Restoring a Community Icon

2014 CEFPI James MacConnell Award Submittal
Battle Creek Area Mathematics and Science Center
Battle Creek, Michigan
Executive Summary
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Battle Creek Area Mathematics and Science Center’s (BCAMSC) students and teachers have changed the face of science, technology, engineering and mathematics (STEM) curriculum since 1991, embracing the Center’s mantra of “Innovation through Inspiration.” The Center serves dual functions: education for exceptional high-school students from 16 neighboring districts; and the design, manufacturing and distribution of Science Unit curriculum kits.

Spearheaded by the economic development organization, Battle Creek Unlimited, this project became a reality in spring of 2011. The Kellogg Company donated the former Cereal City USA Museum and property for the new BCAMSC. Through a comprehensive planning process, the design team was engaged to redevelop the former museum into a new, cutting-edge facility for the Center.

The overall concept removed six existing agricultural roof forms at the existing museum and created cantilevered second and third floors over the entry plaza. Glass curtainwall was used on the exterior of the second floor, creating a greenhouse at the corner to showcase the Center’s commitment to research-based learning. Classrooms surround open collaboration spaces, including a physics perch drop on the third floor.

The building’s interior design concept was inspired by biological science and features several installations to enhance spaces. Sustainability monitors are tied to building systems and interactive technology exhibits, such as the students’ solar car project, occupy open spaces, reflecting the Center’s mantra of “Innovation through Inspiration”.

INNOVATION through INSPIRATION

Size: 64,000 SF
Cost: $14 million
Grades Served: 8-12
Completed: August 2013
Background, Budget and Scope of Work
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The Battle Creek Area Mathematics and Science Center’s history stems back to the 1980’s as a result of a citizen-led committee driven by the vision of William LaMothe, retired Kellogg Co. chairman and CEO.

A community-wide fundraising campaign raised over $2 million to adapt an abandoned 1956 high school for the Math and Science program. The Center opened in 1991 and has grown to serve students from 16 school districts, including Rhodes Scholar recipients, doctors, neurosurgeons, nuclear engineers, forensic chemists, pilots, physicists, sculptors and astronomers. The Center is devised as a half-day program offering a rigorous curriculum in Science, Technology, Engineering and Math (STEM). The 9th and 10th grade curriculum focuses on the basic tools and knowledge students need in order to make decisions on future courses of study and careers. The 11th and 12th grade curriculum provides students with the opportunity to explore scientific areas of interest in greater depth.

Later, as a result of the economic downturn, the Center sought additional funding sources and began selling its math and science curriculum (Science Units and Outreach Program) to schools throughout Michigan. It has since grown to incorporate special education students from Battle Creek Public Schools as well as a science teacher training program which has become a national model for STEM curriculum.

Today, these programs employ 10 people and generate a substantial profit, supplementing approximately 20% of the BCAMSC’s annual operating budget and subsidizing 40% of the K-12 Science Units purchased by local K-12 schools. These Science Units serve over 35% of Michigan school districts as well as schools in Indiana, Illinois, Iowa, and internationally in Dubai.

“If it were not for symbiotic relationship between our three programs, the Math and Science Center would have closed its doors in 1998.”

- Connie Duncan
Former BCAMSC Director
In 1996, design and fundraising efforts also began in Battle Creek for Kellogg’s Cereal City USA, a museum and theme park, to meet demand for tours of Kellogg Company’s South Plant. The $22 million building anchored the end of historic main street at the city’s center and became a community icon. When doors opened in 1998, the 45,000 SF museum drew an annual crowd of more than 162,000 visitors. However, after years of challenges to meet attendance projections and financial losses, Cereal City USA closed its doors. The looming three-story building left a hole in the heart of the city.

In 2008, Battle Creek Unlimited (BCU), the community’s downtown development authority, announced a multi-million-dollar plan to revitalize downtown Battle Creek which included the relocation of the Math and Science Center to downtown. In the years that followed, the Kellogg Company donated the Cereal City USA Museum to BCU, who organized a $14 million fundraising effort between the W.K. Kellogg Foundation and the Kellogg Company Twenty-Five-Year Employees Fund to finance additions and renovations to the BCAMSC. BCU then donated the building to Battle Creek Public Schools.

The design team’s charge was to transform the museum into an immersive learning environment that exemplifies STEM curriculum while inspiring students, staff and community.
Community Engagement Process
Community Engagement Process

Battle Creek Unlimited (BCU) and Battle Creek Public Schools collaborated early-on to include a diverse, cross-section of community members in order to ensure a sustainable and well-planned facility - one that serves that community and beyond. Carl Dehn, President of Battle Creek Unlimited stated, “This was truly a community-focused process from the very beginning. There were several meetings with local businesses, school superintendents from the Calhoun Intermediate School District and community forums to solicit input. A major goal was to create a positive dialogue in the extended community regarding this exciting project and we definitely achieved that result”.

