
STEM Pathways Teacher Guide



Table of Contents

- General Overview
- 4th Grade Experiences
- 5th Grade Experiences
- Resources



Welcome to STEM Pathways!

A collaboration of Minneapolis Schools, STEM community partners, and Minnesota Department of Education

As a teacher in Minneapolis Public Schools, you are working to prepare every child to be college and career ready by 2020, but what does college and career ready mean for your students? Based on the trends in the global economy, STEM workers will be in high demand in the future and many careers, whether they are considered a STEM career or not, will require STEM related skills and practices. Your students are the scientists, engineers, and technicians of tomorrow. STEM Pathways is here to help you prepare your students for their future.

What is STEM Pathways?

STEM Pathways is a collaboration of several Twin Cities informal STEM education organizations, Minneapolis Public Schools (MPS) and the Minnesota Department of Education (MDE) to raise the access, enthusiasm, and academic achievement of young people in STEM and their preparation for future STEM careers.

As opposed to discreet or periodic in and out-of-school STEM experiences, STEM Pathways tests an innovative model of cooperation and collaboration between key informal STEM education partners, MPS teachers and the school district that incorporates multiple STEM touchpoints that are connected, cohesive and that build off prior learning and enthusiasm for STEM each step along the path. Added components, such as the STEM Pathways Passport and Portfolio, Game of STEM and STEM Career Interactive motivate students, strengthen STEM learning and build awareness of careers while providing a more illuminated STEM pathway to the future. Additional goals this year include expanding partnerships and developing additional strategies to engage parents and families in order to build a STEM “ecosystem” of support. The renowned Wilder Research of St. Paul, Minnesota is studying the effectiveness of STEM Pathways for the potential expansion across more grade levels and schools in MPS and replication in other communities across the state and nation.

STEM Pathways is supported and promoted by MN Department of Education, MPS Teaching and Learning and MPS Research, Evaluation and Assessment departments, as well as by principals in all participating schools as an important strategy in strengthening short and long term outcomes for Minneapolis Public School students in STEM.

STEM Pathways Goals

1. *Provide a deliberate, cohesive pathway of meaningful in-school and out-of-school STEM learning experiences that strengthen outcomes for MPS students and builds a STEM ecosystem of support.*
2. *Creates an innovative model and culture for how informal STEM education organizations work together collaboratively, with the whole being greater than the sum of its parts.*

MPS - Participating Schools, 2014-2016

- Bryn Mawr Community School
- Emerson SILC
- Jefferson Community School
- Lake Nokomis Keeywadin Community School
- Loring Community School
- Pillsbury Community School

STEM Community Partners

The following STEM organizations from the Twin Cities area are partnering to provide STEM Pathways to the participating Minneapolis schools.

- The Bakken Museum
- Bell Museum
- Minnesota Zoo
- STARBASE Minnesota
- The Works Museum

Financial and In-Kind Support

This project is made possible by the passion, dedication and cooperation of partner, district and school participants. Financial contributions from Boston Scientific, DoD STARBASE and STARBASE Minnesota provide funding for research, evaluation and project coordination, as well as the development and implementation of STEM Pathways tools for teaching/learning used by MPS students and teachers. Each participating school provides financial support for transportation and program costs where fees are involved. Informal STEM education partners support STEM Pathways with dedicated staff time and highly subsidized or waived program fees. The STEM Pathways Steering Committee, consisting of representation and leadership from all formal and informal STEM education partners, provides overall project direction and actively seeks financial support for the remainder of the pilot project and beyond.



Alignment to MPS Goals and Initiatives

Please see the letter from Elizabeth Stretch, MPS K-8 STEM Curriculum Specialist, regarding how STEM Pathways aligns to the district's vision for STEM.

Wilder Research Study

As noted in the first section, Wilder Research is studying the effectiveness of STEM Pathways. The study includes pre and post surveys of students conducted in early September and late May. Representatives from Wilder Research will contact teachers directly to schedule times for the student surveys. Participating teachers may also be asked to participate in post surveys and interviews. Thank you for your cooperation with this study.

STEM Pathways Year at a Glance

August 31 - September 15

- Baseline student survey with Wilder Research
- Dissemination of teacher binders, student portfolios, Game of STEM, and other resources
- Meetings with STEM Pathways School Liaison - Santi Bromley

September - May - Partner Experiences

4th Grade (suggested sequencing)

- September-October - The Bakken
- October -March - The Works
- April-May - STARBASE Minnesota

5th Grade (suggested sequencing)

- October -December - MN Zoo
- January-March - STARBASE Minnesota
- April-May - The Bell Museum

May 15 - June 1

- Post survey with Wilder Research for students and teachers
- Collection of teacher kit materials for redistribution in Fall of 2016

STEM Pathways Benefits for Students and Teachers

Each of the STEM Pathways partners has a long history of partnership with Minneapolis Public Schools with programs that provide many benefits to both students and teachers, as follows:

- Students are actively engaged in a series of exciting, hands-on STEM learning opportunities that generate enthusiasm for STEM and interest in future STEM careers.
 - STEM experiences are aligned to state standards and connected by common STEM concepts, practices and messages.
 - STEM Pathways experiences provide real-world applications to STEM learning and problem solving that are difficult to replicate in the classroom.
 - STEM Pathways Student Portfolio, Passport, Game of STEM and Career Interactive are tools that teachers can utilize with students to motivate and enhance STEM learning. And, they provide a great way to recognize, reward and track students' accomplishments in STEM throughout the school year. The Teacher's Guide provides essential information on STEM Pathways and connections to in-class learning.
 - Field trips and program classroom visits are made possible to STEM Pathways schools, versus being on a waiting list. Many are a fraction of the cost due to fully funded or discounted fees.
 - STEM Pathways provides multiple opportunities for teacher input and involvement, as well as professional growth.
 - The Teacher's Guide provides essential information on STEM Pathways and connections to in-class learning.
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Grant Funding for Transportation or Other Fees

As noted previously, the STEM Pathways partners have significantly reduced or waived fees for their programming for STEM Pathways schools. There still are some associated costs that are a normal part of participation, such as transportation costs or (reduced) fees for which you may want to seek grant funding. Please see partner program descriptions for specific fee information.

