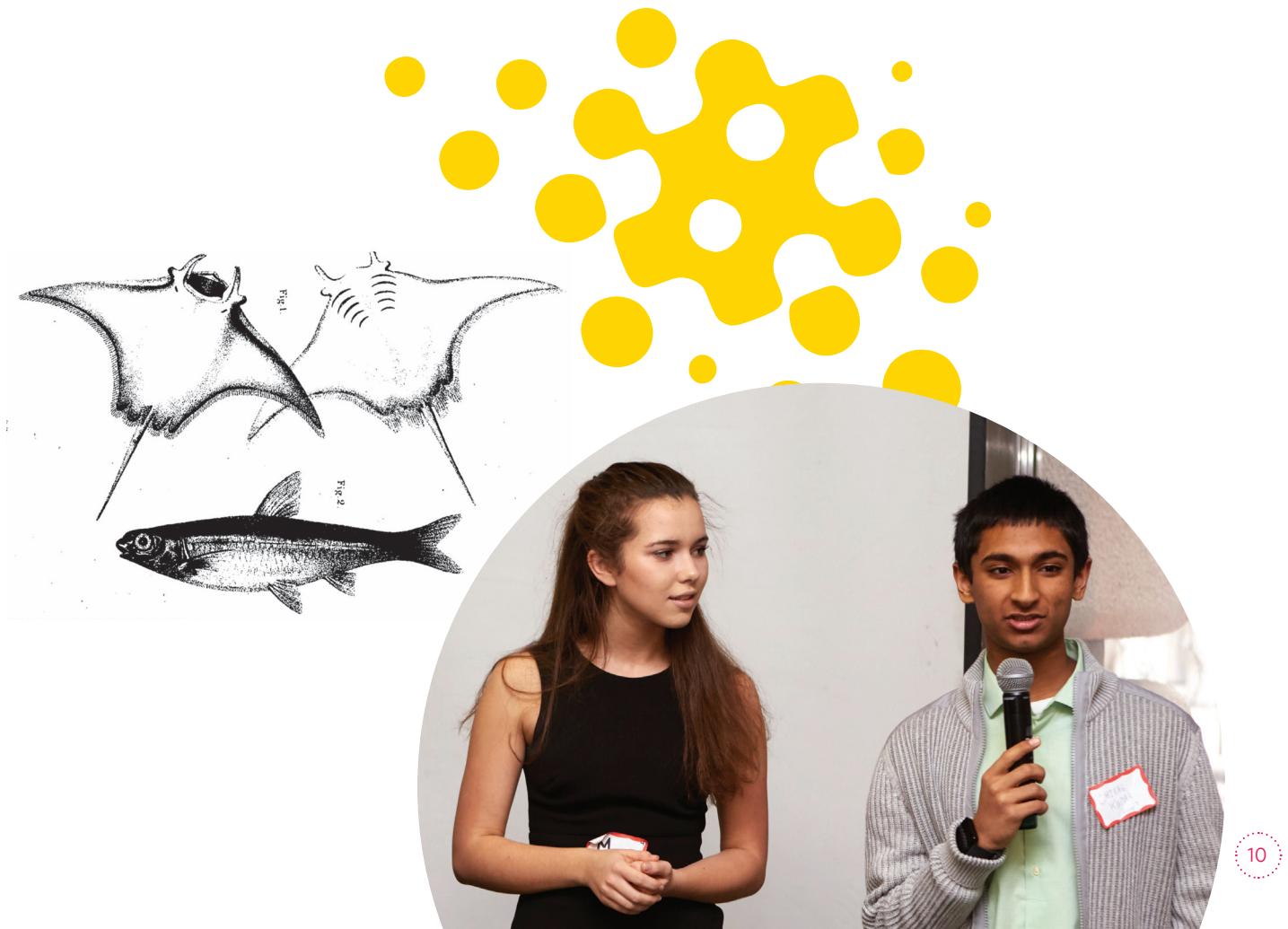


Communicative Competency

Communicative Competency outlines the processes (publish, present, etc.) and vehicles (oral, written, non-verbal) frequently used to transfer and receive ideas from one another. Individuals will consider and select media to share content and information (i.e. selecting to publish a white

paper or to produce a video). *Communicative Competency* expects the individual to know and understand ideas, concepts and content deeply in order to engage and impact other's interpretation and meaning making through the following attributes: *Publish, Focus, Present, and Express*.

