5-15-2016

Office of STEM Education Annual Report 2015-2016

UNO Office of STEM Education
University of Nebraska at Omaha

Office
of STEM Education
Roskens Hall 402
Office of

STEM Education Goals

Provide better communication and coordination between the STEM Office members.
Promote STEM education to the department, college, campus, and PK12 organizations.
Enhance collaboration with the Colleges of Arts and Sciences, Engineering, and Information, Science and Technology.
Seek and coordinate STEM related projects and grants.
Increase the number, the quality, and the diversity of STEM teachers.

REPORT FOR THE TEACHER EDUCATION DEPARTMENT OFFICE OF STEM EDUCATION 2015-2016

May 15, 2016

During 2015-2016 the Office of STEM (OSTEM) Education at UNO has continued to move aggressively forward in undertaking and leading STEM Learning projects, many of which collaborate closely with several other UNO colleges and other formal and informal educational institutions. Also continuing into 2016, OSTEM is steadily transitioning to becoming more of a focused departmental organization, while the UNO STEM Leadership Team takes over more of the campus-wide STEM Priority efforts.

This report describes the TED STEM successes, ongoing efforts and challenges this last year with a direct focus on the TED and COE context, and only lightly touches on the wider campus efforts. For reference on the wider campus STEM Priority efforts, there are other documents that can be reviewed as desired, such as journal articles that have been published related to various UNO STEM initiatives, and that are referenced in this report. The wider UNO STEM efforts have of course been led from a solid base of TED and COE support, and the campus continues to look to our leadership on numerous STEM initiatives. The wider support of Dr. Edwards, Dr. Edick, Dr. Barnes, Dr. Conway and other colleagues in TED and across campus have been critical to the overall UNO campus STEM successes to date, helping to move not only our TED STEM efforts ahead but also the campus STEM efforts.

Continuing into 2016, TED STEM, representing the core of the campus STEM effort along with the team of STEM Community Chairs, continues to be the first “phone call” from many colleagues across the UNO campus that are interested in working more closely with the area schools, undertaking STEM learning grants, or refining their own STEM programs to be more effective in student learning.

Currently, the membership for TED OSTEM includes: Dr. Neal Grandgenett (Co-Chair, Professor), Dr. Sheryl McGlamery (Co-Chair, Professor), Dr. Vicki Lentfer (STEM Instructor), Mr. Derrick Nero (Faculty Development Instructor), Ms. Kelly Gomez-Johnson (Faculty Development Instructor), and Ms. Amelia Squires as the campus STEM Outreach Coordinator. Dr. Ostler, has transitioned to Educational Leadership, but is continuing to periodically attend OSTEM meetings as a key collaborator. We are also proud to be adding Dr. Anne Karabon and Dr. Michelle Friend starting in August as new colleagues associated with the TED STEM efforts. In addition, the other STEM Community Chairs work closely with Dr. Grandgenett in leading campus efforts (Drs. Hodge, Cutucache, and Dorn) and attend on specific topics, such as graduate program conversations that overlap between content and pedagogy. Through the generosity of Dr. Haddix, the STEM Community Chair team will now also add the George F. Haddix Community Chair in Physical Science, which will be based in either Chemistry or Physics. That search process will be initiated this summer of 2016.

Research and Grants - Successful OSTEM Grants in 2015-2016

During this last year of 2015-2016, OSTEM has continued to expand our Co-PI grant involvement efforts. Many NSF grant RFPs for STEM learning now require the participation of an "education or learning specialist". Current and new STEM grants include the following:

- Girls Inc.: Eureka STEM ($80,000: McGlamery, Hodge, Grandgenett, Squires)
- NSF Noyce Math Education Scholarships ($1.1 M: Hodge, Grandgenett, Rech, Matthews, Ostler)
- NSF ITEST: Strategic PBL to Rouse CS ($1.1 M: Siy, Dorn, Grandgenett, Youn, Zhu)
- NSF ITEST: Wearable Technology in STEM ($1.2 M: Barker-UNL 4H & Grandgenett-UNO)
- Sherwood: OPS/UNO Science Innovations ($4.2 M: Cutucache, Grandgenett)
- Sherwood: Teacher Research ($628,208: Cutucache, Tapprich, Shuster, Rhodie, Grandgenett)
- Sherwood: NE STEM 4U $106,877: Cutucache, Grandgenett, Tapprich)
- Peter Kiewit Foundation: NE STEM 4U ($18,000: Cutucache, Grandgenett, Tapprich)
- Online World Wide: CS Education Coursework ($35,000: Zhu, Dorn, Siy, Youn, Grandgenett)

