S²TEM Centers SC

Solutions in Science, Technology, Engineering & Mathematics Education

S²TEM SC Innovation Configuration (IC) Map

Total Instructional Focus: Curriculum, Assessment, and Instruction

Table of Contents

White Paper: Curriculum, Assessment, and Instruction

STEM curriculum, assessment, and instruction promote STEM literacy, are aligned with state standards, integrate disciplines, incorporate world class skills, and provide the foundation for civic responsibility. Included are the knowledge and skills that students are to learn, the instructional practices used to teach, and the approaches to assessment of the knowledge and skills.

A goal for STEM schools is to develop STEM literate individuals. Experiences that lead to STEM literacy enable students to address problems and challenges blending world class skills with integrated academic concepts and content practices. In *The Case for STEM Education, Roger Bybee* explains STEM literacy as an "individual's -

- knowledge, attitudes, and skills to identify questions and problems in life situations, explain the natural and designed world, and draw evidence-based conclusions about STEM-related issues;
- understanding of the characteristic features of STEM disciplines as forms of human knowledge, inquiry, and design;
- awareness of how STEM disciplines shape our material, intellectual, and cultural environments; and
- willingness to engage in STEM-related issues and with the ideas of science, technology, engineering, and mathematics as a constructive, concerned, and reflective citizen."

A viable STEM curriculum is based on state-adopted content standards. It is guided by research on how students learn and what they are able to learn at different levels of their cognitive development.

Theory In Action – Teachers design integrated forces and motion unit

Standards-based STEM curriculum is comprehensive, cohesive and connected across and within subjects and grade levels. Instruction and assessment practices support the content standards. Vertical alignment across grade levels identifies and eliminates gaps and overlaps in the curriculum. For example, within a district, all teachers of science K-12 may collaborate to see that all standards and concepts are taught and assessed at the appropriate level of rigor, ensuring prerequisite skills are addressed. This vertical process encourages learning that builds from grade to grade.

On the other hand, horizontal alignment occurs when teachers within the same subject have a clear understanding of what they must teach at their grade level, what students need to know, what students need to be able to do for that subject. Horizontal alignment ensures consistency of the knowledge and skills students possess as they move from one grade to the next. The implementation of a viable, aligned curriculum is essential to acquiring the knowledge and skills students need to experience success in STEM at each subsequent grade level.

Integrated, Real World

Teaching and learning with an integrated perspective mirrors the world of work where solutions require skills and knowledge from multiple disciplines. In their book, *Meeting Standards through Integrated Curriculum,* Susan Drake and Rebecca C. Burns have defined three categories of curriculum integration: multidisciplinary, interdisciplinary and transdisciplinary. While there are multiple approaches within these categories, curriculum integration in a STEM school moves beyond integration of subjects in thematic units. It is the artful interweaving of rigorous academic standards to create meaningful learning experiences focused on innovative solutions to current, real-world problems.

Multidisciplinary	**Interdisciplinary**	**Transdisciplinary**
Disciplines are taught separately, but a common theme, skill or practice is infused into each. • Examples: Literacy across the curriculum; world class skills integrated across the curriculum; technology across the curriculum.	Processes, methods and language from more than one discipline are integrated to examine a topic or solve a problem. • Example: Students apply mathematical practices, writing processes and the scientific method to report on their analysis of water quality in their town.	All knowledge is interconnected and interdependent. • Example: Students design a school system for a poverty stricken country and engage knowledge from applicable disciplines as needed.

STEM schools should strategically implement STEM integration as close attention is given to the learning needs of students and the professional learning needs of teachers. The findings from a 2014 report, *STEM Integration in K-12 Education: Status, Prospects, and an Agenda for Research*, provides key implications to guide effective curriculum integration. The recommendations include:

- Make integration explicit as students do not always on their own make connections across disciplines.
- Support knowledge comprehension in individual disciplines. Students who struggle in one discipline will encounter challenges in applying that knowledge in other contexts. Integration should complement, not replace disciplinary instruction.
- Take advantage of themes that occur naturally across multiple disciplines.

World Class Skills

In STEM schools, 21st century practices are embedded in the curriculum to promote content mastery and facilitate real world investigations, applications and innovations. These practices enable students to:

- Communicate ideas clearly, verbally and in writing for multiple purposes and audiences, locally and globally.
- Collaborate with classmates and other stakeholders to make decisions, solve problems and advance common goals.
- Create and innovate using a design process.
- Think critically, assimilating core knowledge and key ideas to address complex topics.
- Understand and use the most appropriate technology for a given task.

These practices are an integral part of teaching and learning in the STEM classroom, as teachers provide opportunities for students to apply important academic concepts in real world contexts.

