

STEM implementation at Sagamore Hills Elementary began during the spring of 2012 and has been embraced by the school community to reinvigorate teaching and learning. Upon reflection of the Indicators and Domains, three categories were discovered during the Self Assessment process. These categories are: Strengths, Strong with Room to Grow, and Area of Need.

Areas of Strength

ST1.1: *The STEM school supports non-traditional student participation through outreach to groups often underrepresented in STEM program areas.*

At Sagamore Hills, 100% of students participate in the STEM program during the school day. Sagamore Hills currently serves the following diverse population:

- 47% Ethnically diverse
- 18% English language learners
- 17% Students with disabilities
- 37% Economically disadvantaged
- 49% Female

In addition, extended day opportunities are offered to all students free of charge. These opportunities include: STEM Club, Garden Club, Science Olympiad, Lego Robotics and Jr. Robotics, Math Club and Tournament, Seaperch, Odyssey of the Mind, Science Olympiad, STEM Night, and STEM Stars. Fifth grade students also get an opportunity to go to Rock Eagle, and Sagamore has Sciqest camps during the summer for all grade levels for a fee.

Actions to sustain areas of strength:

- Continue to include 100% of students at Sagamore in STEM.
- Continue and grow all extended day opportunities.

ST1.4: *Students use technology resources to conduct research, demonstrate creative and critical thinking, and communicate and work collaboratively.*

Students at Sagamore Hills have a plethora of technology resources at their fingertips. This technology includes, but is not limited to, the following:

- STEM lab that contains 27 Mac desktop computers
- Laptop cart
- I pads in every classroom
- Two 3D printers
- GoPro Cameras
- Lego Robotics Kits
- Makey-Makey Kits
- Seaperch Kits
- Online resources such as Tinkercad and Scratch

Students use the aforementioned resources not only for research purposes but also to design and implement STEM activities. It also creates an opportunity for cross-curricular lessons and assessments. For example, the fourth grade science teacher paired with the STEM explorations teacher to use Tinkercad to design low flow showerheads. Once designed, the showerheads were printed using the 3D printers.

Actions to sustain areas of strength:

- Continue to keep technology available and up to date.
- Work to grow the number and types of technologies.
- Ensure professional development keeps teacher up to date with new technology and developments to incorporate in the classroom.

ST1.11: Students are supported in their STEM learning through adult-world connections and extended day opportunities.

Students at Sagamore Hills have numerous opportunities to participate in activities focused on adult-world connections. These opportunities include STEM Career Week, STEM Night as well as grade level specific activities that connect curriculum standards with community and industry professionals. For example, every student interacts with scientists from the Atlanta Botanical Garden.

Extended day opportunities thrive at Sagamore Hills Elementary. Students have numerous in which to participate. Examples of these include STEM Club, Lego Robotics and Jr. Lego Robotics, Seaperch and Garden Club. STEM Night brings students, families, and community partners together for a fun filled evening of STEM activities. The STEM Stars program allows students and families to create solutions for real world local problems here at Sagamore Hills. A most recent example of this is students redesigning the path to the learning cottages.

Actions to sustain areas of strength:

- Continue to offer extended day opportunities.
- Involve more community and business partners in extended day activities.
- Continue to increase traditionally underrepresented professionals in Career Week and STEM Night activities.

Strong with Room to Grow

ST1.2 Students work independently and collaboratively in an inquiry-based learning environment that encourages finding creative solutions to authentic and complex problems.

Sagamore Hills is strong in two areas of this indicator, but has room to grow in the learning experiences component. Creative problem solving is highly valued by teachers and students. This is evidenced by the solutions to problems that student groups create. Higher order thinking skills and finding creative solutions to problems is facilitated by the STEM 7-Step Process that

Sagamore Hills students use. This process encourages brainstorming and redesigning until the desired outcome is achieved.

Students also have numerous opportunities to work independently and collaboratively to solve problems. As part of the 7-Step process, students brainstorm and share ideas. Students have the opportunity to create a solution and then share the solution with teammates. Together teammates decides which solution is best, or combines ideas to make a new solution.