Nearly all collaborative STEM grant efforts, including the Sherwood funding, have some level of indirect costs allotment (ranging from 43% for NSF to 10% for Sherwood). More departments are continuing to look to partner with TED on STEM grants. Many UNO STEM discipline departments generally do not have learning specialists in their departments, with the exception of mathematics. In that department, there are three learning specialists (Drs. Hodge, Rech and Matthews). No formal learning specialists exist within the science departments (with the exception of Drs. Cutucache and Dorn, who actually still have content degrees). Requests for grant proposal collaborations with science and computer science departments are continuing to increase. The new hires in TED, as represented by Dr. Michelle Friend, and Dr. Anne Karabon will be a huge help in maximizing TED partnerships to bring in big STEM grants to UNO, as both of these new faculty members are very well qualified to participate in large STEM grants.

In addition to funded proposals, two NSF proposals are currently in review with OSTEM CoPI roles, including: 1) NSF/AISL: NE STEM 4U – Advancing Knowledge and Broadening STEM Participation ($2M; Cutucache; Tapprich, Grandgenett) and 2) NSF / STEM + The Internet of Things ($2.5M; Barker-UNL; Grandgenett-UNO, SparkFun, 4H). The status of these two large grant proposals should be known by August of 2016. We will also soon be submitting a $1.1 Million Dollar NSF Noyce Proposal to help to build the undergraduate pipeline for Science teachers, similar to what we already have received for mathematics teachers. Dr. Cutuache will be the PI, and Dr. Grandgenett will be a CoPI of this new proposal that will be officially submitted during the summer.

Articles and Publications - Successful OSTEM Publications in 2015-2016

The OSTEM TED team is quite productive in article publications, often working with colleagues both within TED, COE, and across the STEM Disciplines at UNO. This helps to provide a growing competitiveness for big grants, since many grants require vitaes showing publications for the PI, CoPI's and Senior Personnel. As increasingly large grant opportunities become available for TED, COE, and UNO leadership and participation, this article foundation will be increasingly critical to future competitiveness. The following are the primary publications associated with members of the team.

1. Hodge, A., Matthews, M., **Squires, A**. (Accepted). EUREKA!-STEM: Hands-on, minds-on STEM for at-risk middle school girls. In R. Wiest, J. Sanchez, & H. Crawford-Ferre. (Eds.) *Out-of-school-time STEM programs for females: Implications for research and practice.* Charlotte, North

Carolina: Information Age Publishing, Inc.

2. **Squires, A**., & Mitchell, C. (Accepted). UNO EUREKA-STEM: Doing something about the double bind. In B. Polnick, B. Irby, & J. Ballenger. (Eds.). *Girls and women of color in STEM: Navigating the double bind.* Charlotte, NC: Information Age Publishing, Inc.

3. Nero, D. (Accepted). *STEM education in Nebraska schools.* Journal of Curriculum, Teaching, Learning, and Leadership in Education, University of Nebraska at Omaha, Omaha, NE.

4. Tapprich, W., **Grandgenett, N**., Leas, H., Rhodie, S., Shuster, R., Schaben, C., Cutucache, C. (2016). Enhancing the STEM Ecosystem through Teacher Researcher-Partnerships. *The Metropolitan Universities Journal*, Volume 27 (1), 2016, pages 71-85.

5. Barker, B., **Grandgenett, N**., Nugent, G., Clark, C., Melander, J. (2016) Developing an Elementary Engineering Education Program *Handbook of Research on Wearable and Mobile Technologies in Educatio*n, J. Holland, Editor, IGI Global: Washington, DC.

6. Franks, B. A., **McGlamery, S. L**., & VanWyngaarden, K. (2016). Effects of Teaching in a Science Summer Camp on the Science Self-Efficacy of Preservice Teachers. *Delta Kappa Gamma Bulletin*, *82*(3), 63.