Following is sample text you may use and/or alter as needed to help apply for grants to cover some of the costs associated with STEM Pathways experiences. An electronic copy of this text will also be sent to 4th and 5th grade teachers at participating schools.

Sample Grant Request Text

1. What are the goals of this field trip experience?

****SCHOOL NAME**** is one of 6 MPS schools participating in the STEM Pathways project. The STEM Pathways project strives to enhance STEM learning through an interconnected system of educational experiences provided in and out of school. Traditionally, fieldtrips and outreach programs provided by community organizations tend to be isolated experiences, disconnected from one another. Through this partnership, the efforts of MPS and community partners strive to form a coherent, connected, and deliberate pathway of STEM experiences to enhance student learning and achievement. Further, there is substantial opportunity to make deeper and more rigorous connections between STEM programs provided by community organizations and the MPS science scope and sequence, MN Academic Standards for Science and the NGSS Science and Engineering Practices. The primary goal of the STEM Pathways project is to develop and implement an innovative educational model that leverages and links student STEM learning experiences across grade levels and between school and community to form a cohesive and illuminated pathway to greater student success in STEM.

SCHOOL NAME is asking specifically for transportation support for all GRADE LEVEL(S) classrooms to participate in programming provided by PARTNER ORGANIZATION, one of six community partner experiences (three in each grade) that are part of the STEM Pathways project. Funding will be used to aid in transportation costs and/or program fees that have been greatly reduced by participating partners. A program description is given below:

(Program/Partner Name you are seeking funding for)

Program Description and hours of participation: (see descriptions in cohort sections).

2. How does this experience support the core curriculum? Please answer with sentences that might describe this to a non-educator.

The Minneapolis Public Schools strives to inspire students in the area of STEM (Science, Technology, Engineering, and Mathematics). Through Minneapolis Public Schools' elementary science curriculum, students engage in hands-on, inquiry-based learning that engages students in science and engineering practices. It is Minneapolis Public Schools' goal to improve students STEM literacy and increase their awareness of STEM careers. To accomplish this, we have partnered with several Twin Cities' nonprofit organizations — each with a long track record of success — that help extend our capacity in STEM. (Partner Organization name) builds off the learning experiences in the classroom with STEM experiences and technologies that are difficult to replicate in schools. Their curriculum is relevant and aligned with state standards; teaching and learning can be directly applied in classrooms.

Sample Grant Request Text Continued

3. How will you measure the impact of this experience?

During and upon conclusion of this experience my students will write their reflections in the STEM Pathways Portfolio which will help me identify impacts on STEM learning and interests. They will also record and write about careers they learned of through this experience as they consider their own education and career path. Further insight will be gleaned as my students choose to conduct extension activities related to their experience and explore careers through the STEM Pathways Career Interactive.

From a broader impact level, through this participation all SCHOOL NAME 4th and 5th grade classrooms will participate in STEM Programs provided by Twin Cities' community partners (The Bakken, The Works and STARBASE Minnesota in fourth grade and The Bell Museum of Natural History, STARBASE Minnesota and the Minnesota Zoo in 5th grade). There is a significant research and evaluation component of the STEM Pathways project that will measure change to students' STEM attitudes and career interests, academic achievement, and school and classroom STEM culture. This research is approved by the Research, Evaluation and Assessment department of MPS and a summary of findings will be provided to all participating schools.

4. Share any additional information you'd like to share about this proposed experience, such as impacts of past participation, more school information, more info about needs and what this experience can provide for not only the students, but for you, etc.

STEM Pathways 4th Grade Experiences





4th Grade Cohort

We think children are scientists and engineers, so we let them be.

Fourth grade students are curious. They wonder about the world around them, ask questions, think, and dream about how they can make things better. They are natural scientists and engineers. As a 4th grade cohort, our focus is to engage students in science and engineering practices, build on their natural curiosity, and nurture their knowledge and skills to help them become the scientists, engineers, technicians, problem-solvers, and innovators of tomorrow.

Common Themes

STEM Career Exploration - Through their experiences with each of the STEM partners, students will have the opportunity to explore STEM careers throughout history and into the future. A STEM career interactive -- a collection of exciting, kid-friendly videos highlighting STEM careers -- will also be made available to teachers and students so they can further explore STEM careers between experiences.

Practices and Processes of Science and Engineering - Students will grow in their own practices of science and engineering as they participate in STEM partner activities, workshops, lessons, and field trips. All the while, they will be learning relevant, grade-level science content and utilizing math as a tool in their experiments, investigations, and designs.

Alignment to Standards - Science and Math

STEM partner experiences are aligned to Minnesota Academic Standards for Science and Mathematics. The tables below show an at-a-glance alignment of 4th grade STEM Pathways experiences to MN standards. Please note that partner curriculum may be aligned to other academic areas outside of STEM. Detailed standard alignment information may be shared by individual partners.

Minnesota Academic Standards in Science	
Strand and Standard	Codes
The Nature of Science and Engineering - The Practice of Science - The Practice of Engineering - Interactions Among STEM and Society	5.1.1.1.(1,2,3,4) 4.1.2.1.(1,2 and 3) 4.1.3.3.1
Physical Science - Matter - Energy - Motion	4.2.1.1.1 4.2.3.1.(1,2,3), 4.2.3.2.(2,3) 5.2.2.1.(2,3)

Minnesota Academic Standards in Math	
Strand and Standard	Codes
Geometry and Measurement	4.3.2.(1,2,3)
Data Analysis	4.4.1.1 and 5.4.1.1

Sequencing

As the 4th grade cohort of STEM partners met throughout the past year to share programming information and develop connections between programs, a natural sequence of experiences emerged, that build upon the learning from one partner to the next. The following sequence of STEM Pathways experiences is suggested for schools:

1. The Bakken Museum - assembly - 1 hour, 2 classroom visits - 1 hour each, field trip - 3.25 hours
2. The Works Museum - field trip - 3 hours
3. STARBASE Minnesota - field trip - 5 days, 4 hours per day

Please note that this is only a suggested sequence for scheduling experiences. Partner experiences are stand alone experiences, enhanced by this sequence, but not dependent upon it.