STEM-Minded schools equip learners with skills and confidence to think and act in STEM-relevant aspects of civic life. Students learn the value of being informed, financially literate, productive citizens of their communities, state, nation and globe. A learning opportunity in a STEM classroom might require students to construct evidence-based arguments for or against a given candidate, based on the candidate's tax policy proposals for small businesses or farmers in their state. Another assignment might have students use data to analyze the impact of a proposed business on the local natural habitat versus its effect on the local economy in their town - or in a village in a foreign land. A viable STEM curriculum provides students with experiences that focus on their civic rights and responsibilities as well as how their actions affect the rights of others.

A viable STEM curriculum is the result of a rigorous developmental cycle including expert review, field-testing and revision based on data about student learning. STEM schools systematically review their curriculum for effectiveness. All stakeholders have input into this process to ensure the curriculum remains challenging and current in its application, preparing students to flourish in an ever-evolving and demanding world.

IC Maps Purpose

According to Shirley Hord (2006), "Innovation Configuration Maps, or IC Maps, provide a description of what a specific educational innovation "looks like" when well implemented. It provides a mental image of an innovation in operation and "vision" toward which the user is moving. Thus, the IC map provides a tool that shares information and helps individuals and organizations figure out where they are and what they need to do to move toward implementation." S^2TEM Centers SC has created an IC map for Characteristics of High Functioning STEM schools and schools wanting to become more STEM-Minded.

The desired outcome is stated on the left. Decreasingly desirable levels along the continuum are to the right. *Sustaining* signifies the ideal and highest quality of implementation and reflects the processing of all actions through a data-informed, evidence-based continuous improvement process.

STEM schools aligned with the criteria identified in the IC maps will progress toward developing students with world class knowledge, world class skills, and life and career characteristics as defined by the Profile of the SC Graduate.

IC Maps Format

Overarching Standard for the respective IC Map.

Standard: Professional learning for STEM educators: is a system of continuous improvement that increases educator effectiveness in preparing students for success in college, careers, and citizenship; it is data informed, research based, aligned with the school's mission, vision, and goals for STEM education and sustained by skillful leaders.

Words defined in the glossary are highlighted in blue

Desired Outcome(s) are listed in each IC Map as statements of STEM school characteristics as related to the Overarching Standard (shown above).

PL1 = Professional Learning Map, 1st Desired Outcome

Title of IC Map (i.e. Professional Learning)

Total Instructional Focus – Professional Learning

Sustaining	Fully Implementing	Refining and Expanding	Progressing	Getting Started
Desired Outcome PL1: Professional learning is the collective responsibility of all STEM educators and is the result of active engagement in a STEM professional learning community (PLC). It is a system of continuous improvement aligned with the school's/district's mission, vision, and goals for STEM education.				
PL1.Leaders1: Support faculty and staff in setting and implementing professional learning goals				
Model and employ with fidelity ALL essential elements of a continuous improvement process school wide including: • identifying STEM goals • planning • implementing • gathering evidence • self-assessing • adapting Support and maintain commitment to personal and PLC learning of faculty and staff through observation, reflecting conversations, and feedback as aligned with the school/district goals for STEM education.	Model and employ the essential elements of a continuous improvement process school wide including: • identifying STEM goals • planning • implementing • gathering evidence • self-assessing • adapting Support commitment to personal and PLC learning of faculty and staff through observation, reflecting conversations, and feedback as aligned with the school/district goals for STEM education.	Provide ongoing support to faculty and staff as they work toward their individual and PLC STEM focused goals for professional growth through observation, reflecting	Support faculty and staff as they work toward their individual and PLC STEM focused goals for professional growth through observation and feedback.	Collaborate with faculty and staff as individual STEM focused goals for professional growth are set.

Indicator by Role for the Desired Outcome (i.e. PL1), then the Role described (i.e. Leaders), then a number to represent which indicator is being outlined (i.e. 1) NOTE: Roles include Leaders, Teachers, Students, and Strategic Alliances.

5 Implementation Levels on the continuum from Getting Started to Sustaining. Read the map from right to left.

Within the white cells are descriptors for each of the 5 levels on the continuum.

IC Map: Curriculum, Assessment, and Instruction

Standard: STEM curriculum, assessment, and instruction promote STEM literacy, is aligned with state standards, integrates disciplines, incorporates world class skills, and provides the foundation for civic responsibility. Included are: the knowledge and skills that students are to learn, the instructional practices used to teach, and the approaches to assessment of the knowledge and skills.