7. **McGlamery, S. L.,** Franks, B. A., & Shillingstad, S. L. (2016). Teacher Training in Urban Settings: Inquiry, Efficacy, and Culturally Diverse Field Placements. *Metropolitan Universities*, *27*(1), 44-55.

8. Cutucache, C., Luhr, J., Tapprich, W., **Grandgenett, N.** (2016). NE STEM 4U: An out-of-school time academic program to improve achievement of disadvantaged youth in STEM areas (2016). International Journal of STEM Education, 3(1), 1-7.

9. Barker, B.S., Nugent, G., **Grandgenett, N.**, Keshwani, J., Nelson, C., Leduc-Mills, B. (2016). Developing an Elementary Engineering Education Program through Problem-Based Wearable Technology Activities. In Janet Holland's (Editor) Wearable Technology and Mobile Innovations for Next-Generation Education, IGI Global: Hershey, Pennsylvania.

10. **Grandgenett, N.,** Edick, N., Boocker, D., Ali, H., Hodge, A., Dorn, B., Cutucache, C. (2015). Community Chairs as a Catalyst for Campus Collaborations in STEM. The *Metropolitan Universities Journal*, Volume 26 (1), 2015, 50-59.

11. Nugent, G., Barker, B., **Grandgenett, N.** (2015). Robotics camps, clubs, and competitions: Results from a US robotics project. *Robotics and Autonomous Systems Journal*. doi:10.1016/j.robot.2015.07.011.

12. Nugent, G., Barker, B., Welsh, G., **Grandgenett, N.** (2015). A Model of Informal STEM Learning and Career Orientation (Published). *International Journal of Science Education*, 37(7), 1067-1088. **DOI:** 10.1080/09500693.2015.101786.

13. **Grandgenett, N**., Thiele, L., Pensabene, T., McPeak, B. (2015). It Takes a Village to Raise an IT Project: Suggestions on Collaboration from a Ten Community College Consortium (Published). *Community College Journal of Research and Practice*.

14. **McGlamery, S**. & Shillingstad, S. (2015). Reflection, growth, and mentoring of science and mathematics teachers. In C. E. Ostler (Ed.), *STEM education: An overview of contemporary research, trends, and perspective*s (pp.139-154). Des Moines, IA: Cycloid Publications.

15. Van Wyngaarden, K., **McGlamery, S**. & Shillingstad, S. (2015). Preservice elementary teachers'

understandings of inquiry-based instruction in science. In C. E. Ostler (Ed.), *STEM education: An overview of contemporary research, trends, and perspective*s (pp.121-138). Des Moines, IA: Cycloid Publications.

16. Davis, B., **McGlamery, S**., Shillingstad, S., & Gilles, C. (2015). Mentors as teacher leaders in school/university induction programs. In N. Bond (Ed.), The power of teacher leaders: Their roles, influence and impact (pp.70-81). New York, NY: Routledge.

17. Shillingstad, S., **McGlamery, S.,** Davis, B., Gilles, C. (2015). Navigating the roles of leadership: Mentors' perspectives on teacher leadership. *Delta Kappa Gamma Bulletin* 81(2), 12-20

18. Nero, D. (2015). STEM education in progressive classrooms: A practitioner's approach. In E. Ostler (Ed.), *STEM education: A contemporary overview of emerging research, trends, and perspectives in STEM learning* (pp. 181-192). Elkhorn, NE: Cycloid Publications.

19. **Gomez-Johnson, K.** (Submitted / Under Review). Instructional coaching implementation: Considerations for K-12. *Journal of School Administration Research and Development.*

Teaching Initiatives – Key Efforts Continuing or Starting in 2015-2016

There are many teaching related initiatives for pre-service and in-service STEM teachers, that are led by OSTEM faculty, or co-lead by partner faculty across campus. Several of the most important ones are now described.

