


9-5-2013

## UNO STEM Strategic Plan

UNO STEM Leadership Team  
*University of Nebraska at Omaha*

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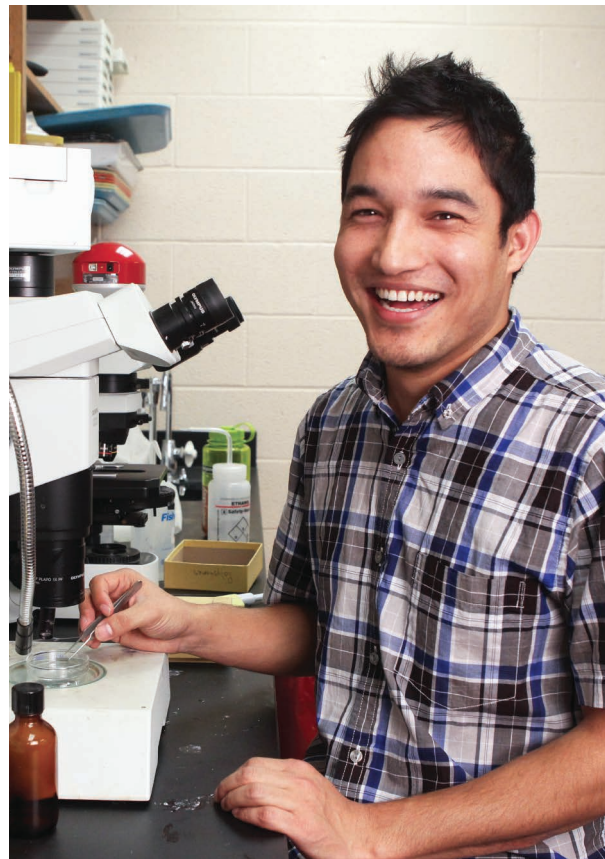
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# STEM STRATEGIC PLAN

SCIENCE, TECHNOLOGY, ENGINEERING AND MATH





# STEM STRATEGIC PLAN

Official Version for Distribution

September 5, 2013

Prepared by the STEM Leadership and Strategic Planning Committee

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# PREFACE

## Dear Colleagues and Friends of UNO STEM Education,

The following document is a strategic plan for STEM education at UNO as of September 5, 2013. The document represents nearly six months of strategic planning discussions, meetings, and conversations between those of us on the writing team and many of you, our colleagues and friends that share our passion for excellence in STEM education at UNO. It is also the result of a review of our local STEM statistics, the professional literature on STEM learning, and a sample of what other universities are doing to enhance STEM learning on their campuses. The document is intended to be a very dynamic one that will be revisited yearly as we continue to move steadily forward. In an appendix, we have listed more than 120 individuals who have already either reviewed the document or contributed to it in some way. We have received feedback and contributions on the plan from so many people over a relatively short period of time that it has been difficult to keep track of everyone who has contributed, and we apologize if we missed including anyone on the list. As a strategic planning team, we are certainly appreciative of the many shared ideas, suggestions, and thoughts, and we continue to look forward to working with everyone who is interested

in contributing to the ongoing UNO STEM education conversations and efforts.

Your input thus continues to be very important to our collective action and ongoing planning for STEM. If you are willing to provide further feedback for this plan, would like to make us aware of your own actions, or simply want to join the collaborative efforts, please contact:

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Thanks very much for joining us on this continuing journey toward excellence in STEM education at UNO.

Sincerely,

The UNO STEM Leadership  
and Strategic Planning Committee

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# NEED FOR THE UNO STEM STRATEGIC PLAN

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## UNO MISSION

*As Nebraska's metropolitan University, UNO is characterized by its strong academic foundations and creative community relationships that transform and improve the lives of constituents, the region, and the nation.*

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*Over the past five years, nearly 1 in 8 undergraduate students, or an average of 1,434 students per year, were STEM majors. A review of UNO data shows that among first-year first-time students declaring a STEM major in Fall 2010, 68% were retained at UNO, but only 56% were still majoring in a STEM discipline, by Fall 2012. Both rates are 5% below campus-wide retention rates.*

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On a national level, there is a growing concern that the United States is not producing enough professionals in science, technology, engineering, and mathematics (STEM) to meet our needs, especially as compared to many other countries around the world. National reports, such as the 2010 Rising Above the Gathering Storm Revisited, paint an alarming picture (National Academy of Sciences, 2010). For example, the ACT now reports that 78% of high school graduates are not ready for entry-level college classes (American College Testing, 2008). At the same time, projections indicate a need for several million new college graduates with STEM degrees by 2018 (Carnevale, Smith, & Stoll, 2010). Needs in Nebraska reflect this trend, with an estimated demand of 48,000 new STEM positions by 2018 (U.S. Innovations, 2011).