Total Instructional Focus – Curriculum and Instruction

Sustaining	Fully Implementing	Refining and Expanding	Progressing	Getting Started
Desired Outcome CAI1: Effective STEM curriculum, assessment, and instruction build STEM literacy, are integrated, standards-based, and cognitively demanding - promoting acquisition and demonstration of transdisciplinary knowledge and world class skills.				
CAI1.Leaders1: Acquire and maintain resources for effective STEM curriculum, assessment and instruction				
Collaborate with all stakeholders in sustaining, through a continuous improvement process, an organizational structure to support the planning, implementation, and effectiveness of STEM curriculum, assessment, and instruction.	Lead the school in building and equipping with appropriate resources, an organizational structure that supports the planning, implementation, and effectiveness of STEM curriculum assessment, and instruction.	Implement the plan for the inventory, maintenance and acquisition of resources needed to implement effective STEM curriculum, assessment and instruction. Collect data to assess the plan's effectiveness.	Develop a plan for the inventory, maintenance and acquisition of resources needed to plan and implement effective STEM curriculum, assessment and instruction. Coordinate acquisition sources (e.g. district funding, grants, donations, etc.) to implement the plan purposefully and strategically.	Identify resources needed to implement STEM curriculum, assessment, and instruction that is aligned with the school mission, vision, and goals for STEM education including but not limited to: • technology, • materials, • facilities, • human resources, • leadership at all levels, • strategic alliances, and • time including master schedule conducive to job-embedded inter- and intra- curricular planning.
CAI1.Leaders2: Provide oversight of curriculum, assessment and instruction				
Review, revise and update STEM curriculum, assessment, and instruction through a continuous improvement process using data collected from multiple sources.	Institute a well-articulated system that includes planning, data collection, and reflection to ensure the alignment, integration and fidelity of implementation of STEM curriculum, assessment, and instruction.	Collaborate with stakeholders to establish expectations to ensure the alignment, integration and fidelity of implementation of STEM curriculum, assessment and instruction.	Monitor implementation of the STEM curriculum, assessment and instruction, through checklists for lesson plans and classroom observations.	Set goals and develop plans for oversight of the implementation of the STEM curriculum, assessment, and instruction (e.g. Schedule of classroom observations followed by feedback to teachers).

Sustaining	Fully Implementing	Refining and Expanding	Progressing	Getting Started
Desired Outcome CAI1: Effective STEM curriculum, assessment, and instruction build STEM literacy, are integrated, standards-based, and cognitively demanding - promoting acquisition and demonstration of transdisciplinary knowledge and world class skills.				
CAI1.Teachers1 Plan, implement, and assess the effectiveness of STEM curriculum, assessment and instruction				
Refine STEM curriculum, assessment and instruction based on data collected continuously and used formatively to guide next steps in teaching and learning. Plan for continuous assessment that includes: • clear learning targets, • descriptive feedback, • instructional strategies that promote and provide evidence of learning, • peer assessment, and • self-assessment.	Assess the effectiveness of STEM curriculum, assessment, and instruction using various forms of data (e.g. student achievement, perception, workforce).	Implement STEM curriculum, assessment, and instruction that is: • standards based, • Interdisciplinary, • problem based, and • inquiry driven.	Set goals and plan for STEM curriculum, assessment and instruction that is: • standards based, • Interdisciplinary, • problem based, and • inquiry driven.	Identify characteristics of STEM Curriculum, assessment, and instruction which include but are not limited to: • standards based, • Interdisciplinary, • problem based, and • inquiry driven.
CAI1.Teachers2: Facilitate STEM learning experiences				
Provide opportunities and coaching designed to support individuals and student teams in creating their own learning experiences to acquire and demonstrate STEM literacy, meaning learners: • gain and apply world class knowledge and world class skills, • think critically and flexibly, • Integrate transdisciplinary concepts purposefully and strategically in the design and implementation of innovative solutions (explanations, products, processes) to complex, real-world problems, and • refine designs through an iterative process (e.g. engineering design process).	Facilitate student acquisition and demonstration of deep content knowledge and world class skills through learning experiences requiring students to: • think critically and flexibly, • apply concepts and practices from **multiple** disciplines, • design and implement innovative solutions (explanations, products, processes) to complex, real-world problems, and • refine designs through an iterative process (e.g. engineering design process)	Facilitate student acquisition and demonstration of deep content knowledge and world class skills through learning experiences requiring students to: • think critically and flexibly, • apply concepts and practices from **one or more** disciplines, • design and implement innovative solutions (explanations, products, processes) to complex, real-world problems, and • refine designs through an iterative process (e.g. engineering design process)	Support student acquisition and demonstration of deep content knowledge from a **single discipline** and world class skills by teaching, modeling, and practicing with students the use of tools and strategies that support: • flexible and critical thinking, • design and implementation of innovative solutions (explanations, products, processes) to complex, real-world problems, and • refine designs through an iterative process (e.g. engineering design process)	Set goals and develop long term plans for STEM CAI that enable students to acquire and demonstrate deep content knowledge and world class skills through learning experiences that require students to: • apply concepts from multiple disciplines, • think critically and flexibly, • design innovative solutions (explanations, products, processes) to real world problems, and • refine designs through an iterative process (e.g. engineering design process).

