CATHOLIC SCHOOL - FENTON

Beyond Sunday

2016-2017 Academic Capacity Enhancement Grant: *Application Narrative*

1. GENERAL INFORMATION

A. Grant Activity Title: *STREAM Curriculum and Makerspace Initiative*
B. Applicant School: St. Paul School, Fenton (STP)
C. Application ID: 1718SE0002A

2. NEED/IMPACT

A. Extent of Need: Aggregated student achievement data on the nationally-normed ITBS exams indicate that, overall, STP students benefit greatly from their STP educational experiences. However, disaggregated ITBS and related assessment data evidence a need to better educate a) students who struggle academically (for a variety of reasons, including learning disabilities, ELL challenges, and learning style differentiation needs) and b) students who generally excel academically but are not appropriately challenged by STP's current curriculum.

Approximately 30% of all STP students are served by our Learning Consultants – and nearly 50% of these students do not have IEPs or a medical diagnosis for a disability. In the aggregate, these students generally score at the 51st percentile on the ITBS Mathematics exam, at the 58th percentile on the ITBS Language Skills exam, and the 56th percentile on the Science exam. Those results do not compare favorably with the rest of the St. Paul student population, which scores at the 60th, 67th, and 70th percentiles on those exams, respectively. These academic struggles are at the heart of many parents' decisions to transfer their children to area public schools with more resources for supporting their children's achievements.

At the other end of the spectrum is a group of about 26% of STP students who generally score at the 90th percentile on those ITBS exams. Despite their testing accomplishments, though, a significant number of those students (and/or their parents) have evidenced concern about a lack of intellectual challenge from their courses and a lack of meaningful engagement in their studies; in a growing number of cases, that deficiency is strongly influencing decisions to leave STP for the excellent area public schools, all of which feature curricular and co-curricular programs designed specifically for this higher-achieving population.

These data suggest that there is more we could and should be doing to solidify, strengthen, and synthesize learning for all students – *but particularly those at the academic margins, and particularly as they age and their educational interests and learning styles evolve and mature.*

A second demonstrable educational need informs this grant request. While offering a fairly standard curriculum addressing all major areas of study, STP has struggled to adequately *integrate* teaching and learning across academic disciplines in a manner that is most educationally impactful per the extensive science on learning. STP assessment data suggest that learning in one area or discipline is not necessarily strengthening or supporting learning in other areas, calling out a need for greater integration in curriculum design and pedagogy. The

literature on this topic documents the benefits of hands-on application of learned principles, creativity in problem-solving, experiential learning, and the novel application of knowledge in new educational contexts – for all students, but *especially* for students who struggle academically and for those seeking advanced intellectual challenges.

B. How Grant-Funded Activity Will Meet Need: The STREAM/Makerspace initiative proposed herein is expressly designed to address the curricular and pedagogical challenges and gaps identified above. Our proposal is greatly informed by and will utilize the *Engineering is Elementary* (EiE) curriculum design principles developed by the Museum of Science in Boston, and based on Wiggins and McTighe's *Understanding by Design*. The EiE principles are both simple yet transformational, as they asks students to work through iterative cycles of questioning, critical thinking, action, and meta-cognitive reflection on the success (or lack thereof) in their work. More specifically, the EiE's process asks students to:

- *ASK: What is the problem? How have others approached it? What are your constraints?*
- *IMAGINE: What are some solutions? Brainstorm ideas. Choose the best one.*
- *PLAN: Draw a diagram. Make a list of materials or information you will need.*
- *CREATE: Follow your plan and create something. Test it out!*
- *IMPROVE: What works? What doesn't? What could work better? Modify your designs to make them better. Test it out!*

These "design principles" are not, however, applicable only to problem-solving in the context of math, science, or engineering. They are educational universals that can be modified and employed by teachers to support student learning *across the curriculum* as students engage with the context and problems raised in history, social studies, religion, fine arts, literature, etc. They promote creative thinking, hypothesis development and testing, use of multiple modes of learning (capitalizing on various learning styles), reflection/meta-cognitive analysis – all hallmarks of higher-level, deep, and more demonstrably impactful learning.