Stakeholders

This education planning project is unique in that it intentionally incorporated a generous amount of public and private stakeholders:

- The Kellogg Corporation
- W.K. Kellogg Foundation
- Kellogg’s Twenty-Five-Year Employees Fund Board
- Battle Creek Unlimited
- Battle Creek Public Schools
- The Math and Science Center’s Policy Advisory Committee
- Calhoun Intermediate School District Superintendents
- Previous donors to the Center
- Local, unionized construction workers
- Alumni, students, faculty, and the community at large as represented by the Mayors of Battle Creek and Springfield, Michigan.
Process

The planning process for the new Math and Science Center was extremely thorough. The nationally-renowned planners, architects, and laboratory consultant led stakeholders through dozens of activities, meetings, tours and presentations. Simultaneously, the architect was conducting facility assessments at four vacant buildings within the community to determine the best fit and viability for the BCAMSC. These efforts all took place over a 9-month period and engaged faculty, staff, students, community and philanthropists.

Faculty Engagement

One of the first efforts included an initial two-day visioning work session with BCAMSC faculty in order to establish a common language and understanding of the project goals and objectives. Faculty were divided into small groups and asked to discuss and report on the following items:

- **Activity 1:** Identify the positive attributes of the current program and facility.
- **Activity 2:** Identify the obstacles brought about by the existing facility.
- **Activity 3:** What initiatives will make the program better?
- **Activity 4:** How can the program better identify vulnerable, at-risk children and help them reach their potential?
- **Activity 5:** Superintendents of the constituent school districts and representatives from Kellogg Company participated in a round table discussion to expand the visioning process and strengthen collaboration for internships, mentorships, and interaction with scientists in the classroom.
- **Activity 6:** What role should technology play in the new facility? When will the Center be implementing one-to-one computing, or better?
- **Activity 7:** What are the types and amount of spaces required to support a high-tech mathematics and science center? What kinds of spaces are needed for individual, small group, classroom, and project-based learning?
- **Activity 8:** What are the necessary spatial relationships? The faculty created Post-It note diagrams conveying their ideas.
Process (continued)

BCAMSC staff also toured several nationally-recognized facilities and produced presentations to share with the entire design group in order to establish a common design language and to communicate likes and dislikes, as well as “wants” versus “needs”. The research included tours of: Bioscience High School in Arizona, New London Science and Technology High School in Connecticut, Philips Exeter Academy Phelps Science Center in New Hampshire, Albion College Science Complex in Michigan, and the Michigan State University Science and Technology Labs.

Tours of leading educational furniture manufacturers were also conducted which included Steelcase and Herman Miller, to become better informed on current educational furnishings research and its positive impact on learning. Other visits included touring Kellogg’s laboratories, Covance Laboratories, and Denso Manufacturing’s production center. The process engineers at Denso also contributed their knowledge to help layout the Science Unit kit distribution center, while Covance helped with laboratory layouts.

The design group then met one-on-one with teachers to identify teaching techniques, space requirements, technology support, lighting, appropriate finishes, storage requirements, equipment, furniture considerations and other needs. See Appendix A for an example of the Educational Specification and Appendix B for an example of the laboratory equipment and template layouts that were developed for this project as a result of these discussions.

This collaboration and community partnership resulted in a design that incorporates innovation, flexibility, advanced technology, natural daylighting, and most importantly, areas conducive to inspiring students and supporting the BCAMSC’s mantra of “Innovation through Inspiration”.

Albion College Science Complex (Albion, Michigan) was one of the locations chosen for benchmarking tours.
Students, Parents and Alumni Engagement

Input from current students and parents was also gathered as a means to better understand the student perspective. Questions included the following:

- What do you like best about the Center?
- What additional programs would you like to see offered?
- How can the Center better serve our community?

A questionnaire was sent to BCAMSC alumni to gather input on the essence of the Center and what additional programs might help future students.

Community Engagement

A community input meeting was held at the existing BCAMSC to engage parents and community members. This was a lively, two-hour discussion that was well-attended and covered by the local media. Some community members voiced concern that other vacant properties (in addition to the former Cereal City USA Museum) should be considered for the Center. In response, the architects studied the top four possible locations for the Center and created a 50-page comprehensive facility assessment (see photos above for location options).

