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Constructing Innovative Makerspaces for Hands On, Minds On Learning

The buzz of excitement welcomes visitors as they enter the colorful newly designed Innovation Center. Looking around, visitors see students actively engaged in an elementary Makerspace with their learning partners, each working on a unique activity. In small teams, conversations are focused on their group's unique goal; excited gestures and voices are a regular part of the learning process. Mrs. Jessica Hodge, the Innovation Coach, circulates, visiting small groups to inquire about their goals and how their project is progressing.

Across the district, a substitute teacher walks into a stunning Makerspace known as a STEM Lab equipped with a Video Production Hub and accompanied next to a STEAM Studio.

The role of the substitute has changed. It is no longer focused on working through a lesson plan, controlling classroom discipline or managing crisis. Instead, the teacher watches students enter and eagerly start pulling out robotic kits,

manipulate solar energy driven vehicles and design bridges and skyscrapers that can withstand powerful natural disasters. Students want to be in these environments as they help each other, develop as leaders, and design their learning world!

Unlike in traditional classrooms, students readily admit to mistakes, shrug them off and discuss what they will try next to solve their problem. None of the students are 'wall-flowers,' watching and waiting for another student to get 'the correct answer' because this classroom is all about process, collaboration and accomplishing that group's self-chosen goals. Each student is an integral and valued team member whose participation is necessary for project success.

Welcome to McHenry School District 15. Here you will find beautiful new learning environments inclusive of STEM Labs, STEAM Studios and Innovation Centers; otherwise known as Makerspaces that students enjoy going to and never want to leave. During their lunch hours, they gravitate back to these amazing spaces for more time to invent, and after school, they return to create and discover.

In today's ever changing world, McHenry School District 15 educators are making sure students are well-prepared for college and careers even though their

career choices are as yet undefined. While there is no one blueprint or road map in how this can be done, an emphasis on STEM, STEAM, and Innovative Learning within a Makerspace concept is a wise path for educational leaders to take. Although no crystal ball exists, the institutions of higher learning and careers of the future will undoubtedly be looking for students who can:

- Think Critically and Problem Solve
- Apply Technology to Workflow
- Manage Projects
- Collaborate and Work as a Team
- Communicate Effectively in a Variety of Formats
- Think Creatively and Innovatively
- Employ Research Skills and Demonstrate Information Literacy
- Demonstrate Self-Direction and Motivation
- Effectively Assess Self-Strengths and Weaknesses

Simply put, an emphasis on educational programming that meets these aims is an investment in the success of children. Through clarification of priorities, proactive planning, and development of spaces, personnel, and curriculum, school systems can take necessary steps to ensure that their students are adequately prepared for the world they will soon be entering. ***Here is the journey of McHenry School District 15:***

Click to view a video highlighting District 15's Innovative Makerspaces.

McHenry School District 15 has transformed traditional technology labs and learning centers into beautifully designed and colorful Makerspaces. Essentially, any space can become a Makerspace. According to Samantha Roslund (2014), a Makerspace is a general term where people get together to make things. "The space is not defined by the tools you find, rather students define the space by what it enables them to do" (Makerspace Playbook, 2013). In McHenry School District15, these spaces include Innovation Centers, STEM Labs, and STEAM Studios equipped with Video Production Hubs and complement newly remodeled Learning Media Centers that are truly eye-catching. These collaborative spaces offer sequential K-8 cross curricular opportunities combining the goal to maintain and enrich the district's core curriculum, allow innovation, and provide project-based exploration.

Edgebrook Elementary School Innovation Coach, Mrs. Gina Nicholls, describes the newly constructed Makerspaces as "robust learning environments that are relevant and rigorous, allowing students to be critical thinkers, problem-solvers, and engaged within their learning experiences.

"It's a vision for a learning experience that is centered on the learner and evolves technologically as quickly as they do," states Nick Watson, Parkland Middle School STEM Coach. "We are providing our students with an educational opportunity that fosters engagement, interaction, and achievement

"We are providing our students with an educational opportunity that fosters engagement, interaction, and achievement through cutting-edge technology in a personalized learning approach." - *Nick Watson*

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The evolution of these spaces has centered on the district's re-imagination of their Learning Media Centers which have been upgraded to a strong foundation for information literacy and blending of digital literacy while also offering better media options for exploration, and flexibility for individual and team research.

