

STEM EDUCATION RESEARCH AND REFORM AT BGSU

STEM Education Research and Reform at BGSU is multi-faceted and exhibits a number of strengths. This area is one of the University's greatest sources of external funding and fosters a vast array of partnerships that include other higher education institutions, many K-12 school districts, strong collaboration with some of the most active and successful STEM-oriented non-profit organizations in Northwest Ohio and demonstrated financial support from numerous large and small corporations. Serving as the STEM Hub for the 30-county quadrant of the northwest corner of the State we strive to advance STEM education for people of all ages, extending the mission of the University beyond its walls throughout our surrounding local, regional and national communities. Here are some examples of our current initiatives, programs, and activities but not all would fit on these two pages so visit our website for more: www.bgsu.edu/nwo.

iEvolve with STEM

We are transforming learning into a more meaningful and valuable experience for more than 3,000 grades 3-8 students in under-served communities in Northwest Ohio by involving them in real science research that is an integral part of classroom instruction, contributing to the development of solutions to important problems for their local, regional and national communities related to water quality, agriculture, ecology and the environment. This project is helping to optimize teaching methods that greatly increase student motivation, effort, and academic success in ways that can be replicated across the nation. This project also promotes adoption of research-based teaching at the undergraduate level in the sciences and mathematics. Funded by a \$7.2 M grant from the National Science Foundation.

Project SEA Change

This project links 457 STEM practitioners, STEM education specialists, and higher education leaders in the investigation of the improvement of undergraduate STEM education by: enhancing quantitative literacy so students overcome barriers to STEM learning, increasing use of research-based instructional practices by STEM faculty, developing an innovative forensic science program in collaboration with a new regional crime investigation facility on the BGSU campus built and operated by the State of Ohio, improving social integration of transfer students in STEM degree programs, and developing and strengthening collaboration of administration and faculty to achieve institutional transformation. Funded by a \$3 M grant from the National Science Foundation.

Granting Access to Mathematics and Science (GRAMS I & II)

Investigating the use of multiple strategies to improve the success of under-represented minority students and women in undergraduate STEM degree programs, achieving first year retention of 95+% and a 65% 4-year graduation rate compared with less than 15% for similar students nation-wide. Funded by two grants from the National Science Foundation totaling \$1.2 million.

Northern Ohio Alliance for Graduate Education to the Professoriate: A Racially and Ethnically Inclusive Graduate Education Model in Biology and Chemistry

An investigation of the use of multiple strategies to improve the recruitment and success of under-represented minority students in doctoral programs in Biological Sciences and in Photochemical Sciences and their entry into the academic professoriate, in collaboration with a coalition of seven universities across northern Ohio including Case Western Reserve University, Kent State University, the University of Akron, the University of Toledo, Youngstown State University, and Cleveland State University. Funded by a \$200,000 grant from the National Science Foundation.



Science and Mathematics Education in Action

Investigating an innovative experiential approach to preparing highly effective science and mathematics teachers who participate in collaborative science or mathematics research in their first year, an internship with a STEM-oriented business in their second year, learn to conduct action research by systematically collecting data on their students' performance to guide the continuous improvement of their instructional practice in their third year, and integrating all of these experiences and expertise in a capstone project in their fourth year during their student teaching creating dynamic learning experiences for their students. Nearly 200 students have or are participating in this program and represent some of the highest achieving students in the University with approximately half earning 4.0 GPAs. This is funded by the Choose Ohio First program of the Ohio Department of Higher Education.

Building Ohio's Sustainable Energy Future

Building on economic and research strengths of Northwest Ohio this project is investigating the use of several innovative practices including an intense, residential summer bridge program, intrusive advising, weekly seminars, creating a strong supportive community of scholars and faculty, participation in undergraduate research, internships and co-ops, and early preparation for graduate programs to increase the participation and enhance the success of students pursuing careers in renewable and sustainable energy research. This is also funded by the Choose Ohio First program of the Ohio Department of Education.

Project ASSETS

A new program with Washington Local Schools and faculty from the College of Education and Human Development at BGSU and the College of Natural Sciences at The University of Toledo led by the Northwest Ohio Center of Excellence in STEM Education. The goals are to improve the academic achievement in science of grades 3-5 students in Washington Local Schools; to develop deep science teacher content knowledge and to promote effective reform-based teaching practices consistent with state and national standards in physical and life science. Thirty grade 3-5 teachers will participate in more than 100 hours of professional development that includes a Spring kick-off session, a 2-week summer workshop, and regular academic year sessions. Funded by the Ohio Dept. of Higher Education Improving Teacher Quality program.

