



2018-19 STEM Innovation Grants

Academy of Whole Learning, St. Louis Park

Life Science Mini-Labs

Grades K-8

Students in grades K-8 will explore life science, integrating the engineering and design process. The Academy of Whole Learning has multiple grade levels in each class, as a result teachers are required to meet the needs of different learning levels within one classroom. We plan to meet our students' needs by teaching through "mini-labs." Mini-labs will expose the students to a topic and allow them to explore through hands-on experiences. This will also allow us to build on concepts over time and provide flexibility with our learning path. Bio-mimicry will be the focus, as it incorporates both life science and the engineer and design process in an engaging and relevant way. Students will create a final project using bio-mimicry to solve a problem. Life science is a great platform to integrate the crosscutting concepts for students. Learning about topics such as life cycles, ecosystems, cells, environmental changes, habitats and more, students will also be exploring the crosscutting concepts, providing students with a sustainable way of thinking that they can apply to various situations on a personal, local, and global level. Often, our students struggle with generalizing their knowledge—using what they learn in school and applying it in other ways or areas of their life. Teachers will use the crosscutting concepts to help students apply their thinking outside of the classroom.

Benilde-St. Margaret's, St. Louis Park

Design Thinking in Math, Engineering, Computer Science, and Art

Grades 7-12

Design thinking is a real-world entrepreneurial process in which the designer (whether an engineer, artist, or computer programmer) proceeds through an iterative cycle to empathize, define, ideate, prototype, and test. Benilde-St. Margaret's is creating several student experiences to follow this model, giving students direct experience with a methodology they may use later in their careers. This grant is being written to support four classes that will use this process during the 2018-2019 school year: Junior High Math, Junior High Engineering, Senior High Coding, and Senior High 3D Make It art class. We are also planning to start a new "Shark Tank" competition in which students compete by proposing new products or processes to a panel of adult entrepreneurs. The prototype stage of the design thinking process can best be supported by allowing students to have the tools necessary to create realistic representations of their ideas. Benilde – St. Margaret's will use the MISF STEM grant to augment the purchase of some flexible, maker technology that can be used throughout the school. We will use these initial successes to expand this real-world design thinking process to other disciplines, including science, business, and faith formation.

Cotter Schools, Winona

Cotter Bike Shop

Grades 9-12

We are seeking to develop a Cotter Bike Shop class. Students will register for this Flex class. Flex groups meet twice per week for 40 minutes. Students in this Flex class will learn the mechanisms and systems that make bicycles work. They will learn how to diagnosis a problem when a bike isn't working properly, as well as how to fix the problem. Students will be trained in the art of bicycle mechanics, learning one system at a time, and graduating to a new system upon demonstration of accurate diagnosis and solution. Cotter currently has a large collection of bicycles for student and staff use. Imagine taking class on a bike ride to study science, art, literature, architecture, nature! Students in this class will use the scientific method, the engineering process, math skills, tools and technology to identify and solve problems. These students will maintain and repair the Cotter bikes and eventually repair other bicycles for a small fee or for free, and then donate the working bicycle to community members in need. Our goal is to grow and provide bike maintenance services to others in our community and to encourage students to get out and ride!

Cretin-Derham Hall, St. Paul

Cretin-Derham Hall Challenge Lab

Grades 9-12

Cretin Derham Hall is seeking an Innovation Grant to create the CDH Challenge Lab. The Challenge Lab is a place where learners define the problems they want to solve and design solutions to address them. Leveraging technology, students engage in activities and projects that expose them to design thinking, engineering, and real world experiences. It also provides for an opportunity for students with great ideas and initiatives to mentor other students. The Challenge Lab is an incubator for student ideas and dreams - it offers partnerships with companies, alumni, and community members to help students recognize their responsibility to be agents of positive change in the world. In the Challenge Lab students will be able to explore robotics, Arduino, Raspberry Pi, 3D printing and computer-aided design. It provides students with a place to take risks, make mistakes, reach a little higher and dream bigger each time. The Challenge Lab will be open one day a week after school in conjunction with the existing FIRST Robotics Program. The Challenge Lab will allow for more than just robotics team members to experience and explore design thinking, building and dreaming all year round.

