St. Benedict School, Fall 2017 Goal: Move up to "Engaged" Level (Pg 6)

1. **STEM Integration:** Describe how students at your school complete self-directed tasks that integrate knowledge and skills from Science, Technology, Engineering and Math. How do they solve authentic problems in doing so? What percentage of your student body participate in such integration? How frequently are students engaged in this integration?

As a STREAM School, we have a program integrated into our curriculum to provide all students the opportunity to explore and learn about the world around them. Students begin this exploration in Pre-Kindergarten and it continues through Grade 8. The program is designed to show students how each area of study can be interconnected, and used to help solve problems & create new solutions. Though we have a weekly designated STEAM Time for each grade level, STEAM is not taught in isolation; rather, it's used to build upon and enhance daily instruction.

Each grade level participates in STEAM lessons taught once weekly, and every five weeks the students enjoy a STEAM activity/project. Using the science curriculum standards as the core, projects are balanced between Life, Physical, or Earth & Space sciences. These STEAM projects are designed to cumulatively support the weekly instruction in STEAM areas.

To encourage the best learning experience for students, teachers outline each activity/project in advance to identify: components of the STEAM curriculum they are focusing on, the anticipated learning outcomes, the prior classroom instruction the activity is based upon, the instructional materials needed, the amount of time needed, and how student learning will be assessed. Teachers are provided with a sample list of grade-appropriate STEAM topics, and all teachers have access to an expanding STEAM project kits and materials library which they can sign out for instructional use.

Our entire student body is incorporated into this learning model.

Some specific examples:

Primary: ELA and Math standards are regularly integrated into Social Studies and Science curriculums with writing projects, art activities, problem solving, and using the scientific method. 1st grade students learn about biomes, and construct examples of animal habitats using LEGO bricks. 2nd grade students designed miniature versions of parachutes to help one of their favorite storybook characters.

K-2 students participated in afterschool "Weird Science" club, where teachers began by explaining concepts and fun experiments, children came up with hypotheses, then teachers performed experiments including "will it sink or float?" (Math, Physics,) and some based on chemical reactions. After each experiment, teachers and students discuss results compared to hypotheses.

Intermediate: Grade 3 is using an ESP (Elementary Science Program) kit in Science class. The children are growing tomatoes from seeds, along with other plants. Through active participation, the students are observing germination rates of seeds in petri dishes, using measuring skills as the plants begin to grow up a pole, and comparing and contrasting the growth of these seeds. Science and Math skills are being used with this task.

Grade 4 will be using both Engineering and Math knowledge and skills as they prepare to build geodesic domes with toothpicks and gumdrops. Math shapes such as triangles, hexagons, or squares can be tessellated. Prior to the activity, technology will be used to watch a video as an introduction to domes constructed from triangles.

Middle School: Math and Art teachers collaborate to assist students in creating "stained glass windows on canvas" of their own design.

2. Connections to Non-STEM Disciplines: Describe how students at your school complete self-directed tasks that integrate knowledge and skills from non-STEM disciplines, such as the Arts/Humanities etc. What instructional support is provided to achieve quality performance in the non-STEM disciplines? How do students solve authentic tasks in these connected activities?

As a STREAM school, we are already integrating Religion and Arts into our program, which are two non-STEM disciplines. Some examples include:

Primary: The primary grades use PEAP (Primary Engineering Adventure Program) to connect students to the non-STEM discipline of reading. Familiar and timeless story characters take center stage for PEAP. Our youngest learners adapt their engineering design process to meet the needs of their favorite literature friends. The children generate ideas, build, and test solutions collaboratively to help their favorite characters solve a problem. For example, the three little pigs work to design and build stronger houses to protect themselves from the big, bad wolf.

Engineering skills are also used in the non-STEM discipline of Art. One example is with our first grade class. The children build snakes that can move and slither. They connect tubes with paper fasteners. Hole-punching is involved, as well as cutting sections of the cardboard tubes so the snake can bend and move. The project is begun by researching snakes and finding out facts about different types of snakes. Once the snakes are built, they then paint them, and if a rattlesnake has been constructed, then the rattler needs to be filled with an item to create a shaking sound.