In addition to the new programming and renovated spaces, the district has outfitted each Middle School with cutting edge Video Production Hubs that allow students to produce educational videos, record and broadcast sporting events, and produce promotional content while partnering with local businesses and community groups.

McHenry Middle School STEAM Coach Jessica Brown shares, "District 15's new Makerspaces have no boundaries. A place with no boundary means students can exceed anything beyond what you ever expected."

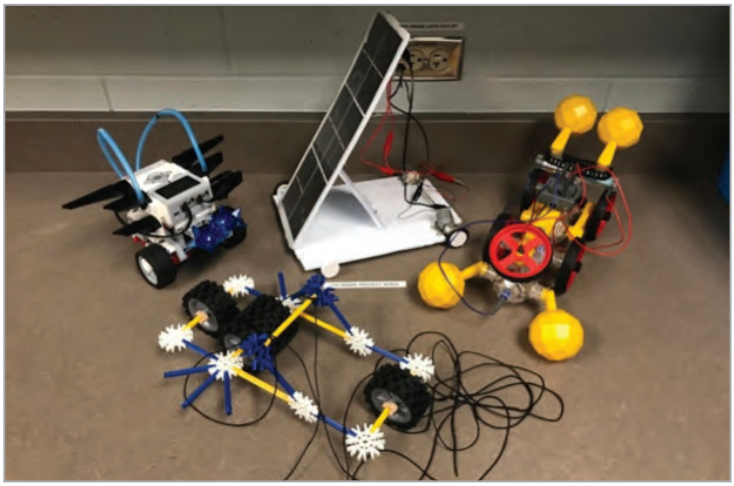
McHenry School District 15 STEM, STEAM and Innovation Coaches have worked collaboratively as a group to design a curricular sequence that is of the highest quality for their learning community. Coaches spent a year researching STEM and STEAM learning opportunities as they conducted site visits and presented to all stakeholders during the adoption phases. Following this research, the district constructed new beautifully designed Makerspaces to meet their vision. Additionally, coaches implemented an inspiring curriculum and

built a philosophy centered on being truly innovative! McHenry District 15 Schools now house some of the most inspiring Makerspaces equipped with a carefully adopted curricular sequence that allows students to grow during their elementary years and beyond.

Believing In Our Students and Taking Risks

Instructional strategies start by believing in the students. Coaches work with students to help them set goals, challenge themselves and trust them to make informed choices when coming up with creative solutions. Coaches promote the transfer of control over to their students and start to guide students from the 'sidelines' at a young age. It is imperative to foster curiosity and provide hands on experimental learning opportunities for young learners (Dewey, 1926). Students acquire the meaning of teamwork and learn how to interact with each other. While learning, students also grow to understand failure is acceptable and a necessary component of the learning process.

Within each Makerspace, students aspire to reach higher goals simply by being allowed to work together in an environment that is dedicated to trial and error. Here they can engage in hands on, mind on learning activities where they can be comfortable knowing it is acceptable to FAIL (First Attempt In Learning). Students identify how failure is a critical element to the learning process. They learn how failure can lead to success while collaborating through the building and programing of robots, testing out Lego structures during



FAIL - *First Attempt in Learning*

earthquake simulations, and designing 3D renderings of buildings, bridges and architectural models. Students realize failure is important while taking risks and experimenting. A clear and realistic understanding comes during these truly authentic assessments as students learn more from what they do wrong rather than what they do right.

Curriculum is differentiated using multi-platform tools and manipulatives. With over 350 Learning Launchers in more than 60 content areas, students explore a wide range of projects and challenge levels. They engage in activities that teach them about Alternative and Renewable Energy, Circuitry, Computer Graphics, Digital Communications, Robotics, Scientific Data, Mechanics and Structures, and Software Engineering.