Of the three domains, Sagamore Hills has the most room to grow in the area of students focusing on problem identification. While locally-relevant many design challenges and STEM projects that these students have completed have had a predefined problem that the students have studied and learned about. One example of this is the clean water crisis where third graders designed water filtration systems. The students have now become more comfortable with STEM activities, and teachers are moving toward more opportunities for students to take on projects that require problem identification. This is also allowing for increased differentiation by interest.

Actions to sustain areas of strength:

- Continue use of teams for collaborative brainstorming and problem solving.
- Create more opportunities for students to identify real-world problems.

ST1.3 Students are empowered to personalized and self-direct their STEM learning experiences supported by STEM educators who facilitate their learning.

Throughout the STEM implementation process, students at Sagamore Hills have evolved to take responsibility for their individual learning. Evidence of personalized learning can be seen in individual STEM journals and in project presentations of findings and solutions.

The transition to the role of teacher as facilitator presented challenges for some. The paradigm shift that was required for this came naturally to some, while others are still working and improving. Teachers at Sagamore Hills are continuously working to ensure that they are facilitating learning by guiding and supporting students as they work and asking questions that require critical thinking skills.

Actions to sustain areas of strength:

- Continued use of personalized STEM journals.
- Create an online “museum” for students to present findings and solutions.

ST1.5: Students demonstrate their learning through performance-based assessments and express their conclusions through elaborated explanations of their thinking.

Performance assessments are used in STEM lessons throughout all grade levels so that the students have an opportunity to show what they are able to do. For example, when the second

graders learned about electricity and energy, they wrote code to design a game. While they were learning about circuits, they used Makey-Makey to create the controls to the game. They aligned this with learning about graphing and coordinates in math as this was needed when coding. To show what they could do, they had to be able to prove that they had a working game. They then had other classes test their game to ensure it was successful. They were assessed using a rubric.

Generally, performance-based assignments are assessed utilizing a rubric or checklist in all grade levels. Below is a sample of other performance-based projects for each grade level:

- Kindergarten-Plant Transporter, Eco Pots
- First Grade-Design a Sleigh, Design Sound Reducing Device
- Second Grade-Design a Hovercraft, Build a Robot Arm
- Third Grade-Solar Ovens, Maglev Trains
- Fourth Grade-Building Bridges, Windmill Design
- Fifth Grade-Build a TarPul, Aquaponics

Each year the fourth and fifth grade students get to work with one of our civil engineering industry partners, Bennett & Pless, to design and build bridges. Over a two week period the engineering firm comes in and teaches the students all about how to design a bridge, mathematical equations to test for stability, and ultimately tests the bridges for which design can withhold the most weight. This provides the students with an opportunity to present their STEM learning to Sagamore's stakeholders.

As the students work through the design process, they have opportunities to explain and defend their thinking in their STEM journals. The STEM journals document the students thinking and ideas through each step of the process, and tracks any re-design that occurs. These journals not only serve as a solid artifact to help explain their thought process, but also act as a reference throughout the school year.

Actions to sustain areas of strength:

- Continue to use STEM journals.
- Continue to use rubrics and/or checklists.
- Continue to include industry partners in presentations of STEM learning.
- Create an online "museum" for students to present findings and solutions.

Sagamore has room to improve in this indicator in involving more of the industry partners, more often, when presenting STEM learning.

ST1.6: The interdisciplinary problem-based curriculum includes a focus on real-world applications.

Sagamore Hills follows the common core curriculum for ELA and math, and the Georgia Performance Standards for science and social studies. Each teacher is required to align STEM

lessons and units to these standards that will allow the students to collaborate based on authentic learning experiences.

Cross-curricular planning occurs during grade-level planning time. Each grade level has common planning time every single day. During this time they will use things such as the Sagamore Hills integration chart to ensure that the STEM lesson they are teaching integrates learning throughout all subject areas. Teachers will also ensure that 21st century learning skills, such as critical thinking and the use of technology, are embedded within the unit.

This leads to innovative experiences in STEM that extend beyond the core STEM subject areas. Sagamore offers the STEM Buddies program where an older grade pairs with a younger grade on a STEM project. For example, the fifth graders paired with the first graders to teach them about our Aquaponics system, and how to care for it. Once they taught them how it works, why it is important, and how to track data such as the pH level and temperature, they helped them build smaller Aquaponics systems out of 5 gallon buckets.