Science skills (STEM) are used in our music class (non-STEM). Tuning forks are used to show the children different frequencies of sound.

Middle School: Students in our 8th grade research the Globe Theater and designing sets. Here, engineering knowledge and skills, are incorporated with the Arts. Play production sets for the students' own 8th grade play

are created. Music is connected to sound effects needed, art is connected to the building, designing, and painting of the flats for background scenery, and the students also learn how to work the stage lights, and microphones.

Students in 6th Grade, in their Social Studies classes, over 7 weeks, work in teams ("nations",) to design catapults. They must develop a language and trade with neighboring nations for building materials, incorporating Mathematics/Economics and Language Arts. (Each team/nation starts with certain "natural resources" such as rubber bands and Popsicle sticks that other teams may need for their design.) After collecting resources and engineering their model catapult, students will "battle" and the nation with the best design claims victory/conquers their neighbors.

3. **Project-based Learning:** Describe how student complete self-directed authentic project-based experiences in all STEM disciplines. Are any non-STEM disciplines integrated? How often are these project-based experiences scheduled?

As indicated in our response to question 1, each teacher is responsible for implementing [8] 5-week activities/projects throughout the school year.

Primary: Social Studies and Science are project based. Students do at least one project per unit of study. Some examples are:

-1st grade family trees [students learn about genealogy, and about the structure of living trees]

-2nd grade solar system creative writing project [students use iPads to research before beginning]

-Kindergarten biome books and habitat construction.

Intermediate and Middle School: STREAM is incorporated in both individual and in group projects, including those based on the solar system, kitchen science, and invention convention.

New this past year, 6th Grade students, during STREAM time, were taught in collaboration by Social Studies, Science and Math faculty to learn about water systems. As an introduction in Social Studies class, students watched videos and read about irrigation and how societies adapt to their environment. Students learned about aqueducts and other examples of how people transform the land. Then, student teams were challenged to design a system to solve the problem of irrigating farm land. With criteria they had to meet for spreading out resources, students imagined, measured, and built a system for distribution of water that had to go both "uphill and downhill", and had to "divide the water in 4 different paths at the end". Students had the freedom to choose their own design and materials, and had access to the Library and Computer Lab for research. The Math teacher explained water velocity/ flow to the teams to help get the water to go uphill. After an initial build, students could test their designs, troubleshoot, and make adjustments before the final test. At the conclusion, students could visit the Niagara Power Project to see a real-world example of hydroelectric engineering.

Middle School students, during Math class, planned a Thanksgiving Dinner. They were asked to select the dishes to be served, calculate the quantities of ingredients based on the number of guests, research the prices of the ingredients & determine a budget, and design the invitations/menus.

Middle School students, during STREAM time, were tasked with solving the problem of replacing our aging school playground. They chose the interactive play equipment, worked within a budget, used criteria to select the best materials for the fence, flooring, etc., and finally had to present their work by plotting/drawing the elements onto a planning grid.

4. **Connections to STEM Careers:** Describe how students complete tasks in a simulated or real STEM work environment. How is student-choice included in exploring multiple STEM careers?

8th Grade Students take part in our year-long Career Awareness Class. Begins with survey on student career interests, includes research into education/credentials needed for chosen career, one-on-one coaching, culminating in a real-world shadow day in the field.

Last year, Middle School students were able to participate in a presentation by Alex Fernandez, (formerly at Yahoo!, now at BAK USA), who talked about his career path before a presentation/demonstration of 3-D Printing/design and Augmented Reality. Students also tried the V/R glasses. (Our students study 3-D design using Google Sketchup in Technology Class)

7th Grade Students engaged in a multi-week Technology Careers Project during Technology Class. Each student selected a different career in technology to research, prepared a paper and PowerPoint, and presented their findings to the rest of the class. Peers recorded the presentations and students were given tips to improve public speaking skills.

Primary Grades: STREAM Academy Courses are offered to help students explore careers and to engage them in activities that connect STEM learning experiences to careers. PEAP (Primary Engineering Adventure Program) helps students in Grades K-3 discover engineering. Our Lego and K'nex Club, also for students in Grades K-3 helps the children build structures and learn about simple machines. These academy courses provide an engaging, playful experience for young students.