Sustaining	Fully Implementing	Refining and Expanding	Progressing	Getting Started
Desired Outcome CAI1: Effective STEM curriculum, assessment, and instruction build STEM literacy, are integrated, standards-based, and cognitively demanding - promoting acquisition and demonstration of transdisciplinary knowledge and world class skills.				
CAI1.Teachers3: Facilitate learning experiences, maximizing technology				
Coach individuals and student teams to maximize technology and other resources in the design and implementation of innovative solutions (explanations, products, processes) to complex, real-world problems.	Facilitate learning experiences in which individuals and student teams select technology tools and strategies that they use in the design and implementation of innovative solutions (explanations, products, processes) to complex, real-world problems.	Facilitate learning experiences that require students to use specific technology tools and strategies in the design and implementation of innovative solutions (explanations, products, processes) to complex, real-world problems.	Teach, model, and practice with students the use of technology tools and strategies that support students in the design and implementation of innovative solutions (explanations, products, processes) to complex, real-world problems.	Use technology tools to teach and assess concepts.
CAI1.Teachers4: Foster student collaboration in designing solutions to challenging, real-world problems				
Design learning experiences that intentionally foster collaboration among strategic alliances, school and district leaders, self, and students in • setting goals, • making decisions, and • solving problems such that all members of the classroom community and external stakeholders learn from each other.	Design learning experiences that intentionally foster collaboration among self and students in • setting goals, • making decisions, and • solving problems such that all members of the classroom community learn from each other.	Facilitate collaborative decision-making among students and invite reciprocal learning among self and students.	Provide multiple opportunities and an array of tools for student collaboration, allowing students to choose when and how they will collaborate (e.g. electronic collaboration tools, norms of collaboration).	Provide parameters and specific strategies for student collaboration. Intentional planning for student collaboration is evident.
CAI1.Teachers5: Collaboratively plan instruction with colleagues				
Collaborate regularly in inter- and intra-disciplinary teams to plan integrated, standards based STEM curriculum, assessment, and instruction, identify and eliminate gaps and overlaps, reflect on lessons that have been taught, and analyze student work and assessment data to determine needed adjustments to curriculum and instruction.	Collaborate regularly in inter- and intra-disciplinary teams to plan integrated, standards-based STEM curriculum, assessment and instruction and to identify and eliminate gaps and overlaps in the STEM curriculum. Example: 6th grade math teachers collaborate with other content area teachers on integrated curriculum and vertically with other math teachers K-12 or within grade band.	Collaborate regularly in intra-disciplinary groups *across grade levels* to plan standards-based STEM curriculum, assessment and instruction to identify gaps and overlaps within their content area within the STEM curriculum. Example. 6th grade math teachers collaborate vertically with math teachers within grade band or vertically K-12.	Collaborate regularly in intra-disciplinary groups *within grade levels* to plan standards-based STEM curriculum, assessment and instruction identifying standards and concepts to be taught within their grade level and content area within the STEM curriculum. Example. 6th grade math teachers collaborate with other 6th grade math teachers.	Plan standards-based STEM curriculum, assessment and instruction individually, aligning curriculum within grade level and content area.

Sustaining	Fully Implementing	Refining and Expanding	Progressing	Getting Started
Desired Outcome CAI1: Effective STEM curriculum, assessment, and instruction build STEM literacy, are integrated, standards-based, and cognitively demanding - promoting acquisition and demonstration of transdisciplinary knowledge and world class skills.				
CAI1.Students1: Demonstrate self-directedness in gaining and applying content knowledge				
Demonstrate self-directedness and STEM literacy as they: • gain and apply world class knowledge and world class skills, • think critically and flexibly, • Integrate **transdisciplinary** concepts purposefully and strategically in the design and implementation of innovative solutions (explanations, products, processes) to complex, real-world problems, and • refine designs through an iterative process (e.g. engineering design process).	Think critically and flexibly as they: • acquire and demonstrate understanding of standards-based concepts, • apply concepts and practices from **multiple** disciplines, • design and implement innovative solutions (explanations, products, processes) to complex, real-world problems, and • refine designs through an iterative process (e.g. engineering design process/continuous improvement process).	Think critically and flexibly as they: • acquire and demonstrate understanding of standards-based concepts, • apply concepts and practices from **one or more** disciplines, • design and implement innovative solutions (explanations, products, processes) to complex, real-world problems, and • refine designs through an iterative process (e.g. engineering design process/continuous improvement process).	Acquire and demonstrate understanding of standards-based concepts using self-selected tools and strategies that support flexible and critical thinking in the design and implementation of innovative solutions (explanations, products, processes) to complex, real-world problems while applying concepts and practices primarily from a single discipline. Refine designs through an iterative process (e.g. engineering design process/continuous improvement process).	Acquire and demonstrate understanding of standards-based concepts using provided tools and strategies that support flexible and critical thinking in the design and implementation of innovative solutions (explanations, products, processes) to complex, real-world problems while applying concepts and practices primarily from a single discipline. Refine designs through an iterative process (e.g. engineering design process/continuous improvement process).
CAI1.Students2 Demonstrate self-directedness in integrating technology in problem solving				
Demonstrate self-directedness as they maximize technology and other resources in the design and implementation of innovative solutions (explanations, products, processes) to complex, real-world problems.	Solicit support from school leaders, teachers, and strategic alliances to locate technology resources to be used in the design and implementation of innovative solutions to complex, real-world problems (e.g. use 3-D printer at local technical college or business).	Select from provided technology tools and strategies for use in the design and implementation of innovative solutions (explanations, products, processes) to complex, real-world problems.	Use assigned technology tools and strategies in the design and implementation of innovative solutions (explanations, products, processes) to complex, real-world problems.	Demonstrate understanding of provided technology tools and strategies.