When compared to the other buildings, Cereal City was an average of 53 years newer and its steel structure was more conducive to renovation. Furthermore, it would be at least 15% less expensive to operate than the current facility due to insulated walls, and energy-efficient roof and windows.
Results of the Process

The design group met with the Battle Creek Public Schools Board of Education members to present an overview of the visioning process and results of the questionnaire.

The design group also shared findings with the Math and Science Center’s Policy Advisory Committee (area leaders including CEO’s, business owners, and School Board members). The purpose of the Committee was to ensure that the community’s input was represented in developing the concepts. The group was divided into small groups to discuss three questions.

- Are there unmet needs that the Center should address?
- Which current programs are essential for the continued success of the Center?
- What are the benefits and concerns of the Center’s potential downtown relocation?

As a result, a Steering Committee was formed which included representatives from BCAMSC, the school district, Battle Creek Unlimited and the Construction Manager. Using findings from the visioning process, the architects presented design concepts to the Steering Committee.

To build additional consensus and community engagement, follow-up meetings were held with all groups previously mentioned, as well as philanthropy organizations. In the end, final designs were announced through press releases and interviews to communicate the plans to breathe new life into the City’s iconic building.
Challenges

This project was not without its challenges...

- Battle Creek is a heavily unionized city; however, school construction projects in Michigan must be bid publicly and without preference. There was an initial uproar from local union contractors, however the picketing was less than expected and the project was allowed to proceed smoothly.

- The Springfield Community (home of the existing BCAMSC) was concerned about what would happen to the vacant facility after the Center relocated. Battle Creek Public Schools is currently looking for the right buyer for the former facility that will benefit both the community and school system.

- There was a community concern that the Science Center's Distribution Center "warehouse" would detract from the downtown image and that it should be located off-site in one of the vacant buildings. However, since the Distribution Center and the Learning Center share staff, it would not be viable in another location. Careful siting of the building, landscaping and a brick façade were used to diminish the visual impact of the Distribution Center to the neighborhood.

- A public street once ran through the site and the process for abandoning it had not been completed when the museum was built. The street abandonment had to be completed before the bus loop was constructed. The City of Battle Creek was very helpful in this process.
Challenges (continued)

- The Biology River Access Platform required approval by the Michigan Departments of Natural Resources and Environmental Quality.

- The Science Unit Distribution Center could only relocate in the last few months of a calendar year due to their strict production schedule. Therefore, the Distribution Center had to be fast-tracked eight months ahead of the Learning Center project to meet this criteria.

- 1-to-1 computing is a unique challenge at the Center because students come from 16 different school districts. Many districts have already standardized on different platforms, and students come to the Center with laptops, iPads, or nothing at all. The solution involved standardizing on the new Texas Instruments Graphing Calculator with the Navigator operating system. This system allows teachers to push assignments to students and display individual student work on the projector over WiFi.

- The initial programmatic budget was $19 million for renovation and addition. The project progressed through several value engineering phases to achieve the final construction budget of $14 million.

Available Assets

A major asset to the project was the donation of the 45,000 SF three-story building that was only 11 years old, and the donation of the construction funds to complete the additions and renovations. Without the community partnerships, this project never would have been completed. The former museum has a unique riverfront site and plaza that significantly contributes to the total learning environment.

In addition, the creative and engaging teaching staff is the biggest asset by far. These imaginative educators have a passion and commitment that goes well beyond the school day.
Value of the Process and Project to the Community

The Battle Creek citizens truly benefitted from the community engagement process. They were able to voice their hopes and concerns for the project early-on. Because their ideas were listened to, consensus started to build around the final solution. The community at large benefits because this project transforms a shuttered, iconic building into a successful program that contributes to the vibrancy of the city. Hundreds of students and their parents now contribute to the excitement of the ongoing transformation of the center city area.

Another significant value to the community is exposing students to high level careers that are locally available. Scientists from the Kellogg Company are actively engaged in mentoring students and assisting with classroom instruction, as several of their facilities are within walking distance. Kellogg and other vested companies hope to attract these future scientists and engineers back home to Battle Creek after college.

At the conclusion of the schematic design, a public press conference was held at a downtown community center to report the findings to all stakeholders and to share the design concept with the community. The design was well received by the hundreds of community members in attendance.

“I am extremely impressed with what has been accomplished here in Battle Creek!”