Each primary grade has a "community" unit in which they learn more about community helpers each year. This involves interviews, field trips, map exploration, walking neighborhood tours, presentations by students, and more.

Intermediate/Middle School: Rocket Club is offered as an Academy Course to students in Grades 4-6. Students are learning about several different types of rockets, designing their own rockets, and then launching their rockets and watching them fly. Students in art class learn about fashion design, landscape design, and car design.

5. **Application of Engineering Design Process**: Describe how students are required to demonstrate higher order thinking skills in the engineering design process while using the full complement of design steps as well as iterative thinking. How do students demonstrate the everyday technology of their choosing and ideas that could improve the technology device or item? How often does this occur?

Teachers are encouraged to introduce EDP principles in their weekly STREAM classes and as a part of each of the 5-week STREAM activities/projects. Some examples include:

Pre-K: Students were asked to help develop a better apple pie. Students taste-tested several kinds of apples and voted on their favorite to help make the best version. The teachers presented the results on an "apple" pictogram.

Primary: In Math and Science, and afterschool STREAM clubs, students often have to "test" and problem solve ways to make their designs better, then rebuild to fulfill requirements.

Intermediate: 4th Graders did background research on plane designs. They then specified requirements to making paper airplane designs. They developed their own planes and tested them, measuring distances traveled. After testing, they evaluated their results, and then redesigned if needed.

Middle School: These students, using everyday food boxes, had to design a type of robot following specific requirements. 1) It had to be freestanding. 2) It had to look human. 3) It had to look like it could move. Development work was needed, building, observation, and sometimes redesign.

Grade 5 students participated in an Invention Convention over several weeks during their STREAM time. Students began by learning the origins of this planet and changes to the environment. Next, students responded to surveys, identifying areas of environmental protection that were important to them. Based on this, they were divided into teams which each picked a specific environmental problem that they saw happening in our world today. They visited the library and computer lab to research conservation methods and to gather ideas. After brainstorming a solution to their chosen problem, the teams used Google SketchUp to create scaled drawings digitally on the computer, of a product to help our world. Students built models to represent their inventions using materials of their choosing. One team, for example, chose to improve upon the designs of the leaf blower and the shop vac to create the "Trash Terminator", a backpack-shaped device for picking up litter efficiently in large quantities. Each group created an information trifold, determined the budget for production & selling price, created a slogan, and filmed commercials to promote their new product. Students presented their projects to their peers and at the school's annual Open House. Each team member was peer-reviewed at the end of each class period based on a grading rubric for individual effort, and for accountability (completing tasks delegated by teammates.)

6. **Technology Integration**: Describe how students are provided high-quality resources and how teachers have access to high quality training to support use of technology integration. How do students regularly use technology to support scientific practices and cognitive skills? How are students given choice in using technology and in transferring skills to solve real-world problems?

Primary Grades: A classroom set of iPads is available for the Primary classes to share, and are used daily. These iPads have been used for research, to find pictures to help with construction, or to view Youtube videos to look at real life examples before building structures, such as bridges, levers, etc.

Intermediate/Middle School: Two classroom sets of Surface Tablets are available for use with classes. These surface tablets have been used for 3D drawings, collecting data, and researching designs. A classroom set of iPads is also available for these grade levels to use.

The school also has a computer lab with 24 desktop computers. All classes are scheduled for technology classes at least once a week throughout the entire school year. The computer lab is also available for use during study halls for Middle School students.

New this year, by mid-year, we will be one-to-one with touchscreen laptops for 6^{th}-8^{th} grade, and will continue onto the Intermediate and Primary grades in the coming years.

All classrooms have Mimio setups, laptops, projectors, and document cameras. Teachers are able to receive professional development on how to integrate technology into smart lesson plans through training over the summer and at PD days.

Some teachers incorporate the Plickers app during math instruction to create a fun, interactive learning environment.

An example of a classroom using technology is when the 4th graders created videos in their technology class, using these to help their classmates as a tutoring device to help them study sample problems for their state math assessments. The videos were uploaded to Youtube so students could review at home as well.