The EIE Curriculum offers a strong Language Arts component. All units for grades 1 - 5 start with a storybook that introduces the engineering concept as a problem solving opportunity for a real world issues. As the class progresses through the unit, more opportunities arise for reflection back to the storybook. The students' hands on activities then move to a broader view of the engineering field and the technologies used in that area. The next activities include gathering scientific data and applying it to concepts learned in the unit of study. The final project of the unit ties back to the challenge faced in the storybook. The reflective worksheets and vocabulary terms supplement the language arts component. Students will also present their final projects reinforcing speaking and listening skills. The units for Grades 6 -8 are very similar in the layout of the lessons, except the engineering field is introduced through an interactive activity. Students use a scientific journal to access information and record their reflections from their activities.

The storybooks' and journals' use of real world connection ties with our religion component. STP students will see a connection from their projects to an added religious standard connecting their lesson to what their project mean as a Catholic. Each project will reinforce a Corporal or Spiritual Work of Mercy. As STP students see the engineering concepts as a venue to help others, they are opened to new ways of living out the Works of Mercy.

- For example, in the 5th Grade unit titled "Water, Water, Everywhere" students design water filters. We will ask students to demonstrate how this project helps them live out the Corporal Work of Mercy to "Give drink to the thirsty" via a service project to aid in supplying clean water to those without it.
- For example, in robotics students will be required to create a robot that can complete given objectives (move a ball, sort colors, communicates, etc.) and to validate the usefulness of their robotic by connecting it to a Work of Mercy. Students might choose to create a robot that picks up objects and sorts them according to color that could aid a food pantry by sorting donated canned goods thus connecting it to the Corporal Work of Mercy to Give Food to the Hungry.

All teachers will receive training on the engineering design process of *ASK, IMAGINE, PLAN, CREATE, IMPROVE*. Once they are educated in this process of critical thinking and reflection on work, teachers can incorporate that way of thinking into their non-STREAM lessons. Some subjects already use a similar process. Our students are familiar with the Writer's Workshop method of Prewrite, Draft, Revise, Edit and Publish. For other subject like Social Studies, this might be a new concept that will assist students to have greater, deeper understanding of a topic. Here are some examples of how this may occur:

Subject	Social Studies	Religion	Computer Science
Lesson	Middle school students learning about World War II are given the task of advisor to President Truman as he decides how to end World War II.	Second grade class learning about the Catholic Church in preparation for their First Communion create a model of a church.	Sixth grade students design their own video game in Computer class using Scratch programming.
ASK	What is the best way to end the war with Japan?	What are the items needed in a Catholic Church?	What are the elements you would like include to create a fun, engaging computer game?
IMAGINE	What are some of the other options? Pick an option to advise to President Truman.	Think about the layout for your church. Which design do you like best?	How do you image your game working?
PLAN	What materials do you need for your plan?	What materials do you need for your plan? Draw a diagram of the church.	What coding algorithms do you need to know to make your game work?
CREATE	Describe how the plan was carried out.	Create your model church	Make your game on Scratch.
IMPROVE	What are the consequences of the plan?	Look for ways to improve your diagram.	How can you use that feedback from your classmates to improve your game?

When students are creating their projects for their EIE Curriculum or participating in the robotics program, they will have the opportunity to utilize our new Makerspace Classroom. The Makerspace Classroom will be located next to our computer lab. The room is currently being

used for the production of our Live Morning Announcements Broadcast. The access to our video equipment makes video presentation accessible to the students in our Makerspace Classroom. This large classroom will have several low round tables for students' workspace. This will allow for collaborative projects, close proximity to floor space if needed, and a safe location for laptops and iPads. There will also be open areas where student can test out their robotics. The room is currently supplied with a projector and smartboard, but have a different look and feel that a typical classroom. All the materials and the classroom will be maintained by the computer teacher.