Actions to sustain areas of strength:

- Continue the STEM Buddies program.
- Continue common planning for teachers.
- Continue to use the STEM integration chart to help during planning time.

Sagamore Hills could grow in this area by adding in more elements of the fine arts, and the fine arts instructors, into the STEM lessons.

ST1.7: STEM educators collaborate as an interdisciplinary team to plan, implement, and improve integrated STEM learning experiences.

At Sagamore Hills full STEM implementation occurs in a highly collaborative environment between teachers, students, staff, and community. Grade level teachers have common planning times in order to collaborate. This is purposeful time to plan standards-based units with a focus on STEM integration of all STEM disciplines. The integration chart is used during these sessions to ensure that all components of STEM occur across the curriculum. Teachers also partner with each other across grade levels to create new STEM opportunities for students. Students across grade levels work as STEM buddies and collaborate on larger school-wide projects such as aquaponics and the STEM Learning Garden. Administrators and teachers collaborate with external school partners to integrate opportunities in the classroom. The established school STEM Committee provides guidance to the school staff, parents, and community and industry partners.

Sagamore teachers meet on a regular schedule to collaborate, innovate, plan, and adjust integrated learning experiences. The master schedule is designed to accommodate grade level collaborative planning each day. Administrators meet frequently with grade level teams to be a part of this planning and collaborative process. Sagamore has a designated team of teachers that function as the school STEM Committee. The committee is composed of a representative

from each grade level, special areas, special education, and administration. The STEM Committee meets a minimum of once each month to review all STEM goals and activities and to plan school-wide STEM activities and events.

There are many strengths to Sagamore's level of functioning with this indicator, but there is also room to grow. As the STEM program evolves and STEM experiences build for all of the students and teachers, these grade level collaborative conversations will become deeper. As the staff adds to lesson and unit implementation experiences, the opportunities to adjust instructional practices will develop further. There is room to grow in incorporating our industry partners and parents in this collaborative process on a regular schedule with purposeful goals and objectives. The industry partners support specific curriculum standards and corresponding units and activities. Sagamore is not not fully engaging our business partners in over-arching conversations to innovate and plan STEM learning experiences for students and teachers.

Actions to sustain areas of strength:

- Continue daily common planning for teachers.
- Implement cross-grade level planning.
- Ensure STEM committee remains inclusive of new teachers each year.

ST1.9: STEM teachers and leaders participate in a continuous program of STEM professional learning.

The purpose of STEM professional learning at Sagamore Hills is to increase teachers' content knowledge and pedagogical skills to implement a STEM curriculum with fidelity. The majority of Sagamore's STEM professional learning activities have occurred in small-group grade level meetings where the focus is on specific curriculum standard correlation and alignment with the STEM disciplines. This on-going professional learning includes aligning STEM instructional strategies and assessments with a standards-based STEM curriculum. At Sagamore whole-faculty professional learning takes place based on identified areas of need; integrating real world challenges, incorporating 21st Century practices, and technology integration.

The faculty and staff participate in STEM professional learning in a variety of settings; graduate classes, workshops, webinars, conferences, and grade level meetings. Professional learning is provided by Sagamore Hills teachers and administrators, district professional learning staff, and the Captain Planet Foundation and Mercer University professors conduct on-site professional learning. The teachers are committed to engaging in this process to further their own STEM learning.

There is an opportunity for growth with this indicator. Sagamore's STEM program is becoming more robust and rigorous as the students and teachers gain confidence with inquiry-based teaching and learning. As benchmark goals and progress monitoring protocols are defined, teachers will need professional learning support to implement common rubrics and portfolio assessments. STEM implementation beyond integrating technology and engineering with science and mathematics is a professional learning need. Opportunity for growth includes

engaging the industry and post-secondary partners with job-embedded support to increase STEM implementation effectiveness. Allowing the teachers to work with teachers in other schools will contribute to this network of professional learning support.

Actions to sustain areas of strength:

- Continue to provide on-site professional learning based on the needs of teachers.
- Continue to fund and support teacher participation in off-site conferences and workshops.
- Continue to include post-secondary and industry partners in the professional learning process.