Frassati Catholic Academy. White Bear Lake

Space: Rocket take off with dings, buzzers and lights

Grade 6

Frassati Catholic Academy is in its 4th year. We are a STREAM school, meaning our curriculum integrates Science, Technology, Religion, Engineering, Art and Math and is coordinated among the staff. As a new school, a grant from MISF could help our middle school team create an interdisciplinary STREAM curriculum unit for grade 6. This grant could support a new curriculum with a scaffolding effort in mind, around circuitry and Maker opportunities in the middle school. On a broader level, we will start 6th by introducing simple circuits using a product called "littleBits." In the coming years, 7th grade can progress to paper circuits, and by 8th grade, the effort will be to reinforce and expand the curriculum using more sophisticated circuitry work such as breadboards and Arduino projects. Perhaps, after this effort, robotics won't be such an overwhelming concept for staff and students. This is the broad vision for the development of a STREAM middle school curriculum. This grant application is the start of a three-year effort to build and grow a circuitry curriculum that is integrated, interdisciplinary and could be a cutting edge model for other schools. The 6th grade would apply the knowledge of circuitry in a unit called *Space: Rockets take Off with Dings, Buzzers and Lights*.

Heilicher Minneapolis Jewish Day School, Minneapolis

Lower School STEAM Lab

Grades K-5

Heilicher Day School is creating a STEAM lab. This past year, administrators, a STEAM consultant, and teacher leaders guided our faculty--improving pedagogy, providing training, and advising on curricular changes to build an inquiry based approach for K-8. As our faculty's knowledge has grown, the need for an innovative learning space has become clear. We've raised the initial seed money for overhead and construction, to transform an existing classroom. Beyond the initial design and construction, there is a need to fully outfit the space for the many "makers" we want to support. This calls for sewing machines, hand/power tools, technology and a wide range of materials for tinkering, designing, coding and creating. While Heilicher can budget for the renovation, this grant would enable the school to purchase materials and be fully operational for the 2018-19 school year. Teachers incorporated a hands-on, inquiry-driven approach to teaching, and identified projects that align with the school's curriculum and state standards. For example, students designed and made doorstops, a STEAM mural, sets for the school play, and tzedakah boxes. While students learned and applied knowledge in new, cross-curricular ways, teachers enjoyed the excitement that drove students to dive deep into their work.

Maplewood Academy, Hutchinson
Virtual Laboratories for Science, Math and Technology
Grades 9-12

Maplewood Academy wants to implement the use of virtual laboratories in our science, technology and advanced math curriculum. We use the connected learning model, which means that all of our classes utilize live video conferencing technology to provide a complete, interactive educational experience for high school students on multiple campuses or in a home setting. One key challenge we have faced with this model relates to the lab science classes of Chemistry, Physics and Physical Science. While students can see what is going on in these science classes through live video conferencing, we are aware that some things are lost for those who are not physically present for these lab demonstrations. Virtual labs will empower all our science students to learn from experiments that mimic what happens in the lab. We will also be able to use aspects of the virtual labs in our technology and advanced math courses like trigonometry. If funded, this project will strengthen our science courses through the use of technology. It is a final step in our goal to offer our best holistic education through the connected learning model.

Martin Luther High School, Northrop
Fish, Flora and Fuel for the Future
Grades 9-12

The Fish, Flora and Fuel for the Future project will provide equipment, teacher training and curriculum used in the new energy classroom building at Martin Luther High School. It will be half greenhouse and half classroom/shop and heated by combination of a geothermal system, solar power and biomass. The green house, in addition to a traditional, soil-based growing area, will contain an aquaponics system. The shop will contain an area for experimenting with alternative fuel sources such as alcohol, electricity, and bio diesel. STEM education will take place on all levels. The aquaponics systems will allow the school to develop and use hands-on curriculum that apply to biology, chemistry, physical science, and physics. Students will study an enclosed ecosystem in which pH levels, bio-filters, temperatures and the health of all organisms will have to be carefully monitored and maintained. This project will enhance and expand the school's ability to reach and capture the interests of students in our agriculturally driven community. By developing this project from the ground up, teachers and students will learn how to solve problems, whether it be maintaining constant temperatures in a volatile Minnesota climate, treating plant diseases, or keeping fish healthy.