Teaching: Continuing Glacier Creek Efforts for STEM Teachers

We have successfully further expanded our efforts at Glacier Creek to support STEM teachers and particularly elementary pre-service teachers. This has involved the offering of additional courses that are for both the pedagogy and content instruction for teachers, including the TED 1100 Inquiry Based Learning in STEM course, that is a general science education course. It is taught by Dr. Carol Engelmann, the new Hubbard STEM Learning Instructor, and her instruction for that course is picked up by the Hubbard Foundation award for that position, with no charge to TED. Several other courses are being designed that will help teachers receive the science content coursework they need for dual enrollment approvals, while also recruiting teachers into TED Masters Degree pathways. Dr. Engelmann is also hosting teacher recruitment and conversation receptions out at Glacier Creek, and a recent event brought 80 teachers to facility, where OSTEM faculty talked with teachers, and passed out flyers on TED program of study options.

Teaching: Efforts to create a STEM prefix for courses

With the very engaged help of Dr. Pasco, Dr. Edwards, and Dr. Danielson, the OSTEM faculty are working closely with STEM Discipline Departments across campus to work on a STEM prefix that can help teachers find the needed courses for graduate credit, in both content and pedagogy. It has considerable support from STEM faculty and department leaders. Such a prefix will particularly help:

1) Departments such as Chemistry to offer graduate courses for teachers, with minimal politics
2) The Department of Teacher Education to offer graduate courses in K12 Engineering for dual enrollment possibilities
3) The establishment of interdisciplinary graduate courses for teachers, such as Bioinformatics
4) Facilitate prefix mechanisms where resources would flow to the instructor and department

5) Better allow a focused dual enrollment programs of study, through TED MS pathways
6) Help to establish a "UNO STEM Certificate" that could eventually be offered to teachers
7) Bring in more external funding from NSF programs targeting STEM reforms for teachers
8) Establish increased STEM innovation with courses that are increasingly collaborative

Teaching: Building Community Efforts for a Citywide STEM Ecosystem Effort.

The ongoing success of collaboration with our Omaha community has been formalized into a new organization, called the Omaha Citywide STEM Ecosystem. Lead partner organizations include: Henry Doorly Zoo and Aquarium (Current Co-Chair with UNO), Omaha Public Schools, Papillion LaVista Public Schools, Westside Public Schools, the United Way of the Midlands, the Omaha Children's Museum, Girls Inc., Gallup, Northstar, the Omaha Chamber of Commerce, the Peter Kiewit Foundation, Completely Kids, the Urban League of Nebraska and the University of Nebraska Medical Center to name just a few of the 30 different participating organizations. With STEM Community Chair leadership, enough funding was raised to move forward to hire a director, with additional funding being raised to support a full three-year seeding for the director position. The director will be a UNO employee, based at the Zoo, and eventually sustained by a citywide dues strategy. That search review process will be starting June 1, and official applicants are already coming into the pool. This position will be a key one for TED/COE student recruitment, since it is all about building pathways into STEM education. It will also allow us to really start to build additional funding pipelines for things like TED student and teacher scholarships, recruitment events, etc. Teacher recruitment will also be a key goal of the position and the joint ecosystem efforts. The Omaha Citywide STEM Ecosystem is becoming known nationally and also recently received official approveal for entry into the STEM Funders Network of Citywide STEM Ecosystems.

Teaching: Growing Pathways in the STEM Disciplines for Teacher Certification

The program to allow teachers in the STEM disciplines to receive a double major with education has been VERY successful, and has had a wide range of successes to mention. The program's growing reputation for success has steadily built STEM teaching pathways in a variety of ways. Current successes include the following:

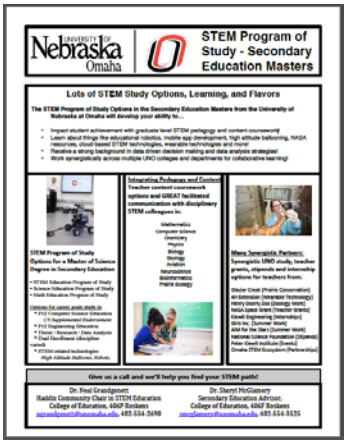
- We have 28 undergraduate students in the Math pathway (5 graduates!)
- We have 3 in the Chemistry and 2 in the Physics pipelines
- Math pathway led to earlier $1.1M NSF Noyce Scholarship Grant (Hodge, PI)
- We will soon submit a $1.1M NSF Noyce Proposal for Science (Cutucache, PI)
- We created a CS supplemental endorsement (18 hours grad/undergrad)
- We have a new CS MS Ed in final review to support UNO dual enrollment
- We are updating and developing STEM classes in blended learning formats