ATTRIBUTE (Element)	PERFORMANCE INDICATOR(S) Academy program participants will:
PUBLISH	Communicate fluently through a range of media to enhance and share content.
FOCUS	Review and select media appropriate for content and purpose (teach, influence, model, clarify, etc.).
PRESENT	Know their audience and deliver meaningful information in interactive ways to impact target readers/viewers/listeners.
EXPRESS	Listen, speak, read, and write effectively to communicate ideas; engage in "give and take" to share ideas and consider others' perspectives.



Content/Expert Competency

Content/Expert Competency promotes the individual's acquisition of proficiency leading to expertise in science content through engagement in each of the The National Research Council's (NRC) three dimensions of science: *Practice*, *Cross-Cutting Concepts*, and *Disciplinary Core Ideas*. The Practice of science is seen across NYAS' Education Standards, for example, NRC's *Practice Dimension* describes ways in which scientists investigate through inquiry, modeling, and develop explanations to explore and understand scientific theory. NRC's *Cross-Cutting Concepts* are those ideas that transcend content and are applicable across the sciences and best realized through interdisciplinary learning. Examples include: systems, patterns, scale, organization, structure function, etc. *Cross-Cutting Concepts* provide scaffolding on which science content is hung. *Disciplinary Core Ideas* are the most essential ideas in science. As per NRC's guidelines, *Disciplinary Core Ideas* are those ideas that are a key organizing concept such as evolution or change over time as seen in biology; provide a lens, access or management strategy for understanding ideas of increasing complexity;

provide meaningful context and/or direct application relevancy to students' lives; and can be taught, understood and learned over time with increasing depth, detail and complexity. *Disciplinary Core Ideas* are distributed across common divisions/descriptors of the sciences: *physical*, *life*, *earth and space*, and *applied* (engineering, technology, etc.). *Cross-Cutting Concepts* and *Disciplinary Core Ideas* are captured in NYASES' Content/Expert Competency.

NYASES' Content/Expert Competency reflects NRC's four science domains (*physical*, *life*, *earth and space*, and *applied*) and promotes individuals' abilities to integrate and apply their learning across the sciences, over time and across contexts (school, home, informal, community, etc.) in novel and unscripted ways as they seek to *Understand*, *Remember*, *Recognize*, *Influence* and *Innovate*. To fully realize the NYASES, individuals will access, engage in, and demonstrate Content/Expert Competency via NYAS' Competencies (*Social*, *Critical*, *Creative*, *Global* and *Communicative*). Content/Expert Competency includes opportunities to demonstrate their ability to : *Understand*, *Remember*, *Recognize*, *Influence*, and *Innovate*.

ATTRIBUTE (Element)	PERFORMANCE INDICATOR(S)
	Academy program participants will:
UNDERSTAND	As determined by content-specific (<i>physical</i> , <i>life</i> , <i>earth & space</i> , and <i>applied sciences</i>): <i>practices</i> , <i>crosscutting concepts</i> , <i>content-specific expectations</i> , and <i>meaningful applications</i> as aligned to NGSS.
REMEMBER	As determined by content-specific (<i>physical</i> , <i>life</i> , <i>earth & space</i> , and <i>applied sciences</i>): <i>practices</i> , <i>crosscutting concepts</i> , <i>content-specific expectations</i> , and <i>meaningful applications</i> as aligned to NGSS.
RECOGNIZE	As determined by content-specific (<i>physical</i> , <i>life</i> , <i>earth & space</i> , and <i>applied sciences</i>): <i>practices</i> , <i>crosscutting concepts</i> , <i>content-specific expectations</i> , and <i>meaningful applications</i> as aligned to NGSS.
INFLUENCE	As determined by content-specific (<i>physical</i> , <i>life</i> , <i>earth & space</i> , and <i>applied sciences</i>): <i>practices</i> , <i>crosscutting concepts</i> , <i>content-specific expectations</i> , and <i>meaningful applications</i> as aligned to NGSS.
INNOVATE	As determined by content-specific (<i>physical</i> , <i>life</i> , <i>earth & space</i> , and <i>applied sciences</i>): <i>practices</i> , <i>crosscutting concepts</i> , <i>content-specific expectations</i> , and <i>meaningful applications</i> as aligned to NGSS.