Minnesota Valley Lutheran High School, New Ulm
Robotics Course
Grades 10-12

This proposal is to help fund the purchase of VEX robotics equipment to supplement materials that are already in place at Minnesota Valley Lutheran High School in order to create a new semester-long course called "Robotics." MVL has some VEX robotics equipment provided by our booster club, but not enough for a full section of students, so these materials are currently only used as a smaller unit as part of an existing STEM course. For the last two years, MVL has worked with an engineer at 3M to introduce our students to automated mechatronics as a unit in our existing STEM course, "Scientific Inquiry." This proposal is to help fund enough supplies to begin a semester-long robotics course at MVL for up to 24 students on a yearly basis. The additional supplies would supplement the partnership already in place with 3M to further our students' abilities and understanding of core STEM concepts. With the additional supplies the current STEM course, "Scientific Inquiry," would in a sense daughter a second STEM course, "Robotics."

Nativity of Mary Catholic School, Bloomington
Makerspace/STEM Innovators
Grades 3-6

Thanks to our 2017 MISF Starter Grant, Nativity of Mary was able to provide our Grades 1-3 students with enriched learning experiences through the use of our Makerspace. The philosophy of the Nativity of Mary Makerspace is that if you can imagine it, you can make it. The Nativity of Mary Makerspace is a learning environment that enables students to collaboratively use various tools, technologies and materials to innovate, invent, engineer and creatively problem solve real life situations. This program provides a flexible, differentiated learning environment where active engagement occurs. These items seamlessly fit into our existing curriculum and will enhance our knowledge of engineering, innovating, and collaborating. Through this Innovation Grant, we want to expand our Makerspace and STEM program to bridge our initial start in Grades 1-3 to Grades 3-6. We want to incorporate several more STEM experiences for our students in Grades 3-6, including, but not limited to, littleBits, Robotics, a 3D printing device, a

mobile Makerspace cart, Makedo, and a fleece/knitting station with sewing machines. By adding to our Makerspace and creating a more flexible learning environment, we hope to continue to create opportunities to spark students' success and to inspire tomorrow's innovators and inventors. Walt Disney once said, "When you're curious, you find lots of interesting things to do." Nativity of Mary wants to deepen the curiosity in the minds and hearts of every student that walks through our halls.

New Life Academy, Woodbury
STEAM through 15% Innovation Portfolio
Grades 6-12

We are eager to build a solid foundation in STEM/STEAM education of a continuous, long-term, student-driven sustainable program through our "15% Innovation Portfolio." Our goal during the 2018-19 school year is to establish five major clubs for students in grades 6-12 to engage in collaborative STEAM activities of their choice. The Robotics & Coding, Rocketry, Nature & Wildlife Ecology, Engineering and Independent Research Clubs will be facilitated by one or more STEAM teachers who have the passion and expertise in these subjects. Students will work in teams to initiate and lead their projects through scientific inquiry or engineering design and will participate in competitions within and/or outside of New Life Academy. Currently, all students are required to graduate with a portfolio that demonstrates growth in innovative thinking while in grades 6-12. By offering the new clubs, students will be inspired, learn new skills, and will be given the scaffolding needed for success. Many projects address humanitarian needs and/or environmental problems and offer innovative solutions. Through the MISF's Innovation Grant, the NLA students will benefit from resources that will prepare them for future endeavors and careers that will impact our country and the global economy.

St. Croix Lutheran Academy, West St. Paul
Practice to Product
Grades 9-12

Our project, Practice to Product, is a hands-on approach that will drive students to take concepts and turn them into products. The ability to take practice through computer systems and turn them into reality will provide real-time feedback allowing students to assess and analyze systems, practices, and products. The use of a generous Innovation Grant by MISF will assist with our STEM initiative that spans across many areas of our curriculum. The purchase of a CNC router will have direct impact on the following courses: Applied Technology, Introduction to Engineering, Principles of Engineering, STEM Capstone, Sculpture, Ceramics, Fundamentals of Art. The total cost of this project is over \$30,000. This includes the purchase of 3D printers, CNC router, laser cutter and engraver, continuing education, wind tunnel, and software. We are seeking a grant of \$7,500 to assist with the purchase of a CNC router. The other funding will come from private donations and budget allocations. We have a local business that has agreed to partner with us. Laser 1 Technologies is a company that has partnered with us in the past for field trips, career day presentations, and summer job opportunities.