Equity in Learning

While integrating the makerspace concept into practice, it was recognized that content and curriculum must be available to reach all types of learners. Digital Literacy and Information Literacy have to be truly equitable. To that end, a robust and rigorous curriculum allows students to ultimately choose what they want to learn and how difficult of a challenge they want to take on. With a system that houses hundreds of multi-level challenges and software programs, students have a choice as they discover project activities that bridge technology concepts and core academic content to be engaging, relevant and learner-centered. Essentially, McHenry School District 15 Makerspaces meet learners where they are and take them as far as they are able to go.

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Students readily engage in real world projects and activities that are built through a STEM and STEAM focus. Examples of their work include the development of actual 3D models and architectural structures, designing next generation vehicles, and discovering new forms of fuel efficiency to benefit our communities and global environment all across the world. Grading strategies are intended to provide immediate and motivating feedback rather than punitive grading systems that penalize risk-taking.

Students are allowed to model their thinking by explaining, discussing, and questioning every task or project they do collaboratively.

Non-STEM and STEAM subjects function and work interchangeably with the district's Innovative programming. Whether students are working through various experiments and formulating inquiries utilizing the new Next Generation Science Standards or developing strategies for taking action and preparing for a lifetime of civic engagement using the new Social Science Standards and ELA Standards, students are collaborating through project-based explorations and learn to think and ask questions for themselves. Additionally, our math curriculum even offers STEM based problems to complement each math lesson so students can draw connections to real life mathematical examples and computations.

Building A Culture and Philosophy of Innovation

As McHenry School District 15 STEM, STEAM and Innovation Coaches have worked cohesively to bring rich and engaging STEM / STEAM based learning opportunities to their students, they have also worked collaboratively with the Learning Media Center Directors to educate and explore learning possibilities for school staff. During Staff Development Wednesday's (District's 15 PLC Model), all educators learn how to integrate innovative learning components into their core curriculum. Learning Media Center Directors developed STEM Discovery Bags which are clear, see-through kits housing enriched STEM projects that teachers can check out and do together with their students in their classrooms. Essentially, every classroom has the potential to be a Makerspace with high-end to low-end technologically driven curriculum and engagements for staff and students

While integrating the Makerspace concept, engaging and collaborative tools have been featured for ongoing professional development and curriculum building. Such tools include the use of a 3D Printer to design, construct and problem solve. Students and staff

learn and struggle through real world applications as they apply mathematical, scientific and social reasoning while growing as innovators. Additionally, Breakout Edu Kits have been combined with STEM based learning activities for both students and staff to foster the facilitation of game based learning where players use teamwork and critical thinking to solve a series of challenging puzzles.

McHenry School District 15's Makerspace concept allows students to have a Specials Curriculum during kindergarten through fifth grade where they participate in Innovative Learning, a STEM and STEAM based course. Students then engage in Exploratory Curriculum (STEM Lab and STEAM Studio) during middle school. Students participate in lab projects that foster creative thinking and understanding of design principles. The course work focuses on the discovery of real world problems (the ***What*** and ***How***) and overall impact their discoveries have on Society (the ***Who*** and ***Why***). Each challenge provides available resources, materials and limitations for students as they work and try to solve real world issues.

Authentic Learning and Assessment
Authentic problem solving opportunities for students are demonstrated as learners document and present their learning through ePortfolios, professionally edited videos utilizing new cutting edge Video Production Hubs, and collaborative engagements in a student-friendly, interactive curriculum platform. Each challenge features a learning launcher that identifies the project-based STEM activity and applies technology to reinforce academics while building on 21st century skills. Multiple challenge levels, open-ended activities, and extended projects make up each grade level and meet all varying cognitive abilities. There are hundreds of authentic projects with integrated assessment rubrics to allow both learners and coaches to identify areas in need of improvement.