Teaching - Undergraduate - Discussions of a High Altitude Ballooning Course (Gen Ed Science)

Discussions continue in collaboration with Aviation and PKI for the development of a STEM general education course that would focus on High Altitude Ballooning that would be used to particularly recruit students into STEM teaching and STEM discipline pathways. Derrick Nero, Neal Grandgenett, Dana Richter-Egger, Scott Tarry and Jim Taylor (PPKI) are particularly working on the endeavor. TED/COE course credit, again for general education natural science credit, would be a key mechanism for student

recruitment and student general education (natural science) credit. The course would use high altitude weather balloons as the lifting platform, with students acting as interdisciplinary STEM researchers to launch experiments. Pilot strategies were already conducted by UNO's Project HALON (High Altitude Learning Over Nebraska), which was lead by UNO's Scott Tarry and Derrick Nero, and PKI Research Director Jim Taylor, and included teachers from OPS, Marion, Millard, and Westside.

Teaching – Graduate STEM Course Recruitment Efforts



This last year, TED STEM faculty have emphasized student recruitment at the graduate level as the number one shared priority, with a variety of efforts associated with recruitment, including flyers, receptions, and targeted meetings. We believe that we have made some solid progress, and of course, there are lots more to do in this important initiative. STEM enrollments have long been problematic at the national level, and the TED STEM faculty members have certainly experienced our own share of personal challenges in ramping up STEM education and breaking down our own internal silos. We think we are turning the corner.

Some of our recruitment efforts this last year have particularly included:

1) The development and editing of TED STEM graduate program flyers and materials
2) Distributing outreach flyers for TED Graduate work at every STEM outreach event
3) Aggressively asking, training, and reminding UNO STEM faculty outside of TED to refer teachers to TED for programs, as they talk about a particular content course they offer or could offer
4) A bit of a reorganization internally for the TED STEM team, so as to have recruitment be everyone's business, and ensuring that teachers interested get some immediate contact with either Dr. Grandgenett or Dr. McGlamery
5) The piloting and planning of teacher circle receptions for particular topics (such as mathematics, Glacier Creek, High Altitude Ballooning, etc.), where a topic is covered and the TED STEM program is showcased. This will be expanded to Solar Eclipse sections in later 2016 and early 2017.
6) Working more closely for TED STEM recruitment with individual grant programs, such as the OPS – UNO Science Sherwood Project effort, and the TED and CS computer science supplemental endorsement effort.
7) New efforts to collaborative address teacher dual enrollment interests by working closely with STEM discipline departments that build options, that also flow into TED STEM degree programs.

The TED faculty members in other areas have been very helpful in addressing some of the challenges in our STEM education graduate coursework, and this last year we are able to accomplish a variety of inroads (particularly with the great help of Dr. Pasco, Dr. Edwards, and others).

Teaching - Graduate: Collaborations with IS&T's Computer Science Department

During this last year, we have had a growing partnership with IS&T, which is bringing in students into TED MS and BS STEM pathways. Synergistic with pressures from the Omaha Chamber of Commerce, businesses and industry, and various other community organizations, such the Mayor's Office, UNO's

Computer Science Department worked closely with TED STEM (Grandgenett, Lentfer, McGlamery) to establish enhanced educational programming for computer science education. Many meetings also included representatives of the MOEC school districts. As an outcome to significant planning efforts, involving lots of supporting individuals within and outside of TED, CS, UNO STEM and the wider community, several accomplishments took a very fast track, with strong TED and COE support and help at a variety of levels. It is important to note that CS careers are the most critical employment need for Omaha, Nebraska, and the overall U.S. for any STEM discipline. Correspondingly, Nebraska is still the very lowest state (50th out of 50 states) in having students take the AP Computer Science exam (less than 1% less year in comparison with California at 12). Only 72 students took the AP CS exam in Nebraska in 2015 (actually about 0.5% of eligible AP students). Typically in the area schools, Nebraska teachers that do teach CS have at most one or two courses, and often no courses. These collaborative achievements to help address the situation her at UNO have included the following:

CS and TED STEM Collaborations:

- A supplemental endorsement option for graduate students and CS teaching
- A set of new content courses specifically designed for CS teachers
- A new MS in CS Education to support CS dual enrollment (close TED partnership)
- An Online World Wide (OWW) grant that will support some CS content courses online
- A continuing NSF grant ($1.1M, SPARCS) to cross train math/science teachers in CS
- A move to allow CS courses to count as science in NU admission requirements
- A new CS tutoring program in IS&T that also supports area High Schools

This is a big win for TED/COE, since there are many on-ramps and off-ramps into these programs, and these efforts have already been a very strong pathway into TED STEM graduate coursework and degrees. TED/COE is already receiving far more new students than we lose to the new pathways. Most importantly, there has been considerable interest by teachers in becoming CS supplemental endorsed, and then continuing on for a Masters Degree in TED. Most teachers only want the 18 graduate hours in CS, and would prefer to continue the MS degree pathway in TED. Since several district meetings for OPS and Millard in particular, interest has increased, and teachers are now contacting both IS&T and TED on degree pathway options, and CS is encouraging the students to work closely with TED. It is estimated that about 80% of teachers who pursue the 18 hour CS supplemental endorsement at the graduate level, will most likely choose TED for the program of study pathway that allows 18 hours of content.

Finally, we are excited to add Dr. Michelle Friend to this effort, which will also allow us to propose many new grants to NSF in this content area for graduate student scholarship, teacher training, and many other very positive accelerants to our TED and UNO STEM programs.

Teaching - Graduate/Undergraduate: NU Program of Excellence Hiring for ECE STEM

We are very excited to have Dr. Anne Karabon join us in TED STEM and ECE efforts starting this Fall of 2016. Through a strongly collaborative effort three years ago, the TED/COE faculty were successful in getting a NU Program of Excellence faculty position proposed and approved, but were initially unsuccessful in finding the right candidate for the position, in a failed first search. The second search produced Dr. Karabon who was hired, and is well known by Dr. Wisneski. She also has a strong foundation for grant writing and a very competitive vitae for the potential for new NSF researcher funding. The TED STEM and ECE faculty are committed to helping her be a successful member of the TED family, and getting a productive start at UNO. The engagement with other members of the TED and COE was a very positive element of the search effort and promises to help Dr. Karabon be successful.

Teaching - Graduate: STEM Educational Leadership Pathway

With the transfer of Dr. Ostler to the Educational Leadership Department (ELD), TED STEM faculty are working increasingly closely with the ELD faculty to allow doctoral candidates in that department to specialize in STEM and to use some of the emerging and current TED offerings as elective courses. This is a powerful connection for future collaborations with the schools, finding adjunct faculty, and generally building STEM infrastructures both in the schools and at UNO. This has taken some time from TED faculty, but having Dr. Ostler now in that department will help on relieving the time demands on TED faculty for collaborating with that COE program. He is already spreading dissertation committee membership more widely across the college and TED. This increasingly strong doctoral pathway is also one that helps STEM Master Teachers in the MOEC schools continue to work through UNO for their final professional degree, as opposed to going to UNL.

Teaching - Graduate/Undergraduate: STEM Learning and Discipline Based Education Research

Continuing into 2016, and as part of national trends, there has been considerable publication and research in learning strategies crossing the STEM disciplines. The STEM departments are increasingly embracing "Discipline Based Education Research" or DBER for short, which is an approach recently suggested by the National Science Foundation, National Research Council and the Association of American Colleges and Universities. DBER efforts cross colleges, and involve collaborative research that has been identified as critical to the U.S. efforts to ramp up STEM education. Both Dr. Friend and Dr. Karabon will be qualified to undertake DBER research, and be a part of the growing NSF teams on campus. Positively, there continues to be a real awakening on campus of the importance of this type of research, leadership by COE and TED, and in particular, the importance of such research to our university, community, and nation as we bring in external resources and innovative STEM programs to UNO.