NYAS Badging System

SOCIAL COMPETENCY	CRITICAL COMPETENCY	CREATIVE COMPETENCY	GLOBAL COMPETENCY	COMMUNICATIVE COMPETENCY	CONTENT COMPETENCY
NETWORKER	OBSERVER	GENERATOR	PROBLEM SOLVER	PRESENTER	STEMIST
TEAM BUILDER	REFLECTOR	CREATOR	TRANS-DISCIPLINIST	PUBLISHER	PHYSICIST
LEADER	MEANING MAKER	IDEA-IST	HUMAN GEOGRAPHER	GRAPHICS SPECIALIST	BIO-MEDICAL SPECIALIST
MENTOR	ANALYST	ENTREPRENEUR	AMBASSADOR	MEDIA SPECIALIST	ANTHROPOLOGIST
INFLUENCER	SYNTHESIZER	DESIGNER		BLOGGER	BIOLOGIST
	CRITICAL THINKER	HYPOTHESIZER		TWEETER	CHEMIST
	DATA COLLECTOR	MAKER			EARTH SCIENTIST
		CREATIVE THINKER			
		INNOVATOR			



Annotated Bibliography

AAAS (1989). *Science for All Americans: a Project 2061 Report*. American Association for the Advancement of Science. Washington, D.C.: AAAS.

Project 2061 posed several essential questions: *What scientific and technological changes will they also see in their lifetime? How can today's education prepare them to make sense of how the world works; to think critically and independently; and to lead interesting, responsible, and productive lives in a culture increasingly shaped by science and technology?* Designed to explore what is important for our next generation to know, understand and be able to do, expert scientists, mathematicians, and technologists defined science literacy and provided guidelines for effective teaching and learning that were integrated in AAAS' publication, *Science for All Americans* (1989).

Project 2061 defines science literacy and emphasizes connections across the sciences, math, and technology and includes specific recommendations for teaching and learning in content specific areas including: the *Nature of Science* (scientific world view, scientific inquiry); the *Nature of Mathematics* (theoretical and applied mathematics); the *Nature of Technology* (impact of technology, its limitations and benefits); the *Physical Setting* (macro and micro exploration of the universe); the *Living Environment* (facts and ideas about how living things function and how they interact with one another and their environment); the *Human Organism* (human biology and biological systems); *Human Society* (individual and group behavior, social organizations, and change); the *Designed World* (how people shape and control the world through technology); the *Mathematical World* (basic mathematical ideas and practical applications); *Historical Perspectives* (examples of exceptional significance in the development of science); *Common Themes* (general concepts, systems and models, that cut across STEM disciplines); *Habits of Mind* (ways of thinking critical to science literacy); and recommendations for effective curriculum and pedagogy.

AAAS (1993). *Benchmarks for Science Literacy*, New York, NY: Oxford University Press. Bell, P., Bricker, L., Tzou, Carrie, Lee, T., and Van Horne, K. (2012). Exploring the science framework; Engaging learners in science practices related to obtaining, evaluating, and communicating information. *Science Scope*, 36(3), 18-22.

Benchmarks for Science Literacy helps educators with sequencing of specific learning goals to develop a meaningful core curriculum leading to basic science literacy as outlined in *Science for All Americans*. *Benchmarks* does not specify any one pedagogical/curricular approach, rather it encourages greater curriculum diversity and guides educators as they re-examine their curriculum.