ST1.10: Community, post-secondary, and business/industry partners and/or families actively support and are engaged with teachers and students in the STEM program.

The support of community, post-secondary, industry partners and families are a strong component of the STEM program at Sagamore Hills. The main partnerships that support our teachers and students are; the Captain Planet Foundation, Mercer University, the Atlanta Botanical Garden, and Bennett & Pless Structural Engineers. Every student and teacher interacts with the Atlanta Botanical Garden throughout the school year through field trip experiences to the Garden and outreach programs that come to us. Programs are matched to grade level curriculum standards. Student and teachers interact with scientists at the garden with a focus on real-world issues and solutions. The Captain Planet Foundation also supports every Sagamore Hills student and teacher. Through STEM project-based learning units, students interact with the STEM Learning Garden. A Mercer University Elementary Science Education Professor, Dr. Deb Rosenstein, has worked with Sagamore Hills for three years providing professional learning to teachers and working with students implementing the Captain Planet STEM curriculum units. Bennett & Pless Structural Engineers specifically support the fourth and fifth grade teachers and students. A two week long unit on structures and forces culminates in a bridge building design challenge. Each of these industry partners has worked with Sagamore for multiple years and plans include maintaining and building upon these partnerships in the future.

Parental and community partnerships are prevalent and on-going in Sagamore's STEM program. Parents in collaboration with neighboring institutions such as Emory, GA Tech, the CDC, Georgia State University, and Mercer University hold an annual Family STEM Night for the Sagamore Hills School community. Hundreds of people attend for an evening of hands-on STEM activities. Parental and community partners provide on-going STEM career lessons for all students. Embedded in every unit are lessons about STEM related careers and career paths.

This indicator has been identified as an area for growth. Although Sagamore's STEM partners support the implementation of exemplary STEM integrated instruction, the STEM partners are not actively involved in the overall planning for the STEM program. The cross-cutting competencies that translate to STEM Careers are a vital part of a rigorous STEM program and an area of improvement for Sagamore Hills Elementary School. By including the parent and

industry partners in the planning during STEM Committee meetings, inviting them to attend faculty meetings, and being actively involved in the development in our Continuous School Improvement Plan Sagamore hopes to increase engagement.

Actions to sustain areas of strength:

- Continue to include industry partners in the STEM curriculum and implementation.
- Continue growth of the STEM Stars program.
- Continue stakeholder participation in extended day opportunities.

Area of Need

ST1.8: STEM learning outcomes demonstrate students' STEM literacy necessary for the next level of STEM learning and for post-secondary and workforce readiness.

This indicator has been identified as an area of need. Sagamore will continue to develop a clear and measurable progress monitoring process with benchmark goals for STEM literacy, cross-cutting competencies, and technology proficiency. At this time there is limited data on students' STEM content knowledge and skills, cross-cutting competencies, and creative and critical thinking strategies that demonstrate progress toward readiness and success at the next level of STEM learning. The data that has been obtained for our students' STEM literacy is based on standardized test results and on limited local qualitative and quantitative assessments.

Student progress is monitored each year through content area standardized assessments; Iowa Test of Basic Skills, and the end of grade state assessment, the GA Milestones, for 3rd-5th grade students. Student progress is also monitored throughout the school year utilizing the STAR Reading and Math assessments. Data points are taken a minimum of three times a year to monitor student growth in the content area of mathematics and reading. Sagamore Hills students also maintain a STEM Journal that is a qualitative compilation of their learning and work focusing on the STEM design process. Progress is also monitored as students complete grade level curriculum activities and assessments. Students are assessed frequently on STEM knowledge and skills on unit assessments and project rubrics.

At Sagamore a comprehensive portfolio approach that encapsulates these multiple assessments is needed. The staff is currently working on developing technology benchmarks for students to show progression during each grade level year. The International Society for Technology in Education (ISTE) Standards are being used as a framework for our technology benchmarks.

Planning toward the future, as we approach the 2016-2017 school year, will include a formalized process to monitor and record the progress of each student on grade level STEM content knowledge and skills, cross-cutting competencies, and creative and critical thinking strategies. This progress monitoring will include standardized test results in STEM disciplines as well as student progress on pre-determined STEM literacy indicators.