Teaching - Graduate: Data Driven Decision Making Course

The Data Driven Decision Making for Educators course (TED 8050), as currently taught by Dr. Grandgenett and Ms. Kelly Gomez-Johnson is being used by the TED STEM faculty as the recommended first course for TED MS efforts in STEM. The summer course section for 2016 is actually a full section of 20 students and the course is becoming increasingly popular with the schools and superintendents. We may need to eventually offer the course with more than one section if the trend continues, and it may become an increasingly helpful TED STEM recruitment tool. It includes popular topics for teachers and administrators. The course content and pedagogy looks at the ways educators can effectively collect, analyze, interpret and display data for educational decision making and to tell an "educational story" for a single student, class, program, or even school. The course provides graduate students with hands-on experiences that model data-driven decision making, while learning how to create valid and reliable assessments; to interpret standardized and locally generated test data; to build data models that identify student, classroom, program, and school needs; and in general, to systematically enhance educational decision making from a base of carefully collected information. Data tools such as logic models, SWOT charts, strategic task charts, and other data devices are covered, and shown as a tool their own K12 students might use for data driven decisions. Potential data use misconceptions and potential problems with assessment validity and reliability are also popular topics in the course. It is now being taught in a blended learning format and is being integrated into both TED STEM and Educational Leadership Programs. It may also be a nice "anchor course" for a STEM suite of courses that might be offered together on specific blended course weekends as being discussed and considered by the TED leadership.

Teaching - Graduate: K12 Engineering Teacher Recruitment

During 2015, the OSTEM team also further worked on a curriculum-based outreach project called "STEM: Engineering Our Future", in partnership with Kiewit Engineering and UNL's Project Lead the Way. The 2nd annual event was held on June 2 and June 3 of 2015. Kiewit engaged 60+ leadership academy engineers from all over the country, and UNO and UNL are hosted 80 teachers from around the state of Nebraska. P12 engineering is problematic nationwide, and engineering educators receive very little curriculum guidance, typically have no formal engineering coursework, and are not certified for teaching engineering (except through Project Lead the Way). This project provided them with some background engineering information as well as sample lessons and activities for their classroom. Most importantly for TED STEM, these teachers are an important target group for recruitment into our new graduate program coursework aligned with P12 engineering. Kiewit asked to skip a 2016 offering, due to internal reorganization, but they have still appreciatively helped to provide internships for Mr. Nero's K12 engineering education coursework, and we look forward to working with them again in 2017.

Recruitment for K12 engineering teachers to enroll in TED graduate programs is also taking place at the Nebraska Robotics Expo, which is part of a continuing collaboration with the Nebraska Strategic Air and Space Museum, UNO, UNL and other area organizations. The group helped to facilitate another large-scale Nebraska Robotics Expo event during February of 2016, which showcased UNO's and UNL's collaborative robotics curriculum efforts. The 7th Robotics Expo was a wonderful success, with more than 1,800 students and 190 teachers participating. The Nebraska Assistant Governor welcomed the competitors on behalf of the state, and Senior Vice Chancellor BJ Reed welcomed the competitors and attendees on behalf of UNO. It is important to note that K12 engineering may well be a very productive focus for increasing TED efforts such as building a new supplemental endorsement for teachers. The CS supplemental endorsement success to date suggests that perhaps the time is right to move this direction for K12 engineering as well. More discussions will be undertaken by Mr. Nero, Dr. Grandgenett, Dr. Edwards and TED and the wider UNO faculty this next year on potential steps to take toward this future direction.

Outreach - OSTEM Leadership

Ms. Amelia Squires continued her third year with TED / OSTEM team, as funded by the UNO Senior Vice Chancellor and COE, to help to coordinate and support UNO STEM outreach. Many of these outreach elements had significant COE or Roskens Hall benefits, such as with the Spring 2016 Nebraska Science Festival, where the "STEM University Open House" activities were hosted in Roskens Hall, with nearly 500 visitors to Roskens, and with sessions held primarily on the fourth floor of Roskens, as staffed by 25 STEM students across campus. Examples of the STEM Outreach efforts by Ms. Squires for last year include the following:

Samples of OSTEM-Related Partnership Outreach Events Last Year:

Nebraska Science Festival; Nebraska Robotics Expo; Collective For Youth Lights On; Calculus Bee; Girls Inc. Eureka Camp; UNO Open Houses; Nebraska Metropolitan Science and Engineering Fair; Kiewit Engineering Day; The Magic of Chemistry; Nebraska Association of the Gifted Showcase; Nebraska Teacher Professional Development Series; Strategic Air and Space Museum STEM Conference; Celebration of the Mind; Bioblitz; Partnership for Kids; NE 4H Extension; Science Olympiad, Nebraska Solar Ambassadors.