Your Role as a 4th-Grade Teacher

As a 4th-grade teacher whose school is participating in STEM Pathways, you play a key role in helping to achieve project goals and strengthen student learning. We need your support and involvement to make the field trips and experiences possible, and connect the experiences and your work in the classroom.

Logistics

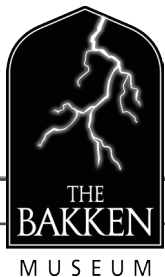
- Verify participation schedule, including classroom visits and field trips
- Arrange transportation
- Any other prep for STEM Pathways experiences (see specific information on partner pages)

Make STEM Pathways Connections - In this guide, as well as the student portfolio, we have included various resources and ideas you can use to help maximize the impact of STEM Pathways for your students. Below are some general ideas and strategies you may choose to use in your classroom. Specific ideas are provided for you on each partner page.

- Relate STEM Pathways experiences to previous or pending classroom work
- Facilitate reflection of STEM Pathways experiences with students
- Engage students in use of STEM Pathways student portfolios and the Game of STEM
- Promote GEMS/GISE and other STEM related enrichment opportunities

Scheduling, Planning, and Preparing

In the following pages, you will find specific information regarding each STEM Pathways experience, including more detailed information about the experience, contact information, and scheduling procedures.



The Bakken Museum

An electrifying experience

Outreach Experience - 3 Visits, 1 Hour Each

Field trip - 1 Day, 3.25 Hours

Your Bakken Dates:

Outreach Experiences

Day 1: _____

Day 2: _____

Field trip Experience

Day 3: _____

Day 4: _____

Costs for Schools

Field trip fee - \$2/student

Transportation - 1 day

Program Description

The Bakken supports teaching of electricity and magnetism with three one-hour outreach visits and a 3.25 hour field trip to the museum (one experience per week over four weeks). The Bakken strives to ensure a fun and educational environment so all students will feel at ease to explore science through investigation. Age appropriate workshops incorporate historical perspectives and interactive discussions, and are designed to meet state and national standards.

Day One - School assembly program for all fourth graders that explores what it means to “Wonder, Try, Discover, and Share” – important habits of every scientist and engineer. A key goal of this presentation is for all students to see themselves as scientists and engineers.

Day Two - A Bakken educator visits each fourth-grade classroom to guide students in applying “Wonder, Try, Discover, and Share” as they re-invent the battery. As scientists and engineers, students practice supporting their claims with evidence and learn the importance of taking risks and making mistakes to the process of discovery.

Day Three - Field trip to The Bakken Museum that includes a hands-on workshop, guided exhibit tour and time for lunch. In the Magnets and Electromagnets Workshop, students discover properties of magnets by recreating historical experiments and explore magnetic force and field and the relationship between magnetism and electricity. During the Guided Tour, students explore history of science and invention via storytelling and interactive exhibits. Every student takes home materials to construct an electromagnet for their own experiments.

Day Four - The final classroom experience is led by a Bakken educator and a volunteer from the STEM workforce who help students connect the STEM they do in school to real careers. Students engage in problem solving to explore a real-world challenge involving electromagnetism and energy.

Scheduling Information and Contacts

Bekki Rezabek

rezabek@thebakken.org

612-926-3878 Ext. 229

Danni Dancer

dancer@thebakken.org

612-926-3878 Ext. 250

Preparing for Bakken Experiences - Logistics

DAY 1

Please plan for a space large enough for all of your fourth graders; a gym or cafeteria typically works great. The show lasts an hour and two Bakken educators will arrive 30 minutes in advance to set up.

DAYS 2 and 4 - These visits take place in classrooms and last about an hour.

DAY 3

- **Payment - Cost of the Bakken field trip for STEM Pathways schools is \$2/student.** Please review your confirmation letter. Note that changes/cancellations made less than 20 business days before your field trip date will incur a \$50 fee. Payment is due before or on your field trip date.
- **Chaperones - The Bakken loves chaperones and encourages you to bring one for every four students free of charge.** PCAs and paraprofessionals assigned to individual students are always free and not counted in your chaperone numbers. Extra chaperones pay \$7 apiece.
- **Buses - Buses must drop-off/pick-up at the 36th Street entrance (NOT Zenith Avenue).** Buses may park on 36th Street. Please stay on your bus until a Bakken educator comes to greet you. Storage space is limited. Please leave coats and backpacks at school or on the bus.
- Please bring your own food and beverages; there are no concessions available at The Bakken.

Making STEM Pathways Connections - The Bakken Museum

Before First Bakken Experience:

- Use the portfolios to introduce STEM Pathways including an introduction the the activity section and Game of STEM.
- Add one class activity or homework assignment from math, science, or STEM class to the activity section of the portfolio and stamp their Game of STEM gameboard.

Between Bakken Experiences:

- Ask students to complete one of the STEM reflection pages from the STEM Pathways portfolio.
- After the Bakken field trip, encourage students to complete the electromagnet activity.
- Make classroom connections to the practices of scientists (wonder, try, discover, share) or other Bakken content.

After Completing Bakken Experiences:

- Ask students to complete The Bakken reflection page found in their portfolio.
 - If available at your school, provide students with information regarding fall GEMS and GISE (robotics) and encourage their participation in afterschool STEM activities.
 - Explore careers related to The Bakken using the Career Interactive.
 - Use the STEM Pathways portfolio to create a showcase of students' STEM related work.
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Field Trip - 1 Day - 3 Hours

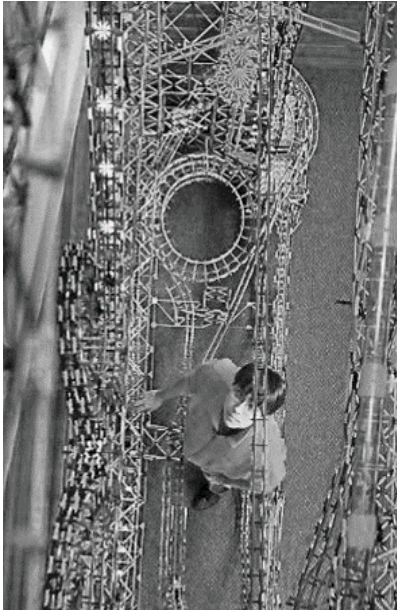
Your The Works Museum Date:

Costs for Schools

\$6 per student

Transportation - 1 day

Program Description



The Works Museum's mission is to inspire the next generation of innovators, engineers, and creative problem solvers. Fourth graders will take a field trip to the museum and attend a Maze Engineering workshop. They will explore engineering with interactive Exhibits featuring building, simple machines, optics, sensors and more. The Exhibits are located on one easy-to-supervise level.