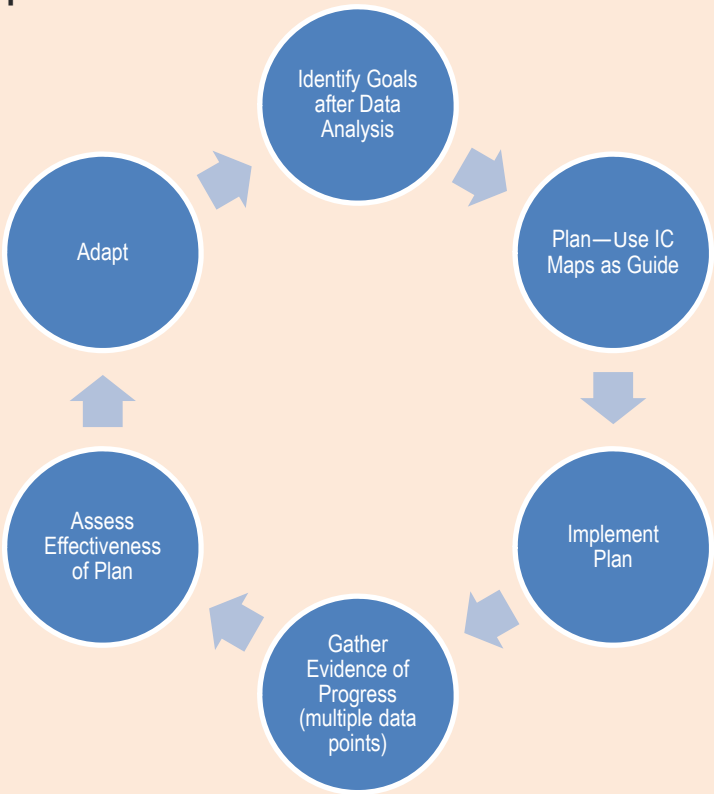
Sustaining	Fully Implementing	Refining and Expanding	Progressing	Getting Started
Desired Outcome CAI2: Provide learning experiences that promote productive citizenship and foster life and career characteristics				
CAI2.Leaders1: Promote civic-minded citizenship school wide				
Use a continuous improvement process to set and monitor goals with teachers for facilitating learning experiences that promote productive, civic-minded citizenship and foster life and career characteristics. Institute a system that celebrates innovative solutions by students and staff that have a positive impact on fellow citizens locally and globally.	Plan, observe, and reflect with teachers on learning experiences engaging students in researching, designing, and implementing innovative solutions to local and global challenges as students develop life and career characteristics of productive citizens (i.e. integrity, self-direction, global perspective, perseverance, work ethic, interpersonal skills).	Collaborate with teachers and strategic alliances to acquire resources (time, information, community connections, etc.) to provide learning opportunities promoting productive, civic-minded citizenship and foster life and career characteristics (i.e. integrity, self-direction, perseverance, work ethic, interpersonal skills).	Support teachers with resources (e.g. time, information, community connections, etc.) to provide learning opportunities promoting civic awareness and citizenship.	Engage all school stakeholders in building a collaborative culture that promotes productive, civic minded citizenship.
CAI2.Teachers1: Design and implement a classroom culture that promotes civic-minded citizenship				
Coach individuals and student teams as they engage in the design, and implementation of innovative solutions to local and global challenges researched and selected by the students. Reflect with students on the students' assessment of their progress towards: • achieving an effective solution, and • exhibiting the life and career characteristics of productive citizens.	Facilitate learning experiences in which students engage in researching, designing, and implementing innovative solutions to local and global challenges as they develop life and career characteristics of productive citizens (i.e. integrity, self-direction, global perspective, perseverance, work ethic, interpersonal skills).	Facilitate learning experiences that promote productive citizenship and foster life and career characteristics (i.e. integrity, self-direction, perseverance, work ethic, interpersonal skills) as students design and implement innovative solutions to local challenges (e.g. have students design and seek funding for a community walking trail to promote community health).	Plan and implement learning experiences designed to promote productive civic-minded citizenship (e.g. have students research and write a proposal to conserve the city's water).	Design a collaborative classroom culture that promotes productive, civic-minded citizenship. Promote student dialogue about: • personal rights and responsibilities within and beyond the classroom, and • civic rights and responsibilities.