Association of American Colleges and Universities VALUE Rubrics
Teams of experts from colleges and universities across the US process examined existing higher ed rubrics that identified and described learning outcomes for undergraduate students. The resultant VALUE rubrics were drafted and vetted by higher ed faculty and are intended to be customized by each institution to guide student learning. The VALUE rubrics are fifteen rubrics divided into three categories: Intellectual and Practical Skills (*Inquiry and Analysis, Critical Thinking, Creative Thinking, Written Communication, Oral Communication, Reading, Quantitative Literacy, Information Literacy, Teamwork and Problem Solving*); Personal and Social Responsibility (*Civic Engagement - Local and Global, Intellectual Knowledge and Competence, Ethical Reasoning, Foundations and Skills for Lifelong Learning, and Global Learning*); and Integrative and Applied Learning (*Integrative Learning*).

Bloom's Taxonomy (Bloom's Cognitive Process Dimensions) A Taxonomy for Learning, Research, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives, eds, Lorin Anderson, David Krathwohl, with Peter Airasian [et. al.] ISBN: 0-8013-1903-X

Bloom's Taxonomy, created in 1956 by educational psychologist Dr Benjamin Bloom, promotes higher levels of thinking in education/schools including: analyzing and evaluating in favor of rote learning. Bloom's taxonomy includes three learning domains: *Cognitive* (mental skills; knowledge); *Affective* (feeling, emotion, attitude or self); and *Psychomotor* (manual/physical skills).

Buck Institute for Problem-based Learning PBL and Common Core—and Next Generation Science Standards (Excerpted from the book PBL for 21st Century Success: Teaching Critical Linking, Collaboration, Communication, and Creativity, published by the Buck Institute for Education, 2013).

The Buck Institute for Education (BIE)'s primary mission is to assist teachers as they prepare today's students for successful lives tomorrow. BIE does this through Project Based Learning (PBL) an effective, enjoyable and research-based way to expand learning and master competencies necessary for success in college, career and civic life. PBL is a pedagogical approach where students acquire knowledge and skills by working for an extended time to understand, investigate and respond to complex questions, problems, or challenges. PBL includes opportunities for students to engage in *Significant Content* (important knowledge and skills, informed by standards and key concepts in core content areas); *21st century competencies* (students build competencies applicable to today's world: problem solving, critical thinking, collaboration, communication, and creativity/innovation); *In-Depth Inquiry* (extended, rigorous process of asking questions, using resources, and developing answers); *Driving Question* (open-ended question that appeal to students and frame their exploration); *Need to Know* (gain knowledge, understand concepts, and apply skills in order to answer the Driving Question and create project products); *Voice and Choice* (students make some choices about the products to be created); *Critique and Revision* (includes processes and opportunities for students to give and receive feedback about their work, leading to revision and further inquiry); and *Public Audience* (students present their work to people beyond their classmates/ teacher).

Duke University Global Learning Value Rubric. The AAC&U's global learning Network for Academic Renewal Conference articulates a vision for college-level global learners and the cross-cutting capacities students need to acquire to thrive now and in the future. This vision is captured in a series of rubrics; each capacity is represented by its own rubric and includes global learning outcomes evaluative description across the continuum. The rubrics are designed and used to inform the development of educational opportunities under the banner of *global learning*. Through global learning, students will: "*become informed, open-minded, and responsible people attentive to diversity across the spectrum of differences; seek to understand how their actions affect both local and global communities; and address the world's most pressing and enduring issues collaboratively and equitably.*"

Edmodo Badging Systems

Edmodo provides a badging feature in its open source learning platform that allow educators to incentivize student learning by recognizing their achievements, completion of tasks, acquisition of knowledge, and demonstration of skills.

Future Work Skills 2020

Institute or the Future for Apollo Research Institute ©2011 Institute for the Future for Apollo Research Institute. All rights reserved.