Saint Mark's Catholic School, St. Paul
Markers MakerSpace
Grades K-8

Two years ago, St. Mark's School received an MISF grant which allowed 7th grade students to learn the basics of coding through the Arduino platform. Part of this grant allowed students to not only learn about circuits, programming and building a prosthetic arm prototype, but also allowed seventh graders to teach the fifth grade class about the Engineering Design Process as well as the basics behind coding an Arduino breadboard to light an LED light. Through this process, the entire school was 'buzzing' with excitement and students wanted more. You could tell that their brains craved to do more with engineering and design. A MakerSpace was developed last summer and the intention of this grant is to fill the space with supplies for students to explore using the Engineering Design Process. Students will also be participating in the first ever "St. Mark's MakerFaire" displaying projects created in this new space.

Saint Michael Catholic School, Prior Lake
Full STEAM Ahead: 3D Printing Power
Grades K-8

At Saint Michael Catholic School, we seek to find opportunities for our students to engage with technology in order to foster 21st century skills connected to STEAM. Our desire is to use the Innovation grant to purchase a 3D printer and supplies in order to implement cross-curricular learning opportunities that span kindergarten to grade 8. We

have observed an immense need for more student-centered learning that engages and excites our students in the area of STEAM, and the 3D printer will provide an avenue for teaching based on the 5E-model of learning. It is through the incorporation of a 3D printer, that we plan to propel our students to think critically, creatively, and collaboratively with peers during project-based learning. Students will use 3D printing to create habitats suitable for animals they have researched and use calipers to make precise measurements of real-world objects in order to replicate and recreate objects to scale. We will utilize Tinkercad--a CAD program that is best suited for elementary to middle school-aged students. Learning via this platform will help to motivate and promote engagement as it will prioritize a student-centered learning environment that emphasizes innovation.

St. Peter Catholic School, Forest Lake
Continuing STEM in the New Middle School
Grades 7-8

St. Peter's Catholic School is expanding! With this growth, we will be moving to a middle school model with the expansion into seventh and eighth grade. This requires expansion of current STEM curriculum to increase hands-on technology, expand robotics, and provide enriching Science and Mathematics opportunities. We currently use Lego EV3 Core Set robotics with our younger students. We would like to continue the theme of critical thinking and creativity learned in the EV3 Core Set. Students deepen their robotics experience with new structural and mechanical elements, and additional building instructions and programs. This grant, along with the support of our community business partner's offer of donating a classroom set of Chromebooks, will allow us to continue our STEM commitment throughout the middle school years.

Saint Thomas Academy, Mendota Heights
The Drone Racing Project
Grades 6-12

Picture this... Students walking by our new Innovation Center see a group of students flying their hand-built mini drones through a series of obstacles using first-person-view (FPV) goggles, while another group works at a computer designing a better drone frame, and yet another group carefully solders flight controllers and motors into a finished drone. It is a rare student who continues walking! This is exactly the attractive project that will generate tremendous interest in our new design center. We would like to use the MISF Innovation Grant to purchase mini-drone racing kits and the necessary peripherals to start an engineering class/club that allows students to learn about electronics, fabrication, communication, teamwork, and competition in a non-traditional way. We would open the club to all of our students, but the focus would be on our middle school, especially our new sixth graders. As the club progresses into an academic elective, students will design and build their own mini-drones on equipment that we have in the Innovation Center and the instructor will develop a curriculum to accompany the project that will be shared with all the MISF schools.

Southwest Christian High School, Chaska
High-Altitude Balloon STEM Research project
Grades 7-12

The High-Altitude Balloon STEM Research project will give SWCHS science students experience in the planning, designing, launching, retrieving and analysis of a high-altitude balloon (HAB) to near space (> 65,000 feet). Students and teachers will participate in hands-on, inquiry based learning as they design and assemble the balloon, plan launch and tracking strategies, and troubleshoot potential problems during retrieval (i.e. falls in a tree or lake). This unique project requires a multitude of skills inherent in physics (kinematics), astronomy, Earth & space science (atmosphere), chemistry (gas laws), geography (tracking with GPS), technology & engineering (building balloon & data acquisition). This project also provides the opportunity to foster a partnership between Southwest Christian High School and Chapel Hill Academy middle school students who will team up with SWCHS students to solve scientific and technical problems. HAB research engages seven of the eight NGSS science and engineering practices. Finally, this HAB research will create greater accessibility for all students to participate in STEM practices, because it will be an annual project in the Earth Space Science class.