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Learners identify key impacts and consequences of each challenge they participate in. Examples include; designing structures, such as bridges or buildings that have to withstand the impact of natural disasters including earthquakes and hurricanes. Students learn how to construct and program

robotic equipment (Lego EV3, VEX and Ozobots) to assist and enhance performed medical procedures or feed animals in a community zoo. Students can also discover more efficient ways to utilize fuel while studying different kinds of energy. They work on predicting future costs via challenges that circulate around new forms of solar and wind technology. As projects lead students to new theories and inventive solutions, young learners discuss the larger impact on society and collaborate to develop marketing campaigns to share how their discoveries will have an influence benefiting communities worldwide.

Building Impactful Partnerships

McHenry School District 15 has also worked on building lasting partnerships with the community high school district, public library and local recreation center, all of which offer students innovative learning opportunities during the school year and throughout the summer. Through these affiliations, there are summer STEM / STEAM learning camps and competitions that students can partake in. Lastly, there is even a partnership with the local Community College for students to enroll in. Students can seek career paths into Medical, Engineering or Computer Programing fields and then get guaranteed enrollment into State Universities!

Local business partners also expose our students to a number of STEM and

STEAM careers through hosted science fairs, career days, and educational field trips. Students engage with professionals in the field and have visiting guest instructors, as well as presenters at their schools. Elementary students even get to participate in Lego Education competitions and virtual field trips with NASA astronauts.

Teachers have benefited as they have received over one hundred thousand

dollars from grants for new innovative project based learning activities and supplemental curriculum resources! Learning Media Center Directors have partnered with Parent Teacher Organizations to build amazing STEM Discovery Bags to complement the Core Curriculum. STEM Coaches even produce and honor outstanding STEM based projects that students have completed through a celebration we call 'The STEMMYS!

McHenry School District 15 has proudly hosted tours where school districts from around the country have visited our newly designed Makerspaces. District team members, in partnership with the school board, have presented at state and national conferences in the completion of this work. District educators and coaches have already worked together with our high school district, local colleges, and state universities, to provide a pathway for students as they continue to grow and develop interests, bridging the concepts of digital literacy and information literacy. New after school clubs and organizations have already been developed to allow students more time to learn, explore and compete with each other.

Click HERE to see an in-depth look at our beautifully designed Makerspaces.

Lessons Learned Building the Makerspace Concept

As a school district, many lessons have been learned while monitoring the implementation of these programs and ensuring that they are rigorous, sustainable and marketable to all audiences. We have designed beautiful Makerspaces and have made modifications and upgrades as we filled these spaces with coaches and students. We have decorated using stimulating research-based colors and furniture concepts. We added the value of flexible seating while integrating collaborative workstations. We have listened to our Coaches and made sure to build plenty of storage and space to demo work by students. We have designed each new Makerspace to accompany our Learning Media Center so our LMC Directors and Innovation Coaches (STEM and STEAM Coaches) develop strong instructional partnerships.