- Dr. Maria E. Scott, Executive Director
Battle Creek Area Mathematics and Science Center
Educational Environment
Educational Environment

Supporting Curriculum

During the design phase, the educational specification became a constant companion to the architects. It served as a comprehensive resource that was highlighted, read and referred to often. The template layouts provided ideal laboratory layouts for both student safety and process flow. With the charge to create “Innovation through Inspiration”, the designers utilized the laboratory templates, but modified them and inserted additional spaces to create moments of inspiration such as:

- Student break-out spaces for increased flexibility
- “Glassware Alley” dedicated to a thorough cleaning process of shared scientific glassware
- Gravity-experiment spaces such as the “Physics Perch” on the third floor

The resulting biology, chemistry, and physics laboratories and classrooms are dynamic and generous spaces that supplement the curriculum.
Supporting Variety in Learning and Teaching Styles

A variety of teaching and learning styles were considered during the design process. The book “Language of School Design” by Nair and Fielding, served as a visual reference for spaces that support multiple learning modalities such as visual, auditory, hands-on and spatial learners. The publication served as a valuable tool in establishing a common language and visual reference when working with BCAMSC constituents.

Traditional classrooms were incorporated for mathematics instruction, while learning studios were found to be more appropriate for the laboratory disciplines. Additionally, laboratory spaces were adjoined by their shared support spaces to maximize use and provide for flexibility.

The overall facility was designed with flexibility in mind as well as providing for learning opportunities to take place anywhere throughout the building. As a result, the “Learning Community” was designed to maximize impromptu and organized learning. This is a dynamic, three-story space centered on a naturally-lit atrium and stair, wrapping around a functioning pendulum. Soft seating is arranged in groups of 2-10, but can be rearranged by students to allow for independent study, peer tutoring, or team collaboration.
On the second floor, a “cave space” was designed (shown at left) and is a place designed for small group study, reflection or quiet reading. It features built-in seating, an exposed technology theme and technology charging stations. Lounge furniture around large monitors supports project-based learning and broadband WIFI is provided throughout the facility and plaza for internet-based research and one-to-one computing. The Engineering Laboratory is a good example of design-based learning, with spaces designed to support classroom instruction, robotics and solar car competitions.
Teacher directed lecture formats are provided for in all of the classrooms and studios. However, seminar-style instruction is best accomplished in the tiered computer lab utilizing a back-facing computer work surface, so that during lecture-type instruction, students face forward and are not distracted by technology.
The cantilevered building itself serves as a teaching tool - the sloped, "V" column, is a wonderful physics problem for the students to study. The former museum’s windmill, man-made stream and sundial were restored to their original condition, with additional interactive exhibits to come.

The site itself is a natural connection to the biology curriculum, which has a special emphasis on water analysis. Students are able to put on waders, exit directly down a stair from the classrooms, take river samples and return directly to the lab. Water samples are then taken to the attached Greenhouse for analysis.

Features such as the Solstice Pole and Primitive Art were incorporated outdoors.

The process also identified a future synergy between Kellogg Corporation’s Food Science Engineers and the Math and Science Center staff. The result will be a new Food Science Class offered at the Center with guest lectures by Kellogg’s own Food Scientists and the researchers at the Global Food Institute. This public/private teaching partnership is unparalleled for most high school students.
Physical Environment
Physical Attributes of the Environment

As a result of the collaboration among various constituents (students, staff and the community), during the design phase, the team established three important design strategies to incorporate in the physical attributes of the building:

1. Maximize the existing space and circulation in order to efficiently develop educational spaces around the existing atrium
2. Transform the agrarian aesthetic to that of a cutting-edge learning facility, that will provide an environment to inspire students
3. Use the building as a teaching tool and opportunities for learning

Exterior Attributes

The solution involved removing the existing roof and adding a cantilevered second and third floor over the entry plaza. Supporting this, an expressive “V”-shaped column at the building’s entry serves as a source of study and inspiration for the students. A glass curtainwall envelops the exterior of the second floor and highlights a greenhouse at the corner, showcasing the Center’s commitment to research-based learning. The new third floor is enclosed in a two-tone metal panel with punched openings inspired by mathematic patterns.
Interior Attributes

The interior design concept draws on biological science. Walls are an expression of organic form set in motion by a three-story pendulum inside the central stair (at right). The stair landings are cantilevered into the atrium space, with the upper landing supported only by cables.

Scientific installations are incorporated throughout and include sustainability monitors tied to building systems, a building systems display case, a technology-inspired small group room, laptop charging stations and the students’ solar car project, enhance the space.
A serpentine technology “snake” tray weaves throughout collaboration space, culminating in the building’s Main Distribution Facility (MDF) room. The MDF room exemplifies “technology on display” with a canted glass display case for a 180-degree view and mirrored back wall. Floor openings with suspended light fixtures help “blur the lines” between floor levels and provide connections for students.