In the Maze Engineering workshop, students will use the Engineering Design Process to design and construct their own maze, pinball or pachinko game to take home. They will experiment with changes in speed and direction and the effects of gravity and friction.

Scheduling Information

The Works Museum Scheduling Contact:

Katy Epler, Registration Coordinator

katy@theworks.org

952-888-4262 extension 215

Scheduling Procedures:

1. The Works staff will email STEM Pathways school contacts with instructions for scheduling a field trip date and time.
2. School contacts will be asked to fill out an on-line Field Trip Request form, allowing a choice of up to three dates that will work for their school.
3. After submitting the request, school contacts will receive a confirmation for their date and time.
4. About six weeks before their visit, school contacts will receive a reminder of their field trip.
5. The week before their visit, school contacts will receive a schedule of activities during their field trip, along with directions and parking instructions.

Preparing for The Works Museum - Logistics

Please see the preceding page for scheduling information. After scheduling your field trip with The Works Museum, please complete any tasks specific to your school for this field trip including, school permission slips, requesting lunches and arranging transportation.

Making STEM Pathways Connections - The Works Museum

During their field trip with The Works Museum, students will have the opportunity to explore engineering and an Engineering Design Process.

Before The Works:

- Total students' points in Game of STEM and give level certificates and rewards, encourage students to engage in STEM to reach another level.
- Utilize the Career Interactive to explore careers related previous STEM Pathways experiences.

After The Works:

- Ask students to complete the Works Museum reflection page found in their portfolio and the engineering reflection page if desired.
 - Encourage students to complete the engineering related activities in their portfolio such as Soaring.
 - Explore careers related to The Works using the Career Interactive.
 - Review your upcoming science kits and/or math units. Find opportunities to engage students in engineering.
 - Continue to add STEM-related work to student portfolios. Encourage students to complete STEM in out of school activities.
 - If available at your school, provide students with information about GEMS and GISE opportunities for the second semester, encouraging their participation.
 - Stamp Game of STEM as students participate in STEM Pathways experiences, complete STEM activities, and/or add pieces to their binder.
-



STARBASE Minnesota

Giving wings to dreams

Field Trip - 5 Days - 20 Hours

Your STARBASE Dates:

Costs for Schools

No student fees

Transportation - 5 days

Program Description

Humankind is driven by discovery and exploration. Fourth-graders at STARBASE learn to be engineers as they explore current and future design challenges related to Mars exploration. The student engineers develop and utilize science practices as they formulate questions, create prototypes, test predictions, and conduct experiments about motion, rocketry, rover technology, and heat transfer. Students apply their knowledge to design a rocket that can transport rovers and landers to Mars, using Creo CAD software to design their own rocket fins, which they 3D print, test at a rocket launch, and evaluate. Math and technology concepts, such as data collection, median, measurement, estimation, GPS technology, and graphing, are essential parts of the students' scientific investigations and applied engineering. Throughout the program, students have the opportunity to learn about and explore STEM-related careers and how they can pursue those careers in the future.



STARBASE Minnesota Contacts:

Melanie Peters - Program Manager

mpeters@starbasemn.org

612-713-2802

Kim Van Wie - Executive Director

kvanwie@starbasemn.org

612-713-2530

Scheduling Information

Scheduling Procedures:

1. STARBASE contacts principals via email during summer or early fall to schedule dates.
2. Once dates are confirmed, STARBASE emails classroom teachers notifying them of schedule and to confirm number of students and contact information for teachers.
3. If participation is scheduled later in the school year, STARBASE may contact teachers again to obtain updated student enrollment information.
4. About one month prior to the program start, teachers receive an email from STARBASE with a link to a website where they can access online registration, permission slips, transportation information, team information, special accommodations for students, etc.

Preparing for STARBASE - Logistics

As noted on the previous page, STARBASE will email you a website link to guide you through the process of preparing for your STARBASE experience. Listed below is an overview of the steps you'll find at the website link.

1. Verify participation information - dates, times, enrollment
2. Schedule transportation - this should be completed at least 1 month in advance
3. Print, distribute, and collect STARBASE permission slips
4. Submit student information using online form
5. Submit security information for all adults using online form*
6. Divide students into STARBASE teams
7. Review program resources (video, description, standards alignment, Clubhouse)

**Please note that STARBASE Minnesota is located on the Air National Guard base and all adults must be processed through security prior to the program start by submitting full name, date of birth and driver's license number to STARBASE.*

Making STEM Pathways Connections - STARBASE Minnesota

Your students' STARBASE experience occurs over five consecutive days. During these five days, as well as before and after the experience, there are things you can do to reinforce STARBASE related skills and content as well as the goals of the STEM Pathways project.

Before STARBASE:

STARBASE is likely your students' third and final STEM Pathways partner experience in 4th grade. This is a great time to revisit the goals of the STEM Pathways project as students prepare for their final experience.

- Total students' points in Game of STEM and give level certificates and rewards, encourage students to engage in STEM to reach another level.
- Utilize the Career Interactive to explore careers related previous STEM Pathways experiences.
- Students work in teams of 3-4 for many of the activities at STARBASE. Complete the Soaring activity in the portfolio as teams of 3-4, even if it is the second time they have done the activity, there are always new solutions to the design challenge.

During STARBASE:

- Ask students to complete their STARBASE journal each day or substitute one of the STEM reflection pages from the STEM Pathways portfolio.
- Encourage students to complete STARBASE Clubhouse activities (packet is given to each student) and reward students with Game of STEM stamps.