Totino-Grace High School, Fridley
Automated Robot Challenge
Grade 11

Automation in many of the factories in the U.S. and worldwide has caused huge changes in the type of employment in our workforce. Many of the new opportunities for individuals are the creation and maintenance of those

automated systems. We want to create opportunities for our students to understand this change in our economy and learn some introductory skills that may inspire students to pursue future education and employment opportunity in this field. The Arduino Robot Challenge is a project designed for juniors in our E3 Engineering Program who are in their second year of engineering courses. This project asks students to design and build a robot to carry out a human task. The motion of their robot will derive from an electrical motor that generates circular motion. With the assistance of modular mechanisms and structural components students will design and build a system that converts that circular motion into a desired motion applicable motion. The system will be controlled with an Arduino micro processing unit that the students will write a computer program to instruct the motors to behave in a particular way for their desired output. Students for example could create a system of mechanisms that could slice a pizza.

Winona Area Catholic Schools/ St. Stanislaus, Winona

Veterinary Medicine for Kids

Grades K-8

The Veterinary Medicine for Kids course at Winona Area Catholic Schools offers students the opportunity to experience the field of veterinary medicine with direct instruction from veterinarians and engineers using hands-on learning labs. The course has different areas of focus ranging from anatomy that uses real animal organs and bones, to using authentic medical tools on swine skin to practice common surgical and suturing techniques. The students explore various muscle tissues and understand common medical terminology. Additionally, the class works closely with local engineers to design wheelchairs for dogs with orthopedic impairments. The wheelchairs are then donated, with complete instructions for use, to a local veterinary clinic for post-operative care. The course hopes to use the Innovation Grant to provide students an opportunity to explore methods used in orthopedic fracture repair using hands-on materials. The reusable bone models, bone plates, wires, and screws provide an opportunity for students to fix a bone fracture, test the repair, critique the outcomes and pitfalls, interrupt and apply the information, communicate with others, alter their wheelchair design, and test again. This opportunity will provide Winona area students and children from the seven surrounding rural areas an opportunity to learn orthopedics and create innovative devices to help companion animals.

2018-19 STEM Sustainability Grants

Academy of Holy Angels, Richfield **Biotechnology in the Classroom Sustainability Grant** **Grades 9-12**

Our project's objective was to bring more biotechnology into our current biology curriculum. We received a STEM grant through MISF to purchase lab equipment and materials to incorporate this content. We also attended a biotechnology class to learn how to use the equipment and to integrate it into our courses. After receiving the grant, we had the opportunity to create a new class called Engineering and Technology in Science, which includes an entire trimester of biotechnology. Gel electrophoresis chambers and accompanying equipment were used in this class and two additional classes. In pre-AP biology, students learn how to use micropipettes and then practice creating a DNA fingerprint using food coloring. In AP biology, students determine whether or not they have the PTC allele using the thermocycler and electrophoresis equipment. In the biotechnology trimester of the engineering course, students use the equipment to investigate different concepts, including bacterial transformation and genetically modified foods. This sustainability grant will help us to expand our biotechnology curriculum. With more electrophoresis chambers and laboratory materials, we will be able to incorporate this into the regular biology course and also possibly a second section of Engineering and Technology in Science.

Bethany Academy, Bloomington **It's more than a toy, it's a machine!** **Grades 3-8**

Bethany Academy is looking to enhance the LEGO engineering and programming components of the curriculum that has been incorporated throughout grades 3-8 curriculum over the past 4 years. The LEGO motorized machines and the Mindstorm EV3 kits purchased 5 years ago are handled with great care by staff and students—even so, normal depreciation takes place. Bethany Academy is looking to: 1. purchase replacement parts, including motors 2. purchase expansion and upgraded parts 3. incorporate 3D printing with LEGO robotics/engineering in partnership with the math department. Grades 3-8 have been using these LEGO kits to enhance the engineering aspect of the curriculum. Grades 3-4 utilize the Motorized and Simple Machines to explore simple machines and the advantage they offer. The students then apply this knowledge to design and build a motorized carnival ride. Grade 8 uses LEGO Mindstorm to collaborate with classmates in a mining project. Teams of 6 are provided a problem that they must design, build, and program robots to accomplish. Bethany has also competed the previous 2 seasons with First LEGO League on the state level. Students in year one were awarded the Innovative Design trophy for their efforts.