Sustaining	Fully Implementing	Refining and Expanding	Progressing	Getting Started
Desired Outcome CAI2: Provide learning experiences that promote productive citizenship and foster life and career characteristics				
CAI2.Students1: Demonstrate civic-minded citizenship				
Assess progress towards effective solutions to local and global problems through a continuous improvement process. Assess self and peers in their approaches as problem solvers and in their demonstration of life and career characteristics.	Research local and global issues, pose problems to solve, seek resources including partners (strategic alliances, peers, parents, and teachers). Assess self and peers in their approaches as problem solvers and in their demonstration of life and career characteristics.	Pose problems and design solutions in collaboration with peers, parents, and teachers. Assess self and peers in their approaches as problem solvers and in their demonstration of life and career characteristics.	Design solutions to community problems assigned by their teachers. Assess self and peers in their approaches as problem solvers and as productive citizens. Identify life and career characteristics (i.e. integrity, self-direction, global perspective, perseverance, work ethic, interpersonal skills).	Identify the characteristics of a productive citizen. Engage with peers and teacher in a collaborative classroom culture that promotes productive, civic-minded citizenship. Dialogue about: • personal rights and responsibilities within and beyond the classroom, and • civic rights and responsibilities.
CAI2.Strategic Alliances1: Promote civic-minded citizenship within and beyond school community				
Partner with the school for ongoing citizenship-related learning opportunities that align with the strategic alliances' goals and the school's goals. Assess the effectiveness of actions through a continuous improvement process.	Assess effectiveness of citizenship-related learning experiences towards meeting community needs. Revise activities based on assessment results.	Collaborate with the school to ensure learning experiences that promote productive citizenship address community needs (e.g. partner with student teams to build ramps or redesign cars for disabled veterans, provide space, manpower, and materials for a garden that students design, plant and harvest in a food desert).	Furnish information and resources that promote learning experiences initiated by the school that promote productive citizenship and enhance the community's lifestyle and well-being (e.g. provide expertise and space for parks or walking trails designed by teams of students, voter registration drives and health fairs organized by student teams).	Support the school with resources (e.g. time, information, community connections, human talent etc.) to implement learning opportunities that promote civic awareness and share the strategic alliance's commitment to being ethical, informed, technologically literate, financially literate and productive citizens of their communities, state, nation and globe.

Sustaining	Fully Implementing	Refining and Expanding	Progressing	Getting Started
Desired Outcome CAI3: A STEM learning ecosystem complements and expands STEM curriculum, assessment, and instruction				
CAI3.Leaders1: Participate in building and supporting the STEM Learning Ecosystem				
Monitor the success of the school's engagement within the STEM learning ecosystem through a continuous improvement process. Create a culture where in school and out of school teaching and learning of the STEM curriculum are byproducts of collaboration, study, purposeful planning, and intentional implementation. Monitor the quality of teaching and learning (both in school and out of school) as applied to the fidelity of the STEM curriculum.	Plan and promote opportunities for all staff within the STEM learning ecosystem to develop an understanding of how each complements and expands the STEM curriculum of the other and the benefits for students. Support out of school learning as an extension of in school learning.	Collaborate with other leaders within the STEM learning ecosystem to plan for how each can complement the other's STEM curriculum, assessment, and instructional goals. Support collaboration between in school and out of school learning personnel such that all are aware of curriculum standards, instructional strategies and expected outcomes.	Determine ways to productively engage with other STEM learning providers (in-school and out-of-school) within the STEM learning ecosystem to enhance STEM curriculum, assessment, and instruction. Support teachers as they collaborate with out of school learning personnel to determine connections and partnerships which strengthen teaching and learning.	Explore STEM learning opportunities in out of school time (e.g. Boys and Girls Clubs, Children's Museums, Science Centers, STEM Summer Camps, STEM festivals and STEM learning sponsored by business, higher education, and community organizations). Assess the correlation or connections between the focus for in-school learning and the focus for out-of-school learning.
CAI3.Teachers1: Support the STEM Learning Ecosystem				
Assess the effectiveness of partnership through a continuous improvement process using student outcomes as evidence.	Partner strategically with personnel (beyond the school) within the STEM learning ecosystem to refine curriculum, assessment, and instruction recognizing the need for mutual benefit of all partners.	Initiate collaboration with personnel (beyond the school) within the STEM learning ecosystem to align learning experiences with STEM curriculum, assessment, and instruction as outlined in the school's instructional plan.	Connect classroom lessons with learning opportunities within the STEM learning ecosystem (e.g. plan virtual and onsite fieldtrips, guest speakers, mobile science labs). Recommend learning opportunities and resources within the STEM learning ecosystem to students and their families based on • students' unique talents, interest and learning needs, and • student selected projects/products.	Explore STEM learning opportunities within the STEM learning ecosystem (e.g. after school, summer programs, children's museums, science centers) for connections to STEM curriculum, assessment and instruction.