After STARBASE:

- Ask students to complete the STARBASE reflection page found in their portfolio.
 - Encourage students to complete activities from the STEM Pathways portfolio; Program a Person, Butter Races, Program a Rover.
 - Insert Clubhouse into portfolio and encourage students to finish any incomplete activities.
 - Explore careers related to STARBASE Minnesota using the Career Interactive.
 - Use the STEM Pathways portfolio to create a showcase of students' STEM work throughout the year by asking students to insert activities completed in class which made them feel like scientists and engineers.
-

STEM Pathways 5th Grade Experiences



BELL MUSEUM
OF NATURAL HISTORY

UNIVERSITY OF MINNESOTA
Driven to DiscoverSM



MINNESOTA ZOO[®]



5th Grade Cohort

Inspiring students to include STEM in their future.

Fifth grade students are one year and one step closer to being out in our STEM-rich world. They are beginning to form strong feelings about their abilities and interests in STEM. Each student's vision of who they think they will be as a teen and as an adult begins to take shape. As a 5th grade cohort, we hope to inspire students to include STEM in their future vision of themselves by engaging them in STEM content that is tied to their interests and the world around them.

Common Themes

Systems - Each organization teaches content and lessons related to how natural and designed systems, such as ecosystems or energy systems, are interconnected and the delicate balance required in order for such systems to be sustained.

Impact of Change - Students have direct experiences with each organization regarding impact of change on a system. Students are challenged to consider how a change to an ecosystem, such as clear-cutting a forest or the decline of honeybees, can have cascading impact. Students consider how their colony system changes as they decide on which Mars colony buildings they choose to include in their designs. Common tools are used by partners to introduce changes.

STEM Career Exploration - Through their experiences with each of the STEM partners, students will have the opportunity to explore STEM careers throughout history and into the future. A STEM career interactive, a collection of exciting and kid-friendly career videos is available to teachers and students so they can further explore STEM careers between experiences.

Alignment to Standards - Science and Math

STEM partner experiences are aligned to Minnesota Academic Standards for Science and Mathematics. The tables below show an at-a-glance alignment of 5th grade STEM Pathways experiences to MN standards. Please note that partner curriculum may be aligned to other academic areas outside of STEM. Detailed standard alignment information may be shared by individual partners.

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Strand and Standard	Codes
The Nature of Science and Engineering - The Practice of Science - The Practice of Engineering - Interactions Among STEM and Society	5.1.1.1.(1,2,3,4), 5.1.1.2(1,2), 5.1.3.4.1 6.1.2.1.(2 and 4), 6.1.2.2.1, 6.1.3.1.1, 6.1.3.4.1
Physical Science - Matter - Energy - Motion	6.2.1.1.1 6.2.3.2.2 5.2.2.1.(2,3)
Earth and Space Science Human interactions with Earth Systems	5.3.4.1.1
Life Science - Structure and Function in Living Systems - Interdependence Among Living Systems - Human Interactions with Living Systems	5.4.1.1.1 5.4.2.1(1 and 2) 5.4.4.1.1

Standards Alignment Continued

Minnesota Academic Standards in Math	
Strand and Standard	Codes
Numbers and Operation	5.1.1.1, 5.1.2.(1 and 3)
Algebra	5.2.1.(1 and 2)
Geometry and Measurement	5.2.2.3, 5.3.2.(1, 2, 3, 4)
Data Analysis	5.4.1.(1 and 2)

Sequencing

As the 5th grade cohort of STEM partners met throughout the past year to share programming information and develop connections between programs, a natural sequence of experiences emerged that build upon the learning from one partner to the next. The following sequence of STEM Pathways experiences is suggested for schools:

1. The Minnesota Zoo- field trip - 4 hours
2. STARBASE Minnesota - field trip - 5 days, 4 hours per day
3. The Bell Museum of Natural History - classroom visit - 1 hour, field trip - 4 hours

Please note that this is only a suggested sequence for scheduling experiences. Partner experiences are stand alone experiences, enhanced by this sequence, but not dependent upon it.

Your Role as a 5th-Grade Teacher

As a 5th-grade teacher whose school is participating in STEM Pathways, you play a key role in helping to achieve project goals and strengthen student learning. We need your support and involvement to make the field trips and experiences possible, and connect the experiences and your work in the classroom.

Logistics

- Verify participation schedule, including classroom visits and field trips
- Arrange transportation
- Any other prep for STEM Pathways experiences (see specific information on partner pages)

Make STEM Pathways Connections - In this guide, as well as the student portfolio, we have included various resources and ideas you can use to help maximize the impact of STEM Pathways for your students. Below are some general ideas and strategies you may choose to use in your classroom. Specific ideas are provided for you on each partner page.

- Relate STEM Pathways experiences to previous or pending classroom work
- Facilitate reflection of STEM Pathways experiences with students
- Engage students in use of STEM Pathways student portfolios and the Game of STEM
- Promote student involvement in GEMS/GISE and other STEM related enrichment opportunities

Scheduling, Planning, and Preparing

In the following pages, you will find specific information regarding each STEM Pathways experience, including more detailed information about the experience, contact information, and scheduling procedures.

**Field trip - 1 Day, 4 Hours****Your Minnesota Zoo Date:****Costs for Schools:**

Field trip, including fees, transportation, and lunch funded by Target Corporation.

Program Description

The Minnesota Zoo has partnered with Target Corporation and Minneapolis Public Schools for eight years to provide Zoo Safari, a one-of-a-kind learning experience that connects students to wild animals and their habitats, provides them with real-world experience, and ultimately supports classroom learning for MPS 5th graders. The program provides a fully-funded field trip to the Minnesota Zoo including bus transportation, admission, lunch and a Zoo Class. In addition to valuable time interacting with animals and exhibits, students take Bare Necessities, a Zoo Class developed in collaboration with MPS teachers to support MPS Learning Targets and the FOSS Environments Kit. Students will dive into one of the Minnesota Ecosystems to learn about how the system functions and make predictions about the impacts of change on their ecosystem. Students will walk away with deeper understanding of ecosystem dynamics and greater appreciation for the important role that each part plays in the system.