Cristo Rey Jesuit High School, Minneapolis **Taking Action on Climate Change: Support for Cristo Rey's Ignatian Carbon Challenge Project** **Grades 9-12**

We look forward to a third year of our Ignatian Carbon Challenge group, a STEM enrichment opportunity available to all students, that works to learn about climate change and act on methods towards living in a more sustainable way. Projects weave together various STEM concepts, and revolve around finding solutions to urgent and real world problems. Projects laid out last year will still take place for spring and fall of 2018. Some projects will be repeated with more complexity, and others have not yet been tackled. They include: (1) take items from our waste stream and turn them into viable, useful objects, (2) make solar phone chargers using discarded mint tins and spare electronic parts, (3) make reusable lunch bags from discarded drink pouches, (4) make plastic lumber from discarded plastic bags, (5) Supply CityKid farms with our school's food waste. Cristo Rey shares a facility with Urban Ventures which—with two greenhouses, an educational plot, an orchard and a bee apiary—supports a Community Supported Agriculture program, providing fresh produce to nearby residents. Funds from an MISF sustainability grant would be used to purchase additional materials and lab equipment that are directly needed to accomplish specific future projects. These may include purchasing additional materials to replenish those used this coming spring, and will include materials for projects brainstormed at a later time.

Maranatha Christian Academy, Brooklyn Park **MakerSpace Expansion** **Grades K-5**

We would love the opportunity to expand our makerspace and STEAM (STEM plus art) program. We currently have Cubelets in our Makerspace but we would love to be able to allow students to program during Makerspace as well. We want to add the mBot arduino robots to our space because they use a simpler coding program that would enable us to bring programming to younger students (2nd-5th). We have a 3D printer in our Makerspace too; however, we need "Simplify 3D" software to make printing easier. Students use the free CAD software "SketchUp for Schools" right now to design their own 3D creations. If we had Simplify 3D, it would be easier for us to 3D print more often and with younger students. Our STEAM program has gotten our students excited about Computer Science, Engineering, Robotics and trying new things. We believe that these subjects will help prepare our students to take on challenging careers in the future. It has been an incredible experience getting to see how students develop not only their knowledge of technology but also their problem solving and communication skills.

**Nativity Of Our Lord, St. Paul
Creative Learning Lab Restock
Grades K-8**

The success of our after school program in the Creative Learning Lab has left us short on supplies. We've gotten resourceful with looking for material donations, but it is hard to keep up with the more than 700 students who have access to the lab every week. We encourage students to play, build and dream and along the way we use a lot of materials. Students who design their own projects are able to produce them with our Makerbot and so it is running almost constantly. We need funds to buy filament, replacement nozzles and print plates to keep up with the student demand. We go through copious amounts of tape, glue, pipe cleaners, Popsicle sticks and cardboard—all in the name of play and problem solving. Our young engineers have discovered the magic of circuitry with tools like Snap Circuits and Squishy Circuits, but with our very heavy use of these great tools, we periodically need to replace parts as well as order extensions that will continue and extend the learning excitement.

**New Ulm Area Catholic Schools, New Ulm
VEX Robotics
Grades 9-12**

Last fall New Ulm Area Catholic Schools introduced a VEX Robotics class and club with the help of an MISF STEM Grant! The class consisted of seniors and juniors, and the club consisted of 7th and 8th grade students. The curriculum proved too juvenile for the class. After building their "clawbot" and visiting the local 3M plant, they started building competition robots for a November VEX tournament. The students worked together designing, building, and programming their robots! The two teams did so well that they wanted to compete in January! One of these teams took second place and the honor of competing at state. The club, divided into two teams, met Saturdays through December. With the help of an engineer and class members, the two teams attempted to design, build, and program competition robots. Because of extra-curricular conflicts, only one team was able to compete in January, taking first place, and also invited to state competition. Competing against other middle school teams at the state level, they placed first and are now going on to Worlds in April! There is so much pride involved with these successes! These teams brought home trophies for their accomplishments! It is just an awesome experience!

**Our Lady of Peace Catholic School, Minneapolis
Lego Robotics
Grade 4**

During the past five years, Our Lady of Peace Catholic School fourth graders have learned how to build and code robots to complete the First Lego League Food Factor challenge. This program has helped the students meet the State of Minnesota's Life Science Standards, which focus on germs and protecting our bodies from germs. Bringing the concepts of First Lego League into the classroom has helped students learn how to collaborate on projects. It has enhanced their creativity and problem solving skills. The project has introduced them to research skills. The students research a problem related to food safety and protecting food from germs as those food items travel from farm to table. Then the students use the engineering design process to plan an innovative solution to their problem. Those solutions are then presented to their classmates, teachers, and community members. In addition to the design challenge students build and code robots to travel through a Lego board with food related challenges. They must choose their challenge and program their robot to complete the challenge. The students use math skills, the engineering design process, and science concepts throughout this cross-curricular unit of study.