Heidi Hayes Jacobs, Curriculum 21: Essential Education for a Changing World Association for Supervision and Curriculum Development, 2010 - Education - 251 pages

Dr. Jacob leverages her expertise in K-12 curriculum design and builds a compelling rationale for schools to refocus and commit to their essential role: to prepare student to be successful in the world. To do this, Jacobs proposes an overall to K-12 education that calls for overhauled and updated curriculum as the vehicle including: what changes need to be made to reflect new technologies and a globalized world; where portfolios and new kinds of assessments fit into accountability mandates; how to improve the use of instructional time and the formation of instructional groups; how to cultivate students' global perspective; and how to improve students' media literacy.

Harvard Project Zero

Project Zero, founded by Nelson Goodman at the Harvard Graduate School of Education (HGSE), to study, understand and improve arts education. Now extending beyond arts education, to include emphasize on visible thinking, content learning, reasoning, creativity, selfmanagement, decision making and frameworks for how to create "cultures of thinking" in classrooms and entire school..

Institute for Museums and Library Services

Lee, O., Quinn, H., & Valdés, G. (2013). Science and language for English language learners in relation to Next Generation Science Standards and with implications for Common Core State Standards for English language arts and mathematics. Educational Researcher, 42(4), 223-23.

Learning Times

Learning occurs across setting. Where, when, how and why we learn are rapidly changing. Badging pulls varied learning experiences together allows for acknowledgment of learning/achievement and application beyond the specific learning setting.

Maryland STEM Standards

Massachusetts Department of Education

Massachusetts Department of Education Science and Engineering Practices Progression Matrix!

New Canaan Public Schools

SAPL Program (Social, Academic and Personal Learning Tools)

New York State Education Dept.

Norwalk Schools Rubric for Global Awareness

The Next Generation Science Standards (NGSS)
NGSS Appendix F

NRC (2012). A Framework for K-12 Science Education: Practices, Core Ideas, and Cros-Cutting Concepts. Washington, DC: National Academy Press. concepts, and core ideas. Washington, DC: The National Academies Press.