This initiative will be conducted throughout the daily curriculum and into the co-curriculum as an after-school program. Accordingly, this initiative will support both the general STP student population and, in particular, those target populations identified above. All STP teachers will be involved, and the EiE educational principles will come to characterize curriculum development and pedagogy across academic areas – bridging and strengthening learning institution-wide.

C. How Need is Currently Met: As noted in Section 2.A above, there are gaps in the STP curriculum that this initiative is designed to address. All STREAM subjects are currently taught at STP – to various extents, and at various levels of success with particular student populations. But they are most frequently taught in isolation and, as such, are not as mutually informing and mutually reinforcing as they should and could be.

D + E. Assessment Plan (Outcomes, Evaluation Methods, Use of Assessment Data for Improvement: The outcomes, evaluation methods, and plans for using assessment data to inform programmatic improvements are as follows:

STREAM Curriculum & Makerspace Initiative Assessment Plan

#	Program Outcomes	Evaluation Methods	Use of Assessment Data for Improvement
	What we expect students, or STP as an institution, to achieve as a result of this initiative.	*How we'll document and measure performance toward achievement of the outcomes.*	*How we'll regularly use assessment data to "close the loop" and inform improvements in curriculum and pedagogy.*
1	The average ITBS score for *all STP Students* on each of the ITBS exams will increase to the 80th percentile by 2020.	This data will be documented with data from the annual IOWA Basic testing given in the Fall of each school year.	Monthly Team PLC Meetings will be held with the administrator for data comparison and collection. Strategies will be designed to ensure that all students are succeeding. Monthly classroom observations by the administrator to ensure that new teaching strategies are being integrated into daily practice.
2	The ITBS Mathematics, Language Skills, and Science test scores of *students served by our Learning Consultants* will increase by 3 percentile points each year from 2017-18 through 2019-20.	All IOWA Basic scores of students served by our Learning Consultants will be compared yearly to measure this increase. These scores will also be included in the average of all STP students above.	Monthly Team PLC Meetings will be held with the administrator for data comparison and collection. Strategies will be designed to ensure that all students are succeeding. Monthly classroom observations by the administrator to ensure that new teaching strategies are being integrated into daily practice.

3	The number of students whose academic performance no longer warrants regular support via the STP Learning Consultants will increase by 10% each year from 2017-18 through 2019-20.	We will use baseline data from the beginning of each school year, and document progress	Monthly Team PLC Meetings will be held with the administrator and the Learning Consultants for data comparison and collection.
4	The percent of middle-school students indicating on annual surveys that they receive sufficient academic challenge or engagement across the curriculum will increase by 10% annually from 2017-18 through 2019-20.	Middle school students will participate in a "Serravallos Engagement Inventory" with data review annually.	Teachers will use the engagement survey with students (observational) weekly and data will be tabulated at the end of each unit of study. This will be analyzed by class as part of the Monthly PLC Data Meeting.
5	The percent of parents indicating on annual surveys that their children receive sufficient academic challenge and engagement across the curriculum will increase by 10% annually from 2017-18 through 2019-20.	We will use quantitative surveys to gather subjective opinions from parents beginning with baseline data from the 2016-17 school year.	This data will be collected at the end of each school year and analyzed in the summer evaluation meeting. If the curriculum is too easy or too difficult, outcomes could be affected. Both curriculums allow for the opportunity to change grade levels for the units of study.
6	The percent of parents who transfer their children from STP to an area public school because of a perceived lack of academic challenge or cross-curricular engagement at STP will decrease by 10% annually from 2017-2018 through 2019-20.	We will use baseline data from 2016-17 school year, and compare with each concurring year to see if there is a decrease in transfers due to academic challenge or lack of challenge.	This data will be collected at the end of each school year and analyzed in the summer evaluation meeting.