Scheduling Information and Contacts

As soon as school starts, Zoo Safari information will be sent out to fifth grade teachers and principals through the MPS K-5 science specialist. A registration form and other relevant information, including how to schedule busing and direct invoices will be provided at that time. Please schedule your field trip as soon as possible. **STEM Pathways schools should plan to schedule their Zoo Safari field trips between September and November, if possible.**

Minnesota Zoo Contacts:

Kelly Willis
Education Scheduler
educate@mnzoo.org
952-431-9218

Gina Goralski
School Programs Coord.
gina.goralski@state.mn.us
952-431-9260

Abby Moore
School Programs Supervisor
abby.moore@state.mn.us
952-431-9222

Preparing for Minnesota Zoo Experience

- To register - complete and send the Zoo Safari Reservation form by email to educate@mnzoo.org or call 952-431-9218, and identify your group as part of the STEM Pathways Zoo Safari Program.
- After registering - you will receive an email confirming your field trip date. A detailed schedule for your day at the Zoo will also be sent as well as the pre/post visit activities.
- After a date is confirmed - schedule your transportation with your bus company as per your buildings procedures and be sure to indicate that this is for a “Minnesota Zoo Safari Program.” Let the transportation service know the bill is to be sent to the Minnesota Zoo- Education, c/o Gina Goralski.
- Before your trip – review confirmation paperwork, call 952-431-9218 with any questions. Complete the pre-visit activity.
- When you arrive at the Zoo, unload buses, enter the Zoo, and then look for the Zoo staff to help you begin your day.
- After your trip—Complete post-visit activity, talk about your experience.

Making STEM Pathways Connections - Minnesota Zoo

As the classroom teacher, you help to provide that valuable link between the STEM Pathways partner experiences, your classroom, and your students’ futures in STEM. STEM Pathways has provided you with some tools to help you make the most out of these experiences for your students and assist you in making these connections. Please see the information below as a starter list you can use to help your students meet the goals of STEM Pathways.

Before Minnesota Zoo Experience:

- Use the portfolios to introduce STEM Pathways including an introduction to the activity section and Game of STEM.
- Add one activity (MN Zoo pre-visit activity), other in class STEM work, or homework assignment from math, science, or STEM class to the activity section of the portfolio and stamp their Game of STEM gameboard.

After Minnesota Zoo Experience:

- Ask students to complete the Minnesota Zoo reflection page found in their portfolio.
 - If available at your school, provide students with information regarding fall GEMS and GISE (robotics) and encourage their participation in afterschool STEM activities.
 - Explore careers related to the Minnesota Zoo using the Career Interactive.
 - Encourage students to complete activities in their STEM Pathways portfolio; A Season for Change, Eat Like a Bird.
 - Use the STEM Pathways portfolio to create a showcase of students’ STEM related work.
-



STARBASE Minnesota

Giving wings to dreams

Field Trip - 5 Days - 20 Hours

Your STARBASE Dates:

Costs for Schools

No student fees

Transportation - 5 days

Program Description

Students develop and utilize their skills in science, technology, engineering and math (STEM) as they engineer a mission to Mars. Using rovers and other technologies, students investigate the planetary conditions of Mars to identify the engineering needs of a human mission to Mars. Students conduct scientific experiments integrating math, technology and engineering to learn more about Newton's Laws of Motion, robotics, the atmospheres of Earth and Mars, air pressure, renewable energy, and the vacuum of space. They learn about units of measurement, estimating and coordinate graphing, calculating area and volume, finding the mean, analyzing graphs, as well as explore technology-based designs and functions. Students experience the work of real life scientists and engineers as they use Creo (CAD) software to design a wind turbine and a Mars colony. They use robotics software to program and test Mars rovers. All along their 5 day journey at STARBASE, students explore various STEM careers and the path they will need to take to reach their own career goals.



Scheduling Information and Contacts

STARBASE Minnesota Contacts:

Melanie Peters - Program Manager

mpeters@starbasemn.org

612-713-2802

Kim Van Wie - Executive Director

kvanwie@starbasemn.org

612-713-2530

Scheduling Procedures:

1. STARBASE contacts principals via email during summer or early fall to schedule dates.
2. Once dates are confirmed, STARBASE emails classroom teachers notifying them of schedule and to confirm number of students and contact information for teachers.
3. If participation is scheduled later in the school year, STARBASE may contact teachers again to obtain updated student enrollment information.
4. About one month prior to the program start, teachers receive an email from STARBASE with a link to a website where they can access online registration, permission slips, transportation information, team information, special accommodations for students, etc.

Preparing for STARBASE - Logistics

As noted on the previous page, STARBASE will email you a website link to guide you through the process of preparing for your STARBASE experience. Listed below is an overview of the steps you'll find at the website link.

1. Verify participation information - dates, times, enrollment
2. Schedule transportation - this should be completed at least 1 month in advance
3. Print, distribute, and collect STARBASE permission slips
4. Submit student information using online form
5. Submit security information for all adults using online form*
6. Divide students into STARBASE teams
7. Review program resources (video, description, standards alignment, Clubhouse)

**Please note that STARBASE Minnesota is located on the Air National Guard base and all adults must be processed through security prior to the program start by submitting full name, date of birth and driver's license number to STARBASE.*

Making STEM Pathways Connections - STARBASE Minnesota

Your students' STARBASE experience occurs over five consecutive days. During these five days, as well as before and after the experience, there are things you can do to reinforce STARBASE related skills and content as well as the goals of the STEM Pathways project.

Before STARBASE:

- Total students' points in Game of STEM and give level certificates and rewards, encourage students to engage in STEM to reach another level.
- Utilize the Career Interactive to explore careers related previous STEM Pathways experiences.
- Students work in teams of 3-4 for many of the activities at STARBASE. Complete the Soaring activity in the portfolio as teams of 3-4, even if it is the second time they have done the activity, there are always new solutions to the design challenge.
- If available at your school, encourage students to participate in GEMS and GISE for the second semester.

During STARBASE:

- Ask students to complete their STARBASE journal each day or substitute one of the STEM reflection pages from the STEM Pathways portfolio.
- Encourage students to complete STARBASE Clubhouse activities (packet is given to each student) and reward students with Game of STEM stamps.