**Presentation of Mary School, Maplewood
Lego Lab**

Grades K-8

Last year we received a grant to purchase 3 Lego web 2.0 and 2 Mindstorm EV 3 sets to start a Lego lab. The lab has allowed children to have hands on experiences and explore and discover in the areas of science, math, engineering, language and technology. They have been fascinated not only with the process but with the outcome. As a teacher it has been a rewarding experience to see the problem solving and communication that has happened during this process. They have taken turns in different roles of the process and worked to collaborate on how the process should be completed. This Sustainability Grant would allow us to purchase a couple additional Web 2.0 sets so that an entire class could participate in a lesson at the same time.

St. Alphonsus Catholic School, Brooklyn Center

Maker Space Lab

Grades K-8

During the 2017-18 school year, we were able to get our Maker Space Lab off the ground and running. We developed a STEM course for our 6th-8th grade students to specifically address the application of math and science in real world settings. These students have invented a security system, earthquake resistance structures, river models and many other projects. STEM is integrated into the curriculum for K-5th grade and they have worked on coding, robotics, movie-making and even saved a Flat Stanley. We hosted our first annual STEM Night for families at which we had 10 stations with Olympic theme activities/projects. All of these projects and activities were made possible by our grant from MISF. With a year under our belt, we found we are still in need of materials to enhance our curriculum as well as replace the items that were "used" this year.

St. Joseph's School, Grand Rapids

LEGO Robotics Phase II

Grades 5-6

In Spring 2017, St. Joseph's School was honored to be the recipient of a MISF STEM "Starter Grant" which enabled us to embark on a LEGO Robotics adventure with students in grades 5 and 6. We wish to apply for an MISF STEM "Sustainability Grant" that would enable us to secure funding towards the purchase of an additional LEGO Mindstorm Education EV3 kit to better accommodate the number of students involved in this program. We have observed that interest in this program is building among students; we want to sustain momentum.

Southwest Christian High School, Chaska

Cortisol Hormone Test Development & Research

Grades 10-12

Southwest Christian High (SWCHS) school is developing a student research program to develop a test that will measure cortisol hormone in human saliva. Many SWCHS students are interested in the medical field, so the program is designed to use medical research as a platform for learning science, show how medical research is done in a corporate setting, and encourage student to consider careers in science. What has been accomplished? Last year, PSEO Chemistry students verified a commercial test for salivary cortisol and worked with Honors Biology underclassman to design and conduct a clinical study involving salivary cortisol. The PSEO Chemistry students also worked with bioethics students to design a clinical study and manage "patient" data. A concurrent project was also done to develop an "in house" salivary cortisol kit. This team set up and verified basic lab equipment for protein conjugation and purification such as chromatography columns, chart recorders, fraction collectors, spectrophotometers, microtiter plate washers and readers, and pH meters. How will this grant sustain the project? The funds from the sustaining grant will purchase additional equipment to create the in house cortisol test. Having an in house test is critical to the project, because it cuts down the cost of the cortisol testing by 70% and provides a rich learning experience for more technically interested and capable students.

Southwest Minnesota Christian High School, Edgerton

Scoring Water and Mimicking its Content

Grade 12

About ten years ago with the help of a MISF Stem Grant, Southwest Minnesota Christian High School launched a new class designed specifically to teach students about rivers. This hands-on class was designed to place each student directly in a river, thus teaching them stream characteristics and the methodology of data collection. Areas of focus have been on stream chemistry, entomology, and stream morphology. Students have worked alongside Fisheries, Parks, Biologists, and Hydrologist Branches within the Minnesota Department of Natural Resources and the Pollution Control Agency. In fact, our recent two-year stream study on the Redwood River was instrumental in

designing an important stream improvement within Camden State Park—the repairing and stabilization of Site #12. Looking forward, the Department of Natural Resources and Camden State Park have both voiced interest in additional stream research such as water quality testing and silt/sediment counts. Grant funds will support such projects and also replace consumables and damaged equipment. We would continue to monitor the health of both streams through chemical testing, insect analysis, and morphological changes as well as continue both fly tying and fly casting classes. This class has become a school favorite and quickly fills to capacity. Due to the limited number of tools and equipment available as well as the depletion of materials, the class can presently handle a maximum of ten students. The funds from the Sustainability Grant would be used for: restocking of basic fly tying material, purchasing fly tying tools, adding more waders and boots, restocking of chemicals, and adding additional testing hardware to help with continue testing of water quality.