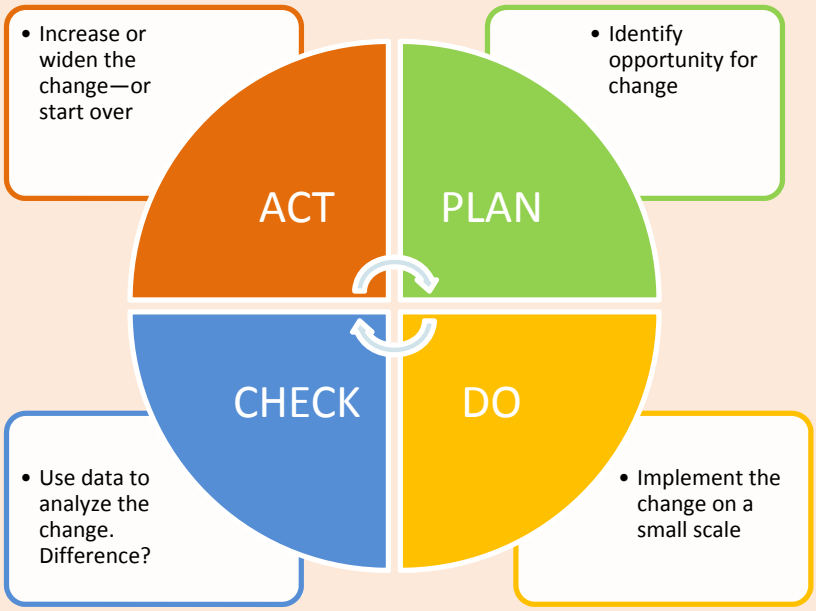
Sustaining	Fully Implementing	Refining and Expanding	Progressing	Getting Started
Desired Outcome CAI3: A STEM learning ecosystem complements and expands STEM curriculum, assessment, and instruction				
CAI3.Students1: Engage in learning activities within the STEM Learning Ecosystem				
Demonstrate self-directedness in seeking support to address own barriers to success and further personal interests and abilities in STEM.	Provide descriptive feedback to providers of STEM learning experiences on the effectiveness of STEM learning opportunities. Seek mentors, tutors, internships and other support from STEM learning ecosystem.	Seek learning opportunities to enhance their understanding of STEM curriculum. Apply learning to new situations.	Engage in STEM learning opportunities within the STEM learning ecosystem based on learning needs identified by teachers (e.g. tutoring, mentoring, internships, out of school learning opportunities, etc.).	Explore STEM learning opportunities within the STEM learning ecosystem (e.g. after school, summer programs, children's museums, science centers) based on interests.
CAI3.Strategic Alliances1: Initiate, promote and sponsor STEM learning opportunities to build and support the STEM Learning Ecosystem				
Initiate collaboration with school community to design, align and enhance STEM curriculum, assessment, and instruction from kindergarten through college. Connect sponsored learning opportunities to workforce needs and to the school's STEM curriculum, assessment, and instruction.	Collaborate with school leaders to provide technology, facilities, funding, and human resources (e.g. co-teaching, professional learning opportunities, artists in residence, mentors, internships, tutors,) to support effective STEM curriculum, assessment, and instruction.	Promote and sponsor STEM learning opportunities for teachers, students, parents and community. Initiate community wide STEM activities (e.g. STEM festivals, technology fairs, career fairs, internships, and mentorships).	Honor school requests to sponsor STEM focused events and programs to support STEM curriculum, assessment, and instruction.	Identify ways to support effective STEM curriculum, assessment, and instruction.

Glossary

Collaborative Norms	The capacities and skills that guide productive dialogue and discussion in collaborative groups. Each group member agrees to the norms and governs himself or herself accordingly. http://www.thinkingcollaborative.com/norms-collaboration-toolkit/
Collective Responsibility	The attitudes and beliefs that all stakeholders in the school community share the responsibility of ensuring high levels of learning for every child and that they use their communal strengths to prepare students for success within and beyond K-12 schooling.
Continuous Improvement Process	A data-informed, active and ongoing process in which self-directed learners at all levels of the school identify, plan, implement, monitor, and refine goals. This approach applies to the continuous learning and growth of students, faculty, staff, leaders, organization, and community. **Examples of Continuous Improvement Processes** (NOTE: These are a few examples; not an exhaustive list): **Example 1** **Continuous Improvement Process** 