NYS STEM Quality Learning Rubric

Not Evident	Emerging	Engaged	Accomplished
#1 Degree of STEM Integration			
No opportunities for students to consider relationships between STEM disciplines,	Students complete tasks that integrate knowledge/skills from two of the STEM disciplines.	Students complete tasks that integrate knowledge/skills from three of the STEM disciplines.	Students complete self-directed tasks that integrate knowledge/skills from all four STEM disciplines and solve an authentic problem.
#2 Connections to Non-STEM Disciplines			
No opportunities for students to make connections between their STEM learning and other disciplines (ie. The arts, Language Arts, Social Studies).	Students are encouraged to make connections between STEM and non-STEM disciplines but are not performing tasks that integrate those disciplines.	Students complete tasks that integrate knowledge/skills from STEM to at least one non-STEM discipline.	Students complete self-directed tasks that integrate knowledge/skills from STEM to multiple non-STEM disciplines including instructional support for quality performance in the non-STEM disciplines. The tasks solve an authentic problem.
#3 Degree of Use of Project-Based Learning (PBL)			
No opportunities for students to be engaged in PBL in STEM disciplines.	Students are engaged in PBL at least monthly in all STEM disciplines.	Students are engaged in PBL at least monthly in all STEM disciplines and at least one non-STEM discipline.	Students regularly complete self-directed, authentic PBL experiences in all STEM disciplines and multiple non-STEM disciplines.
#4 Connections to STEM Careers			
No opportunities for students to explore STEM careers relating to STEM learning experiences.	Students explore careers in some STEM fields but there is no connection with STEM learning experiences.	Students explore one or more STEM careers and are engaged in activities that connect STEM learning experiences to careers.	Students complete tasks in a simulated or real STEM work environment of their choosing and explore multiple STEM careers that directly connect to their STEM learning environment. Tasks include: describing the work/workplace, noting observations in a journal, describing the educational and skill requirements and reflections on the career/career experience.

#5 Individual Accountability in Collaborative Work

No opportunities for students to work or learn in collaboration with other students.	Students are encouraged to work in teams but the work is informal with no attention to individual accountability.	Students are required to work in formally structured teams with specific methods to measure individual and team accountability.	Students are required to work in formally structured teams with clear evaluation of expectations for team and individual accountability including instruction on interpersonal skills valued in the real-world work setting. Students contribute to the development of accountability rubrics.

#6 Application of the Engineering Design Process

No opportunities for students to apply the engineering design process.	Students are encouraged to refine higher order cognitive skills but with no direct connection to an engineering design process.	Students are required to demonstrate higher order cognitive skills in at least half of the steps in the engineering design process in suggesting an improvement to an everyday item.	Students are required to demonstrate higher order thinking skills in the engineering design process while using the full complement of design steps, well as iterative thinking. Students demonstrate the process of an everyday technology of their choosing and ideas that could improve the technological device or item.

#7 Assessment of STEM Learning

Student learning is assessed infrequently and with traditional measures (quizzes, multiple choice tests).	Student learning is assessed periodically with at least one performance-based assessment task.	Student learning is regularly assessed with at least one performance-based task tied to a well-developed rubric.	Student learning is regularly assessed with multiple indicators of success including more than one authentic, performance-based task, presentations and portfolio entries tied to well-developed rubrics requiring students to apply real-world knowledge/skills.

#8 Connections to STEM Partners

No opportunities for students to benefit from STEM partnerships with other schools, community resources, professional organizations, higher ed or businesses.	Students are engaged in a STEM experience resulting from a STEM partnership.	Students are engaged in multiple STEM experiences resulting from two or more STEM partnerships.	Students regularly complete self-directed, authentic STEM experiences resulting from well-developed partnerships that are purposeful, monitored and evaluated.

#9 Degree of Technology Integration

No opportunities or resources for students to use technology to support scientific practices and cognitive skills. Technology is used as a demonstration tool in a teacher-centered environment.	Students are provided limited resources to support technology integration and are occasionally required to use technology to support scientific practices and cognitive skills.	Students are provided sufficient resources to support technology integration and are frequently required to use technology to support scientific practices and cognitive skills. Teachers are provided sufficient technology training and support.	Students are provided high quality resources and teachers have access to high quality training to support technology integration. Students regularly use technology to support scientific practices and cognitive skills and apply these transferable skills to solve real world problems in a student-centered environment.