Winona Area Catholic Schools, Winona

Rube Goldberg

Grades 3-6

We are completing year two of the Rube Goldberg Fair. Students have been working for the entire school year to build a project with at least five transitions. This year's challenge is to raise a flag at the conclusion of the transitions. The projects are bigger, more creative, and more high-tech than last year. We try to save as many of the construction items as possible, but when a board gets too many holes we just need to discard it. We cannot reuse hot glue. We attempt to clean up and reuse the bridge-building dominoes, but some cannot be salvaged. Foam pipe insulation pieces eventually cannot be reused. We opted not to purchase pre-made kits with instructions, therefore we need to replenish many small parts and supplies—but the creative choices made by the students as they engineer their projects is well worth it. Every day the students come and try to make their project work and be reliable. Sometimes developing reliability involved redoing something they spent many minutes or even hours creating, but de-bugging and re-working is real-life experience. The Rube Goldberg projects are as individual as the children creating them.

2018-19 STEM Starter Grants

Community of Saints Regional Catholic School, West St. Paul Jumpstart to STEM!

Grades 6-8

At our school we have students from diverse backgrounds and many are turned off by math and science because they cannot identify with its relevance to their daily lives. We hope that this project will jumpstart STEM in our middle school, excite and engage students in science and math, and inspire other teachers in the school to implement STEM in their classrooms. In this project teams of students will use the engineering design process to design, build, test, evaluate, and improve a set of blades for a wind turbine. Because the design process yields an infinite number of solutions, students will need to collaborate and use creativity and critical thinking to design the best possible solution. Students will see the impact of their blades and experience energy transformations first hand by attaching a gear train and generator to the blades to create electricity and power a circuit. This project meets four Minnesota math standards and twelve Minnesota science standards while immersing students in the real and relevant problem of harnessing green energy. This project is sustainable for many years and the materials needed for this project can be used for a variety of other design challenges in the future.

St. Dominic School, Northfield EiE - I'm Oh So Excited for STEM!

Grades K-5

Through the incorporation of the Engineering is Elementary (EiE) K-5 Curriculum, St. Dominic School intends to create a multi-discipline approach to STEM learning. We are in the process of developing our school's STEM program, and feel that this curriculum series could lay down a strong foundation for multi-year, cross-curricular learning experience for our students. Learning to draw from all experiences and knowledge to problem-solve will better prepare our students for their future in education and careers. The EiE curriculum is based in literacy. Each unit starts with a storybook in which a distinct character, cultural setting, and STEM problem are presented. The cultural setting sparks curiosity in social studies—where does the story take place in our world? Why does the STEM problem presented exist in his or her setting? What are the limitations within the setting? The STEM problem presented is rooted in both Science and Engineering. The program is designed to meet Minnesota State Science Standards as well as Next Generation STEM Standards. This allows the classroom teacher and the STEM specialist to work in tandem to present real world problems with varied elements of experimentation and views toward solutions.

St. Joseph Catholic School, Waconia St. Joseph Robo Saints

Grades K-8

In order to support engagement in STEM from the earliest ages, St. Joseph has been participating in the First Lego League robotics challenge. This activity engages students of all ages in team-based problem solving activities, capitalizing on their existing enjoyment of building with Legos to naturally inspire a love of learning. They use motors, sensors, and programming to solve a number of real-world engineering problems. In this past year, we expanded our Lego League teams from the existing 4th to 8th grade students, and we now have a 3rd grade team and plan to expand to include grades K-2 in the Junior league challenges. Our existing hardware is worn out, and many of the electronics are no longer produced or supported. Additionally, we want to provide the opportunity for our youngest students to participate, and to engage them in creative STEM-based activities at a level that challenges and encourages them. With this grant, we would be able to provide the different grade levels with equipment to allow each to progress at a pace and to a depth that keeps them engaged and challenged throughout their time with our school. This funding will allow us to give all of our students experience in programming and solving real world problems that involve engaging technology.