After STARBASE:

- Ask students to complete the STARBASE reflection page found in their portfolio.
 - Encourage students to complete activities from the STEM Pathways portfolio; Soaring, Design a Cargo Boat, Tight Spaces.
 - Insert Clubhouse into portfolio and encourage students to finish any incomplete activities.
 - Explore careers related to STARBASE Minnesota using the Career Interactive.
 - Use the STEM Pathways portfolio to create a showcase of students' STEM work throughout the year by asking students to insert activities completed in class which made them feel like scientists and engineers.
-

Classroom Visit- 1 Visit, 1 Hour

Field trip - 1 Day, 4 Hours

Your Bell Museum Dates

Classroom Visit - _____

Field Trip - _____

Costs for Schools

No student fees

Transportation - 1 day

Program Description

Humans are interdependent with nature. Fifth-graders at the Bell Museum of Natural History examine this interdependence throughout the Honey Bees, Pollinators, and Our Food program. Student scientists will exercise critical thinking and literacy skills as they explore the concept of biological diversity, the process of science, and the connection between our food and a healthy environment. Students will gain experience using scientific tools and processes like microscopes, forceps, and dissections to make observations of bees and flowers as students are immersed in sessions focusing on these organisms, their anatomy and biology, and their interconnectedness. The students will also be exposed to current research happening at the University of Minnesota and will apply their knowledge about pollinators as they plan meals, and discuss and analyze the impact of the disappearance of pollinators on the meals they've prepared. A tour of the Bell Museum's dioramas will allow the students to see some of the native habitats that are beneficial to pollinators. This program is structured to empower student scientists to learn more about where their food comes from and how humans are connected to the many processes and relationships involved in obtaining food and maintaining a healthy environment.



Scheduling Information and Contacts

Bell Museum Contacts:

Heather Hendrickson

K-12 Outreach Educ. and Assist. Curator

cummi344@umn.edu

612-624-8245

Shoghig Berberian

Assoc. Director of K-12 Educ. and Family Programs

berb0003@umn.edu

612-626-3858

Scheduling Procedures:

1. Bell Museum contacts principals via email during late fall semester or early spring semester to schedule dates for Bell Museum educators to visit each school and for each school to visit Bell Museum.
2. Upon confirmation of dates, Bell Museum emails classroom teachers notifying them of dates.
3. Teachers are asked to submit information to Bell Museum regarding number of students, contact information for teachers, and description of any accommodations needed for students, teachers, chaperones, etc.
4. Teachers are responsible for scheduling the bus for their visit to Bell Museum.

Preparing for Bell Museum Experiences - Logistics

- Teachers will be supplied with pre-visit materials to introduce the program to their students.
- Bell Museum educators will visit each classroom with for an introductory hands-on session in preparation for the visit to Bell Museum.
- Bell Museum educators will leave additional materials and activities with classroom teachers at the time of the in-school visit.
- As noted above, teachers are responsible for scheduling their bus to and from Bell Museum.

Making STEM Pathways Connections - Bell Museum

Before Bell Museum:

The Bell Museum is likely your students' third and final STEM Pathways partner experience in 5th grade. This is a great time to revisit the goals of the STEM Pathways project as students prepare for their final experience.

- Total students' points in Game of STEM and give level certificates and rewards, encourage students to engage in STEM to reach another level.
- Utilize the Career Interactive to explore careers related previous STEM Pathways experiences.
- Remind students of their experience with the Minnesota Zoo and what they learned about systems and change. If they haven't already done so, encourage students to complete Season of Change, and Eat Like a Bird.

After Bell Museum Experience:

- Ask students to complete the Bell Museum reflection page found in their portfolio.
 - Use the STEM Pathways portfolio to create a showcase of students' STEM related work.
 - Explore careers related to Bell Museum using the Career Interactive.
-

STEM Pathways Resources



STEM Pathways Portfolio Description and Guidelines

STEM Pathways Letter to Families

Master Copies

- 4th Grade Reflection Sheets
- 5th Grade Reflection Sheets
- STEM Reflection Sheets
- Career Log
- Game of STEM Level Certificates



STEM Pathways Portfolio

Classroom Teacher Information Sheet

Thank you again for being a partner in STEM Pathways! Together, our goal is to engage and inspire our students in STEM now and in their futures. We hope that you continue with this effort in your classroom and use the STEM Pathways Portfolio as a tool to help students reflect on their STEM experiences, showcase their STEM related activities, and track their progress in STEM. While we hope to make a strong impact on your students during their Pathways experiences, your efforts to reinforce this work back in your classroom will ultimately make this initiative a success! Please see the descriptions and guidelines below for how you can use the STEM Pathways Portfolio to support the goals of STEM Pathways.

STEM Pathways Portfolio Kits

Your Classroom Kit Includes:

- STEM Pathways Portfolios for each student
- STEM Pathways stamp
- Game of STEM classroom poster
- Game of STEM level Certificates

Guidelines for Use of STEM Pathways Portfolios

General

- Keep all portfolios in one safe location in the classroom for easy access.
- Leave portfolios at school unless requested by a partner organization.
- Remind students to write their names on any sheets they remove from the portfolio.

Section 1 - Passport

- Help students track their partner experiences by stamping the passport tree.
- Encourage students to identify and record STEM careers they learn about throughout the year.
- Use reflection pages shortly after visiting a STEM Pathways partner site. There are site specific reflection pages as well as reflection pages related to STEM integration.
- Reflections may be completed at school or at home. If completed at home, have students remove the necessary pages from their portfolios.

Section 2 - Activities

- Activities included in the portfolio may be completed in class or assigned as homework.
- Add additional STEM activities to students' portfolios. For example, the STARBASE Clubhouse packet can be inserted.
- Recognize and include STEM related classroom work you are already doing, such as math assignments, science experiment notes, STEM related projects, etc.

Guidelines Continued



Section 3 - The Game of STEM

The Game of STEM is a fun way for your students to track the STEM they do throughout the school year, both as part of the STEM Pathways experiences and in your classroom. As students participate in STEM, they can receive STEM Pathways stamps on their game board. Each stamp is worth points, the more points students earn, the more they can increase their “level” of STEM! As students increase their “level” of STEM they move up on the Game of STEM classroom poster.

How can students earn stamps?

- Participating in STEM Pathways experiences.
- Completing site specific and STEM integration reflections.
- Doing STEM by completing activities included in the portfolio binder, provided by partner organizations, or assigned or completed classroom work.
- Anything else STEM related you want to recognize!

How can I recognize students’ achievements?