“Inspiration through Innovation is realized in the accomplishments of our community of students and teachers... the instructional and common spaces are designed to teach, inspire and innovate!”

- Luke Perry, Director of STEM
Battle Creek Area Mathematics and Science Center
In the third floor atrium, a cantilevered physics perch becomes a place to safely drop objects and measure the results. Physics labs also provide a flexible dark room for optics study and an inflatable planetarium.

Additional exterior spaces were developed to provide safe access to the river for biology students to study, sample, and analyze the ecosystem. Proximity to the Kellogg Corporation headquarters is also a valuable site consideration. Food Science engineers from Kellogg are able to cross a river bridge directly to the Center to make presentations and meet with students along with other business and industry partners who are close by. Additionally, students will be given access to Kellogg’s real world lab environments.

How the Project Inspires and Motivates

This building is a collection of spaces that expressively emphasize the Math and Science Center’s mantra of “Innovation through Inspiration.” Every design decision was made by carefully considering these principles and the result is a facility that truly inspires and motivates its occupants to reach their fullest potential.

The building itself is utilized as a teaching tool with exposure to technology cabling, exposed structural systems, building data collection station, an operational pendulum and suspended stairs that serve as a physics study.

“INNOVATION through INSPIRATION”
Results of the Process and Project
Results of the Process and Project

Achieving Educational Goals and Objectives
This facility is an innovative learning environment as a direct result of the Owner’s commitment to their mission. They challenged the design team to leverage every possible space for learning and inspiration and ultimately, they achieved a very dynamic educational environment.

The Center’s mission statement incorporates the concepts of accelerated enrichment, professional staff development, and building partnerships with local businesses and industries. The new facility accomplishes each of these goals admirably. The high quality and unique educational spaces, combined with a very sophisticated technology environment, enables students to perform at a much higher level. Staff are chosen for their subject area expertise, in addition to their passion to see students succeed.

The educational environment is also conducive to teacher accessibility as staff offices were intentionally located near student spaces to foster student-teacher interaction and collaboration. Additionally, the partnerships and sharing of information with local businesses is another key ingredient in the success of BCAMSC graduates.

Mission:
The Battle Creek Area Mathematics and Science Center will deliver educational services in mathematics, science, and technology to area students, teachers, and administrators. Its mission includes four components:

- Foster improved mathematics, science and technology instruction to all students in grades K-12
- Provide accelerated enrichment instruction to students in grades 9-12
- Provide quality professional staff development for area K-12 educators
- Build lasting partnerships with area businesses and industries
To achieve the school district’s sustainability goals, the building was designed to LEED Gold levels; however, the school district decided against formal certification because of cost implications. Nonetheless, the electrical engineer was able to submit the sustainably-designed lighting system for rebates totaling more than $20,000.

Additionally, community outreach is a major goal of the district and the facility is now fostering an environment to better-serve students, teachers, parents and administrators in surrounding communities in the following ways:

- **Professional Development** – providing curriculum workshop opportunities, in-services for science units, preparing for MEAP testing, teaching inquiry-based science, literacy integration, and using technology in the classroom. All teachers using BCAMSC Science Units must meet professional development requirements for each unit before implementation in the classroom. To meet this requirement, there are several training / conference rooms located on the first floor of the building.
Leadership Development – effectively train leaders in STEM education and support principals and other administrators by collaborating with subject area professional associations and support statewide efforts. BCAMSC regularly holds training for teachers from around the state of Michigan through the Science Unit distribution program. The new, on-site warehouse facility helps to produce more Science Unit kits to meet the growing demand.

Curriculum Support – assist area school districts with alignment and implementation of all math, science, and technology curricula. Multiple school districts benefit by sending students and staff members to the programs, which then has a positive impact on their home school districts.

Student Services – in-class programs, after-school programs, support for research, support for special investigations and periodic problem-solving sessions. The flexible support spaces in the new facility provide for multiple activities, during and after school hours.

Community Involvement – effectively work with area museums, libraries, nature centers, outdoor education centers, businesses, professionals, K-12 educators and college / universities to enhance curriculum.

Resource Clearinghouse – provide math manipulatives, science units, reference materials, and science equipment to school districts throughout the State. The new facilities greatly enhance the ability of BCAMSC to promote math and science education throughout Michigan.
Achieving Community Goals

The new facility is virtually an intellectual playground for the Center’s students and constituents. The Math and Science Center not only holds purpose and distinction within its community, but also restores a well-deserved icon to the heart of downtown Battle Creek. Carl Dehn, President of Battle Creek Unlimited said:

“This project was the cornerstone to the revitalization efforts which have breathed new life into downtown Battle Creek.”