Black Swamp Math Teachers' Circle (BS – MTC)

Focuses on preparing K – 12 in-service teachers for the Common Core State Standards for Mathematics (CCSSM) by providing about 100 hours of professional development about best practices in teaching mathematics including ways to promote the 8 Standards for Mathematical Practice expected by the CCSSM. A major focus of this grant project is deepening teachers' mathematical problem solving power. Teachers work to solve rich mathematical tasks that start with mathematical ideas around grade 4 and grow to levels of complexity that professional mathematicians would work on. By reflecting on and explicating the problem solving techniques used in these mathematical tasks teachers deepen their own abilities and gain insight into pedagogical spaces for their students to do the same. Teachers then go on to explore and practice these BS – MTC techniques with their own students, and share their findings with others at state level conferences. Funded by an Improving Teacher Quality grant from the Ohio Department of Higher Education.

Common Core for Achievement & Middle Grades Mathematical Proficiency (C²AM²P Middle Grades)

An investigation of the impact on student learning of teachers better mastering math content and practices embedded in the new mathematics standards and developing instructional strategies that promote problem solving through rich tasks, technology, and research-based practices such as teaching through problem solving. Teachers met with the instructional team 8 times during the academic year and conducted 2 lesson studies in Findlay City Schools and Lima City Schools. The teachers concluded their year one work with an eight-day summer institute in June 2015 where they worked on writing a series of lessons for use by their entire grade level team. Funded by the Math Science Partnership program of the Ohio Department of Education.

Common Core for Mathematical Proficiency in Elementary Schools ((CO)²MP Elementary)

A similar investigation to C²AM²P but involves Sandusky City Schools, Sandusky Central Catholic, and faculty in BGSU's Colleges' of Education & Human Development and Arts & Sciences led by NWO. We are exploring how professional development focused on the greatest areas of their students' mathematical content and mathematical proficiency needs for 30 K-5 teachers from two school districts in the Sandusky area (Sandusky Central Catholic & Sandusky City Schools) improves student learning. Teachers met with the instructional team 8 times during the 2014 – 15 academic year, conducted lesson studies and ended with an eight-day summer institute in June 2015. Year two will add a new group of 20 teachers in grades 6 – 8 from multiple districts. Funded by the Math Science Partnership program of the Ohio Department of Education.

iTraining III

Provided 135 teachers in the rural schools districts of Van Wert and Putnam County with nine hours of professional development designed to train teachers in Google Education software tools for the PBL classroom. Topics included: implementing and using Google tools; managing PBL classrooms; and effective online communication between students and teachers. Funded by the Martha Holden Jennings Foundation

The Ohio Junior Science and Humanities Symposium (OJSHS)

Brings approximately 100 of the best and brightest students from Ohio schools together for a competition to highlight and evaluate the quality of their research projects in STEM fields. The research that these students present is of the highest caliber. Oral and poster presentations by these students demonstrate a level of achievement that would rival some of the very best junior and senior undergraduate students with some even approaching what is expected of beginning graduate students. Past Ohio winners have gone on to win the top award at the National competition, demonstrating the extraordinary talent and achievement of these students. OJSHS is funded by a grant from the Academy of Applied Science and the three branches of the U.S. Military Services.

The Bowling Green Council of Teachers of Mathematics (BGCTM) Math Camp

An energetic and active day of teamwork, problem solving, and development of skills for K-12 students. Students engage in fun-filled experiences about mathematics, and the connections between mathematics and the real world, in a camp atmosphere where there is song, dance, and silliness. Research is showing that students who attend BGCTM Math Camp's demonstrate statistically significant improvement in their mathematical self-efficacy, are more comfortable with mathematics, and become more flexible in their problem solving strategies. Each math camp is specifically designed by the preservice teachers of BGCTM with oversight from BGSU's mathematics education faculty. The camps are aligned with the Common Core and New Ohio Learning Standards for Mathematics. The BGCTM preservice teachers work with each school's liaison to identify specific areas of mathematical need for the students in order to design a worthwhile and focused camp experience. Camps are conducted for one grade level at a time to ensure that the mathematics tasks are targeted to the specific needs of the students attending the camp. So far Math Camps have been conducted with 480 grades 4-8 students led by 180 college students in multiple school districts in Northwest Ohio.

STEM in the Park

Investigates how a rich and diverse array of hands-on STEM activities in which families can participate increases public interest and encourages learning in STEM. Held on the BGSU campus the event features 4 hours of more than 110 activities from over 50 area businesses, schools, and organizations along with take-home STEM activity cards for parents and children to continue STEM exploration at home. By increasing awareness in STEM facilities, programs and activities in the area, STEM in the Park is an opportunity for businesses, universities, K-12 schools, and non-profit organizations to showcase innovation, educational opportunities, careers, and to promote positive attitudes toward STEM teaching and learning. Funding was provided by a number of regional businesses and foundations including BP-Husky, Lubrizol, and Verizon, Bill Rowles Youth Foundation Fund of the Toledo Community Foundation; Bowling Green Community Foundation; John Deere; Spectra Group Limited, Inc.; Thayer Family Dealerships; Tony Packo's; and Walmart. Carolina Biological Supply Company; Cooper Tires; Dura Magnetics; Giant Industries; Kroger; Meijer; Spark! Learning Perrysburg; SSOE Group Architects, Engineers and Managers.