We encourage you to help students celebrate their achievements! As students earn stamps and move through their game board they will come to check points where they can total their points. As their total points increase, they can increase their level of STEM.

Recognize Level Achievements By:

- Giving students a Level Achievement Certificate (black line masters provided)
- Displaying level achievements on your class poster (provided)
- Various incentives of your choice such as:
 - Free homework pass
 - Lunch with a teacher/staff
 - Preferred STEM time or preferred activity time
 - Help present a lesson with the teacher
 - Create and share a STEM lesson or activity with the class
 - Opportunity to mentor a younger student during STEM time in their classroom
 - Partner with other STEM specialists to generate ideas for other incentive
 - Other ideas you may have!

STEM = Science, Technology, Engineering, and Math

What is STEM Pathways?

STEM Pathways is a partnership of Minneapolis Public Schools (MPS), MN Department of Education and several Twin Cities STEM education organizations— The Bakken Museum, Bell Museum of U of MN, Minnesota Zoo, STARBASE Minnesota, and The Works— to immerse students in exciting STEM learning opportunities to help create the innovators and problem-solvers of the future.

MPS - Participating Schools, 2014-2016

- Bryn Mawr Community School
- Emerson SILC
- Jefferson Community School
- Lake Nokomis Keeywadin Community School
- Loring Community School
- Pillsbury Community School



What does STEM Pathways mean for your child?

- Participation in several exciting, innovative, hands-on STEM experiences in and out of school throughout the year that strengthen STEM learning and create a path to the future
- Exploration of a wide range of STEM careers as realistic possibilities for your child's future
- Important STEM experiences that are connected, aligned to MPS learning targets and standards
- A means to reward and track your child's learning and achievements in STEM with the STEM Pathways portfolio, passport, Game of STEM and other activities
- Info about additional ways your child can be involved in STEM to promote further learning

Additional Information:

The impact of STEM Pathways will be studied by Wilder Research. Understanding of successes and lessons learned will inform expansion to more schools, grades and community STEM organizations in the future.

For more information: Please contact your child's teacher or principal.

STEM Reflection - The Bakken Museum



What do you remember about your experience with The Bakken?

I will always remember...

because...

What was your favorite part of doing STEM with The Bakken?

My favorite part of doing STEM with the Bakken was...

What is something new that you learned with The Bakken Museum?

Why do you think your teachers wanted you and your class to visit the Bakken Museum?

Describe a career you learned about at The Bakken Museum.



STEM Reflection - The Works Museum

What do you remember about your experience with The Works?

I will always remember...



because...

What was your favorite part of doing STEM at The Works?

What is something new you learned at The Works?

How do you think The Works experience will help you in 4th grade and in your future?

Why do you think your teachers wanted you and your class to visit The Works?

I think my teacher wanted me to experience The Works because...



STEM Reflection - STARBASE Minnesota



What do you remember about your experience at STARBASE Minnesota?

What was your favorite part of doing STEM at STARBASE Minnesota?

What is something new you learned at STARBASE Minnesota?

I learned...

Describe a STEM career you learned about at STARBASE Minnesota.

I think...

What are some skills you learned or practiced at STARBASE that could help you in this career?



STEM Reflection - The Minnesota Zoo

What do you remember about your experience with the Minnesota Zoo?



MINNESOTA ZOO®

I will always remember...

because...

How did you use or observe STEM with the Minnesota Zoo?

What is something you learned at the Minnesota Zoo?

How do you think the Minnesota Zoo experience will help you in 5th grade and in your future?

My experience with the Minnesota Zoo will help me....

Describe a career you learned about or observed at the Minnesota Zoo.



STEM Reflection - STARBASE Minnesota



What do you remember about your experience with STARBASE Minnesota?

How did you use or observe STEM at STARBASE Minnesota?

What is something you learned at STARBASE Minnesota?

I learned...

Describe a career you learned about at STARBASE Minnesota.

What are some skills you learned or practiced at STARBASE that could help you in this career?



STEM Reflection - The Bell Museum

What do you remember about your experience at The Bell Museum?

I will always remember...

because...

How did you use or observe STEM with The Bell Museum?

I used or observed STEM when...

What is something you learned at The Bell Museum?

How do you think your Bell Museum experience will help you in 5th grade and in your future?

Why do you think your teachers wanted you and your class to visit The Bell Museum?



Science in STEM Pathways



Scientists use a creative process to ask and investigate questions about the world around them.

Describe a process you used during your STEM Pathways experience.

How did you use technology, engineering, or math in this process?

- Science
- Technology
- Engineering
- Math

Draw a picture of a process you used as a scientist during your STEM Pathways experience. Label the parts of your process.

Technology in STEM Pathways



What do you think about when you read the word technology?

When I read the word technology I think about...

Sometimes we think technology is only things like cell phones and computers.

Technology can be so many things!

Technology can be anything we create to meet a need or want.

How did you use or observe technology during your STEM Pathways experience?

Draw a picture of two examples of technology from your STEM Pathways experience. Make sure at least one example is something that **doesn't** have batteries, a cord, or a screen!

Technology Example 1

What did you draw?

How is this an example of technology?

I drew...

I think this is technology because...

Technology Example 2

What did you draw?

How is this an example of technology?

Why do you think technology is important to the other parts of STEM?

Science

Technology

Engineering

Math

Engineering in STEM Pathways



Engineers are inspired to make things better.
They identify problems and then work to design a solution to meet human needs and wants.

Think about an engineering problem you learned about or solved during your experience.

Describe the problem below.

Draw a picture of the idea, invention, or solution that solved this problem.

As an engineer, what inspires you? Describe a problem you would like to solve.

How did the other parts of STEM help you to be a successful engineer?

Science
Technology
Engineering
Math

Math in STEM Pathways



Math is a vital tool for scientists and engineers as they work to answer questions and solve problems.

How did you use math during your STEM Pathways experience?

Describe the math skills you used.	How did this math help you learn something new or solve a problem?

How can you imagine using math in your future STEM experiences?

My STEM Pathways Career Log

Name of Career:

Why do you find interesting about this career?

What questions do you have about this career?

Name of Career:

What do you find interesting about this career?

What questions do you have about this career?

Name of Career:

Why do you find interesting about this career?

What questions do you have about this career?