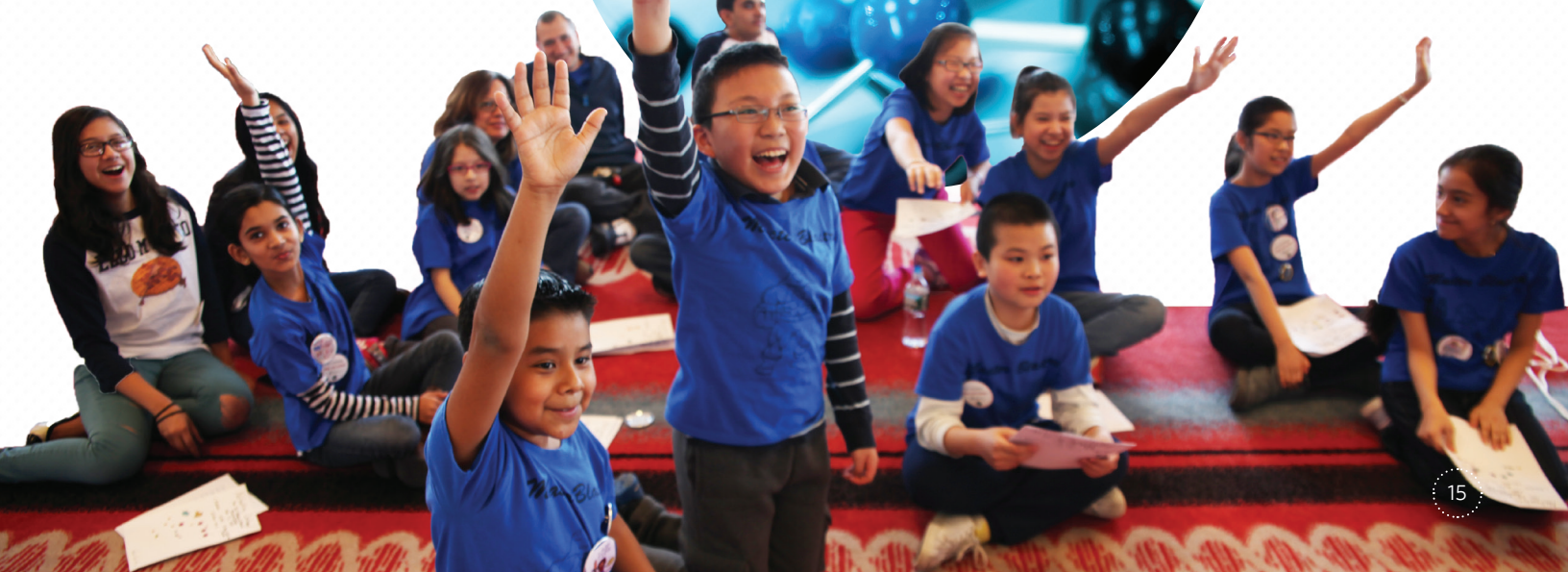
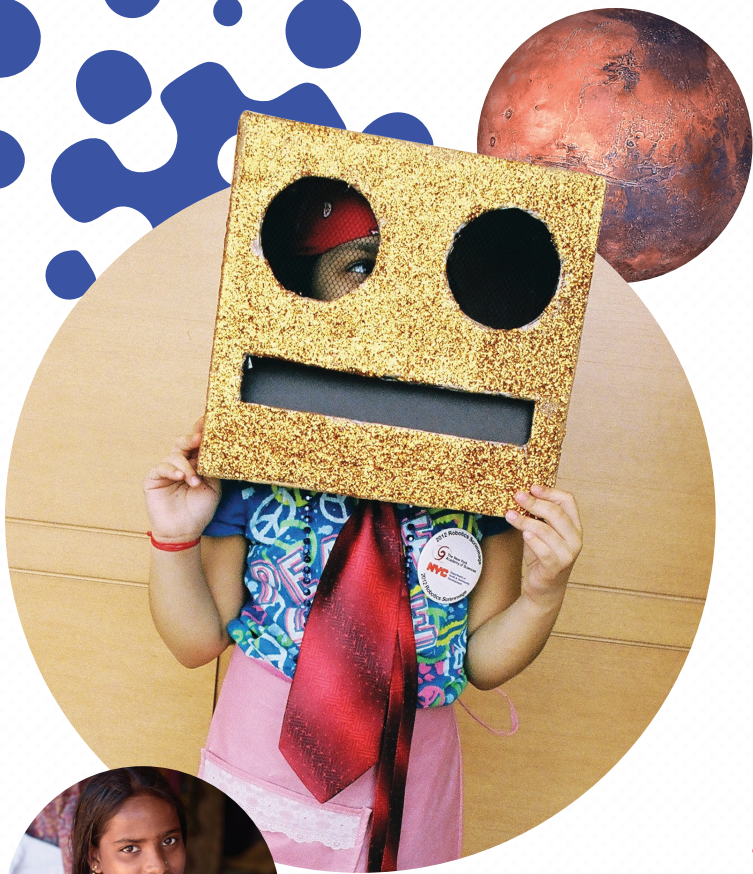
NRC (1996). National science education standards. Washington DC: National Academy Press.

Richard Paul and Linda Elder, The Miniature Guide to Critical Thinking Concepts and Tools, Foundation for Critical Thinking Press, 2008

SEI Global Capacities Framework: Studies in Educational Innovation @ TC, Columbia University

Webb's Depth of Knowledge (DoK) Webb's Depth of Knowledge (DOK) provides a vocabulary and a frame of reference when thinking about students and how they engage with content. DOK offers a common language to describe "rigor" in assessments, curriculum, and learning activities. Webb developed four DoK levels that grow in cognitive complexity and provide educators with guidance to elevate learning expectations.

Weston Public Schools 21 Century Skills Rubric



THE GLOBAL STEM ALLIANCE

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The Afterschool STEM Mentoring Program is supported in part by the National Science Foundation (DRL-1223303) and (DRL 1440869).

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