Example 2

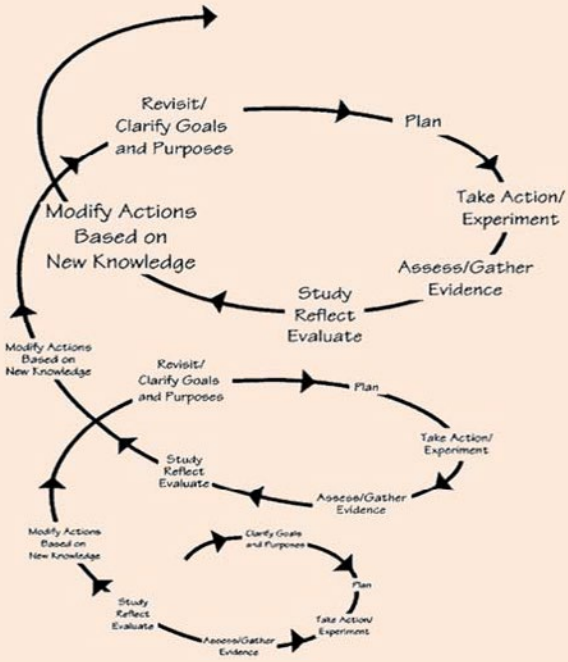
Continuous Improvement Process



(Deming, n.d.)

Example 3

Feedback Spiral



(Costa & Kallick, Assessment in the learning organization, 1994)

Gatekeeping Processes	Processes (multiple measures) that are the entry requirements for STEM courses of study.
Intra-disciplinary	Processes, methods, and language within a single discipline.
Interdisciplinary	Processes, methods and language from more than one discipline.
Professional Learning Community (PLC)	A group of educators who engage in job-embedded, collaborative learning; together, participants develop professional and student learning goals, and monitor progress towards meeting those goals through a continuous improvement process.
School Community	The collective group of stakeholders reflecting the environment in which the STEM school operates including the cultural norms, political influences, economic resources, and education levels.
Self-Directedness	Being guided by oneself to set challenging goals, develop a plan of action, persevere in the face of challenges, and accurately assess progress and performance based on evidence.
SMART Goals	**Framework for goal setting. SMART goals should be:** **S** = Specific **M** = Measurable **A** = Attainable **R** = Results-based **T** = Time-bound
Stakeholder	An individual or group with an interest in the success of a school in fulfilling its mission, includes but not limited to parents, students, faculty and staff, businesses, institutions of higher education and community organizations.
STEM Leadership Team (SLT)	A team representing the diversity of the community, consisting of school/district leaders and representatives from all stakeholder groups. The SLT will lead in the development and implementation of the STEM mission, vision, and goals ensuring that all stakeholder ideas and concerns are represented. SLT members should be influential within the groups they represent and able to articulate with clarity communication from their constituent groups to the SLT and vice-versa.
STEM Learning Ecosystem	A network of in-and-out of school STEM learning opportunities that work together to deepen students' STEM understandings; the system may be comprised of STEM learning experiences made available by schools, afterschool providers, universities, museums, science centers, community organizations, and families. "This phrase," according to the National Academy Press publication, Identifying and Supporting Productive STEM Programs in Out-of-School Settings, "refers to the dynamic interaction among individual learners, diverse settings where learning occurs, and the community and culture in which they are embedded. STEM learning ecosystem includes all of a community's STEM-rich assets, which include: • *designed settings,* such as schools, clubs, museums, and youth programs; • *naturalistic settings*, such as city parks, waterways, and forests and deserts; • *people and networks of people,* such as practicing STEM professionals, educators, enthusiasts, hobbyists, and business leaders who can serve as inspiration and role models; and • *everyday encounters* with STEM, such as on the internet, on television, on the playground, or during conversations with family members and other young people." http://www.nap.edu/catalog/21740/identifying-and-supporting-productive-stem-programs-in-out-of-school-settings

STEM Literacy	The knowledge, skills, attitudes, and capacities to: • integrate **transdisciplinary** concepts purposefully and strategically in the design and implementation of innovative solutions (explanations, products, processes) to complex, real-world, personal, local, and global challenges • think critically and flexibly • refine designs through an iterative process (e.g. engineering design process/continuous improvement process)
Strategic Alliance(s)	An individual or group of stakeholders who may be outside of the day to day work of schools, but who engage in ongoing active partnership with schools in developing and implementing a shared mission, vision and goals for STEM education. Strategic alliances may include but are not limited to businesses, institutions of higher education, community and civic organizations.
Transdisciplinary	Student driven approach to teaching and learning in which students, guided by their own questions, design solutions to solve complex, real world problems by calling upon the knowledge, skills, and processes of multiple disciplines as they need them.
World Class Knowledge	**(Source: Profile of the South Carolina Graduate)** • Rigorous standards in language arts and math for career and college readiness • Multiple languages, science, technology, engineering, mathematics (STEM), arts and social sciences
World class skills	**(Source: Profile of the South Carolina Graduate)** • Creativity and innovation • Critical thinking and problem solving • Collaboration and teamwork • Communication, information, media and technology • Knowing how to learn

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