3. CAPACITY

A. + B. Collaborations & Partnerships: Internal collaborations will be integral to the success of the initiative. Teachers will collaborate via teams designed to advance the integrative principles of EiE in curriculum design while continuing to ensure best disciplinary practices. Common planning time has been designated to report on progress and address needs. Parents with expertise in design-based thinking, including professionals from throughout various

engineering-related disciplines, will be asked to speak both with students and teachers about their work and its impact on their intellectual, professional, and spiritual development.

Externally, our partnership with Engineering is Elementary is critical to the professional development of our teachers in the context of the initiative; one STP teacher will be trained as an EiE Collaborator. For the robotics component of our STREAM curriculum, we will collaborate with and learn from the experience of other teachers who are part of the Legos Education community. We also intend to partner with teachers and leaders of other area schools to organize a collaborative Robotics Competition/Showcase; we are reaching out to the Clavius Project, as well as leaders of area high schools that participate in the FIRST Robotics program for their assistance and support.

C. Key Personnel: The key personnel implementing this initiative will be:

- *STP Principal Fran Nieburg:* A veteran school leader with extensive experience in the award-winning Parkway School District, Mrs. Nieburg will provide critical leadership of this effort informed by the successes of competitor public institutions. She will provide teacher development/support, conduct program evaluation and data analysis, and lead the continuous improvement efforts informed by student achievement and related assessment data.
- *STP Technology Coordinator Debbie McCaslin:* A teacher and school technology leader with extensive experience in Archdiocesan schools, Mrs. McCaslin will oversee the selection and purchase of all equipment, coordinate professional development, and oversee the implementation of program evaluation efforts.

D. Impact of School Closure or Merger: Should STP merge with another Archdiocesan school, grant-funded equipment and related resources would continue to be employed in the merged institution (assuming agreement among principals/curriculum directors). A key benefit of having an STP teacher trained and certified as an EiE Collaborator is that she/he can be an important professional development resource to any area Archdiocesan school. In the event of STP's closure, all grant-funded equipment and resources would be allocated to other Archdiocesan schools per Archdiocese policy; in such a case, STP faculty and leadership would surely welcome the opportunity to continue to support the project and the Archdiocese's students, even if at another institution.

4. BUDGET

A. Additional Funding: STP's intent is to institutionalize the programs of this proposal and eventually incorporate them fully into the annual operational budget. This will take several years to accomplish, however, as the successful implementation of the programs will enable us to phase out other, less impactful programs in favors of our STREAM and Makerspace initiatives. In the meantime, continued external funding will be necessary to support procurement of certain non-renewable program resources (e.g., computers, robots, lesson materials, etc.). Targeted funding will be generated from fees for the STREAM after-school programs, as well as from additional grants from sources such as Cardinals Care, the President's Computer Science For All Initiative, and the programs of the American Innovation and Competitiveness Act.

The computer science education programs currently used at STP (i.e. Scratch, Code.org,

Kodable) are free for schools, and engineering resources like Tryengineering.org and Boeing Educational Resources offer services for educational institutions at no cost. Our plan is to take extensive advantage of such no-cost resources, and to continually foster relationships with educational, corporate, and industry partners that will, either directly or via in-kind donations of professional expertise and equipment, sustain these programs.

B. Impact if Grant Not Funded: In the absence of Beyond Sunday finding, it is unlikely that this STREAM Curriculum and Makerspace Classroom initiative could be implemented at STP in the near future; the internal budget re-allocations noted above to support long-term program sustainability would not be sufficient to cover the comparatively substantial initial expenses requested via this grant proposal.

5. PRIORITIES

A. Alignment with Archdiocesan Initiatives: By integrating the Spiritual and Corporal Works of Mercy into each STREAM Unit, students will not only be learning their valuable core Catechesis, but also how to implement their Catholicism into daily projects. As part of each culminating activity in each unit of study, students will be required to relate their project to a particular Work of Mercy. Students' focus will move from their creation to the bigger picture of how they can use their gifts and talents to be stewards of Christ.

Additionally, our STREAM Curriculum and Makerspace initiative aligns well with several key Archdiocesan initiatives, as detailed below.