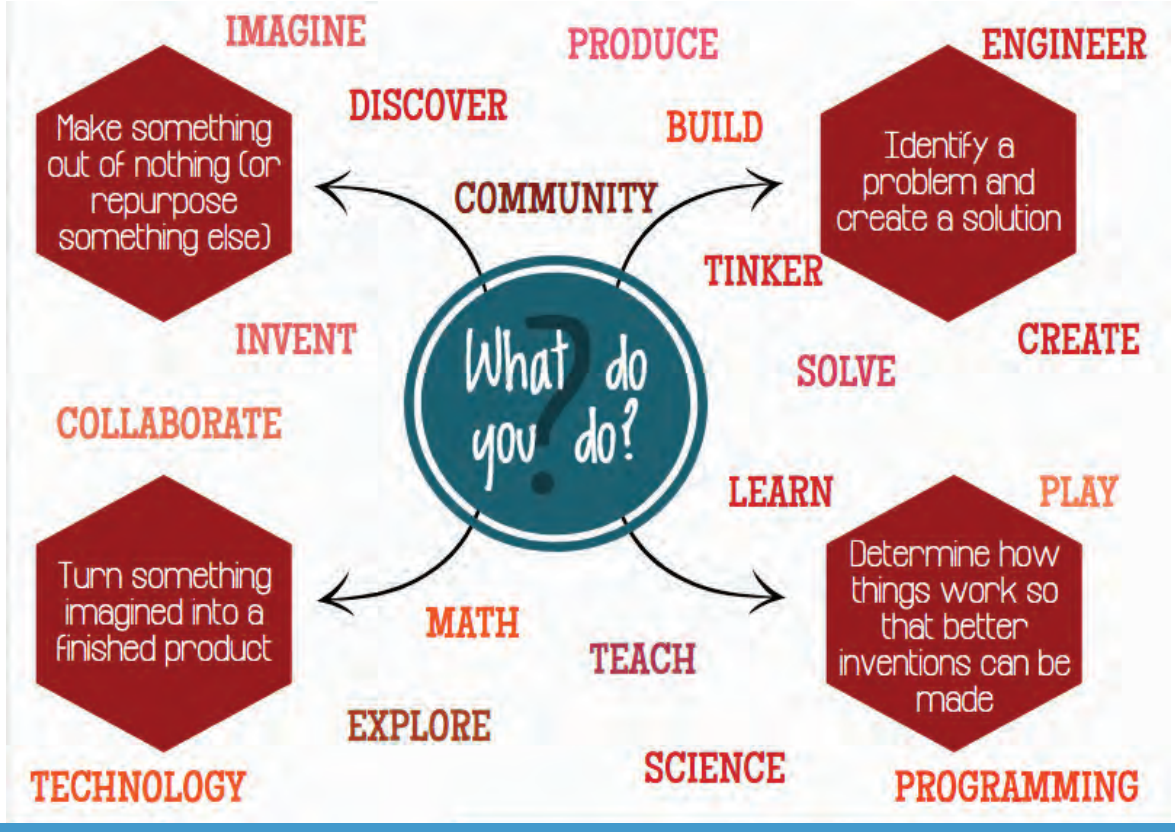
We have identified and structured our job titles and job descriptions to facilitate the exploration and discovery of learning and not just instruct and dictate learning. We have placed a strong emphasis on learning applied concepts and technology, not just skills that become obsolete. We have also highlighted career connections and have built pathways for the future!

Lastly, upon survey of district educators, administrators and board members, ***the following themes emerged as key strides McHenry School District 15 made to be successful within the overall five-year implementation period:***

- Collaboration with future Coaches (STEM, STEAM and Innovation Coaches
- Design of a model that bridges together Information Literacy through the Learning Media Center along with the discovery of Digital Literacy through new Innovative Programming
- Inspired stakeholders through site visits, presentations and research
- Understanding that there is not a one size fits all approach to building a Makerspace concept
- Invested wisely with thoughtful implementation of the Makerspace concept and programming as it is a curricular sequence that is marketed to the students, staff, school board and community
- Being creative with our spaces but consistent. Like attributes are in all of McHenry's schools although not all spaces are the same dimensions. K-8 programming is in place so students will continue to grow each and every year and build upon acquired knowledge

- Developed partnerships with sister districts and colleges. Our students now have a pathway that can take them all the way into college and beyond
- Invitation of guest visitors and marketing to the community. We have built a foundation of strong support and have a rejuvenated energy from our community since opening our new Makerspaces and launching our new innovative programming

Dr. Josh Reitz *is the Assistant Superintendent of Learning for McHenry School District 15.* ***Dr. Fred Laudadio*** *is the Executive Director of Learning Services and Technology for McHenry School District 15. Dr. Reitz and Dr. Laudadio have worked extensively creating new Innovative Programming that bridges the integration of Information Literacy and Digital Literacy. Through this effort, Dr. Reitz and Dr. Laudadio guided the implementation of McHenry School District 15's Makerspace concept producing stunning new STEM Labs, STEAM Studios, Innovation Centers, Video Production Hubs and Learning Media Centers. Recipients of the Digital Content and Curriculum Award by the Center of Digital Education, Dr. Reitz and Dr. Laudadio have delivered presentations and keynotes on Technology Integration and Fusion, Innovative Hands On, Minds On Learning, and Ongoing Staff Development Through Technology Driven Professional Learning Communities.*



See more of Heather Lister's PiktoChart HERE.