Ms. Squires is an absolutely critical contributor to TED, COE and UNO, and we are so appreciative of having her with us.

Outreach – Girls Inc. Eureka

Girls Inc. EUREKA Camp: The OSTEM team continues to work each year with Girls Inc., which also worked this last year to initiate another grant proposal and continued efforts involving Girls Inc. for a summer camp experience. Dr. Sheryl McGlamery, Dr. Angie Hodge, Dr. Neal Grandgenett are the UNO-based Co-Principal Investigators of the outreach project, with Ms. Amelia Squires is the project director for the 2016 EUREKA Camp that was again funded for 2016, which this year was funded for $80,000 (about $2,000 more than in 2015). The project also involves other STEM units on campus, and COE undergraduate and graduate students will again be participating in the efforts during the Summer of 2016. The number of participating girls is now at 60 girls for this upcoming year in EUREKA!

Outreach - Helping Districts with Strategic Planning Assessment

Through OSTEM's past leadership of the campus on STEM Strategic Planning, the OPS and Westside School Districts requested help during 2015 and 2016 on STEM strategic planning.

For OPS, this has entailed close work within the context of their Sherwood Science Initiative, which has resulted in collaborative OPS funding with UNO subcontracts for $4.2 Million over five years. Each semester OPS provides a subcontract with UNO for specific coursework and professional development efforts, that also qualify for indirect costs to UNO (10%). For Westside, the OSTEM has been significantly helping the Westside Community Schools initiate strategic planning and particularly assessments for their district, particularly related to technology, critical thinking, and personalized learning, as well as other important district STEM-related initiatives. Dr. Grandgenett and Dr. Ostler have worked closely with Dr. Mark Weichel, Associate Superintendent at Westside to help the district to engage in internal strategic planning and evaluation efforts. This is hoped to become a replicable model for other districts that wish to expand their internal research and evaluation work for various initiatives. The Westside effort will also result in a national article on university and school district collaborations for strategic planning.

Outreach - Professional Organizations

OSTEM personnel continue to be active members of regional STEM-oriented groups including the ESU #3 Instructional Technology User Group (ITUG), the Metropolitan Omaha Educational Consortium's (MOEC) Technology Task Force, the Nebraska Educational Technology Association's annual conference (NETA), the Nebraska Association of Science Teachers (NATS), the Nebraska Association of Teachers of Mathematics annual conference (NATM), the Nebraska Gifted Association (NAG), and the Nebraska Academy of Science (NAS) annual conference. The NATM connection is of particular note, since Dr. Ostler now assumes the President role of that organization during 2016-2017.

OSTEM Overall Impact

Finally, the UNO Office of STEM Education is very proud of its sustained and substantial impact during its sixteen year history at UNO. The OSTEM is in some ways splitting off now into more of an internal TED and COE focused role (with student recruitment as Priority 1), while also collaborating closely with the UNO STEM Leadership Team which is growing and increasingly more organized for campus decision making and support and led by the four STEM Community Chairs. The impact is expected to

continue to increase, and to particularly support TED and COE efforts. Estimates suggest that this last year OSTEM has directly reached more than 2,200 teachers around Nebraska and the U.S. in various activities, and more than 10,000 K12 students statewide and nationally in various projects and efforts. During this last year, OSTEM faculty members continued or expanded roles as CoPI's for more than $4,100,000 of external funding at UNO, and an additional $4,200,000 brought jointly to OPS and UNO by Sherwood funding. Each of the related grants continue to generate shares of indirect costs that will also help to support TED and COE faculty travel, coursework development, outreach and other support that extend both within and beyond STEM. The challenges are as great as the successes, but we believe with internal and external collaboration, we will continue to thrive in STEM education in 2016 and 2017. The OSTEM faculty team continues to be proud members of TED and COE and work very hard to be ongoing contributors to our collaborative college and departmental vision, initiatives and joint efforts. It is a wonderful base to build from, and the campus is increasingly recognizing the critical contributions of TED and COE to the wider STEM Priority on Campus.