Archdiocesan Initiative	How STP's STREAM & Makerspace Initiative Aligns...
Be One: *Foster Missionary Discipleship*	By integrating Christ's Works of Mercy into each STREAM unit.
Be One: *Promote human dignity and social responsibility*	By helping students define the value of their work in terms of its benefit to others.
Be One: *Embrace a Culture of Leadership*	By demonstrating to students how their work can transform their talents into leadership opportunities.
Be One: *Secure the future of Catholic education*	By specifically implementing curricula and providing resources to best support the populations of students most likely to transfer to our high-quality area public schools.
Alive in Christ! (Objective 1.1): *Develop and implement benchmarks for achieving excellence in academics and adopt standards that require schools to be fully and authentically professional in the academic instruction in accordance with "best practices" in education today.*	This proposal is a benchmark-driven initiative grounded in "best practices" for curriculum design and pedagogy; it is in formed by contemporary research in learning science and leading curriculum development resources.

NSBECESS* Standard 2: *Provide a rigorous academic program for religious studies and catechesis in the Catholic faith, set within a total curriculum that integrates faith, culture, and life.*	This proposal provides curriculum and materials needed to initiate a STREAM curriculum allowing academically engaging opportunities and afterschool enrichment activities to benefit all STP students.
NSBECESS* Standard 7: *A clearly articulated, rigorous curriculum with relevant standards, 21st Century skills, and Gospel values, implemented through effective instruction.*	The EiE Curriculum aligns to Missouri State Standards, instructs students to use engineering as a venue to solve real world problems. STP teachers will be thoroughly prepared in Professional Development and provided material for successful instruction.
NSBECESS* Standard 8: *Use of assessment methods to document student learning and program effectiveness...to inform the continuous review of the curriculum and the improvement of instructional practices.*	See our Stream Curriculum and Makerspace Initiative Assessment Plan in Section 2: Needs/Impact D. Assessment Plan
NSBECESS* Standard 12: *Develops and maintains a facilities, equipment, and technology management plan designed to continuously support the implementation of the educational mission of the school.*	The Technology Committee completed St. Paul's Technology Plan for 2015 – 2021. An objective stated in this plan is to begin researching and integrating a STREAM curriculum and robotics program to our school. Our Technology plan is updated annually and discussed at our monthly meetings.
National Standards and Benchmarks for Effective Catholic Elementary and Secondary Schools	

6. Delivery

A. Detailed Description of Proposed Activity:

B. Timeline:

Date	Activity
By May 1, 2017	Purchase all devices and materials
By June 1, 2017	Set up Professional Development for Engineering is Elementary Curriculum
Summer 2017	Set up Makerspace Classroom
August 2017	Start STREAM Classes

C. Post-Grant Sustainability:

Item	Lifespan	Annual Recurring Cost PLAN A	Annual Recurring Cost PLAN B	Annual Recurring Cost PLAN C
24 laptops	5 years	none	none	none
Laptop Cart	7 years	none	none	none

20 iPads Air 2	7 years	none	none	none
20 iPad Covers	7 years	none	none	none
iPad Cart	7 years	none	none	none
EIE Curriculum	7 years	*$3500 in addition to some materials added to student supply list	*$3000 in addition to some materials added to student supply list	*$2100 in addition to some materials added to student supply list
Mindstorm Robotics Materials	Legos' lifespan is unlimited; new or improved legos may be needed in 3 – 5 years	none	none	none
We Do 2.0 Legos	Legos' lifespan is unlimited; new or improved legos may be needed in 3 – 5 years	none	none	none
Sphero	7 years	none	none	none
3D Printer and supplies	5 years for printer Material purchase annually	Materials $300		
Materials	One-time purchase			
Total		$3,800	$3000	$2,100.00

*All materials are for 30 students. If a teacher feels it would be beneficial to work in pairs or small groups materials would not need to be purchases annually.

Projected Income:

After School Enrichment Activities (Robotics)

Class Cost	Students	Instructor Cost	Income/session	Sessions/year	Projected yearly Income
$50	12	$100	$500	6	$3000

D. Replication/Scalability:

Plan A:

Engineering Curriculum:

There are 21 units for grades 1 - 8 taught by classroom teachers. This plan would provide 3 units per year for students in grades 1 – 5, and 2 units per year for students in grades 6 – 8. There are 4 additional units to be used for after school enrichment opportunities for students in a mixed age setting (K-2, 3-5, 6 - 8). The students pay for the class in order to cover the cost of the supplies.

Robotics:

Robotics will be incorporated into our Computer Science Curriculum for students in grades 1 - 8. There would be 24 sets of robotics for students in grades 6 – 8 to work in groups of 3 – 4; 12 sets of robots for grades 4 -5 and 12 sphero for students in grade 1 – 3.

Digital Printer:

Three dimensional art will be incorporated into our computer science curriculum by designing objects digitally, then seeing them come to life on the printer.
Materials:
Includes items such as plastic storage containers, rugs, tables, chairs, etc.

Plan B:
Engineering Curriculum:
We would eliminate the after school enrichment materials.
Robotics:
Our robotics component would not change
Digital Printer:
Not included in this plan.
Material:
Not included in this plan.

Plan C
Engineering Curriculum:
The number of units would be reduced from 21 to 16. All students in grades 1 - 8 would have 2 units of the engineering curriculum.
Robotics:
We would reduce the materials purchased from 24 sets to 16 for students in grades 6 -8 and from 12 – 8 for students in grades 4 – 5. The robotics component for grades 1 - 3 would not change.
Digital Printer:
Not included in this plan.

Table displays the materials that change in each plan. A full budget is included in the attachment section.

Materials	PLAN A	PLAN B		PLAN C		
	Amount	Budget	Amount	Budget	Amount	Budget
EIE Curriculum	**25 Units**	$17,730.00	**21 Units**	$14,400.00	**16 Units**	$11,352.00
Mindstorm Robotics	24 sets	$9,358.80	24	$9,358.80	**16**	$6,239.20
We Do 2.0 Legos	12 sets	$2,111.40	12 sets	$2,111.40	**8 sets**	$1,407.60
3D Printer and supplies	1	$1,700.00	**0**	0	0	0
Materials		$1000.000	**0**	0	0	0
Total		$55,000.20		$48,970.20		$42,098.26

Project Budget

Items	PLAN A		PLAN B		PLAN C		Source	Status
	Amount	Budget	Amount	Budget	Amount	Budget		
Laptops ($500 Each)	24	$12,000.00	24	$12,000.00	24	$12,000.00	CDWG	Requested but not committed
Laptop Cart	1	$700.00	1	$700.00	1	$700.00	Amazon	Not yet requested
*iPads Air 2 ($400 Each)	20	$8,000.00	20	$8,000.00	20	$8,000.00	Apple Store or Amazon	Not yet requested
iPad Covers ($25 Each)	20	$500.00	20	$500.00	20	$500.00	Amazon	Not yet requested
IPad Cart	1	$700.00	1	$700.00	1	$700.00	Amazon	Not yet requested
*Engineering is Elementary Curriculum; Professional Development	25 Units	$17,730.00	21 Units	$14,400.00	16	$11,352.00	Eie.org	Not yet requested
*Mindstorm Robotics	24 sets	$9,358.80	24	$9,358.80	16	$6,239.20	Lego Education	Not yet requested
We Do 2.0 Legos	12 sets	$2,111.40	12 sets	$2,111.40	8 sets	$1,407.60	Lego Education	Not yet requested
Spero	12	$1,200.00	12	$1,200.00	12	$1,200.00	Sphero	Not yet requested
3D Printer and supplies	1	$1,700.00	0	0			Amazon	Not yet requested
Materials		$1000.00	0	0			Amazon	Not yet requested
Total		$55,000.20		$48,970.20		$42,098.26		

*Price increase/decrease as of Jan. 1, 2017