The University of Nebraska at Omaha (UNO) is committed to contributing to the solution of this crisis by working cooperatively with its many community partners, including P12 educators and STEM professionals, to expand and improve the local STEM pipeline. UNO is the largest institution of higher education in the Omaha metropolitan area, which has a population of 865,000. UNO has a total undergraduate student enrollment of 12,730 and a graduate enrollment of 2,664 (Fall 2012). Over the past five years, nearly 1 in 8 students, or an average of 1,434 UNO undergraduate students per year, were STEM majors. A review of UNO data shows that among first-year first-time students declaring a STEM major in Fall 2010, 68% were retained at UNO, but only 56% were still majoring in a STEM discipline, by Fall 2012.

Both rates are 5% below campus-wide retention rates. This challenge is not unique to UNO; national reports highlight many places along the educational path where potential STEM graduates are lost, citing in particular the students' crucial first term on campus and the summer after their first year of study (National Academy of Sciences, 2010).

In response to these local and national challenges, UNO is actively increasing its organizational capacity to recruit, retain, mentor, and prepare STEM students who will become STEM professionals and educators. The university's growing commitment to STEM education is reflected in a number of developments on campus, including the formation of the Math-Science Learning Center (2007), the hiring of the first full-time associate vice chancellor for research and creative activity (2010), the hiring of two named professorships with leadership responsibilities in STEM (2010 and 2011) and the funding of two more (2013), elevation of UNO's Carnegie Classification from "Master's Large" to "Doctoral/Research" (2010), the formation of a new Fund for Undergraduate Scholarly Experiences (FUSE; 2011), and completion of the Environmental Education and Research Facility at the university's Glacier Creek Preserve (2013). In 2012, UNO formally established STEM learning as one of five key campus priorities. This STEM Strategic Plan is designed to direct the further and ongoing development and implementation of UNO's STEM Priority and to help ensure that institutional resources are allocated appropriately to accommodate growth and maintain the educational quality of UNO's STEM programs.

# CONTEXT/CAPACITY

UNO is well positioned to undertake a leadership role in STEM learning, and our metropolitan university mission is well aligned with our focus on strengthening STEM efforts by growing partnerships within our community. In particular, the current capacity of UNO for such a priority effort includes the following:

1. Faculty Interdisciplinary Collaboration: Collaboration among faculty members from different disciplines on our campus is a longstanding strength, and, to date, many of our externally funded grant programs in STEM education have resulted from this strength. We have received external funding with co-principal investigators across colleges in areas such as bioinformatics, biomechanics, collaboration science, computing, educational robotics, environmental studies, mathematics education, and neuroscience, to name a few. Faculty collaboration at UNO frequently crosses the administrative lines of colleges, which is critical in STEM education (Miele et al., 2011; National Research Council, 2011). New research facilities such as the Glacier Creek Preserve, the Elkhorn River

Research Station, and the Biomechanics Core Facility also promise additional contexts for faculty interdisciplinary collaboration.

2. Community Engagement: UNO has undertaken numerous innovative joint STEM projects with our community that have engaged local businesses (such as the Applied Information Management Institute and the Omaha Public Power District), informal education partners (such as the zoo and museums), area nonprofits (such as Girls Inc.), and other educational institutions (such as community colleges and school districts). In addition, a strong UNO Service Learning Academy continues to strengthen and help formalize our institutional capacity for community partnerships. Such community engagement provides a key context for effective STEM education across age and grade levels (National Academy of Sciences, 2010; National Science Board, 2009).
3. A Growing STEM Focus: Many UNO faculty and staff have already expressed a growing interest in STEM, as represented by the strong and ongoing faculty attendance and participation in the “STEM

Engagement Links” coordinated by the UNO Office of Research and Creative Activity. More than 40 faculty and staff routinely attend these meetings to discuss STEM and to brainstorm additional opportunities for external STEM funding.

4. Student Research: UNO has recently decided to invest in supporting undergraduate research with the establishment of the Fund for Undergraduate Scholarly Experiences (FUSE) program. This program funds undergraduates to conduct research both on and off campus, working with faculty mentors and the community. It is expected that this program will aid in the recruitment, retention, and graduation of STEM majors, as identified in national studies (Gentile, 2011; Lopatto, 2009). Undergraduate research has also been shown to be particularly effective in attracting underrepresented populations into STEM disciplines (Foertsch, 2000; Gregerman, 1999; Ishiyama, 2001; Nestor-Baker & Kerkor, 2009).
5. External Funding Efforts: UNO faculty members have been very interested in fielding STEM-related proposals, and we have a history of externally funding STEM learning projects at UNO. Funding sources have included the National Science Foundation, the U.S. Department of Education, the National Institutes of Health, the National Aeronautics and Space Administration, and numerous private foundations. Many grant proposals, whether funded or not, have also initiated new reform efforts in STEM learning at UNO, such as the recent pilots of flipped classroom environments and inquiry-based learning implemented by faculty in the Colleges of Arts and Sciences, Information Science and Technology, and Education.





# THE STEM STRATEGIC PLANNING PROCESS

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*Participants in the strategic planning process recognized that students must be central to our efforts and that they need the support of creative educators, innovative instructional environments, and other learning assets to be successful. The necessary financing, policies, programs, management, and oversight must also be strategically engaged to fully operationalize the STEM Priority.*

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In the fall of 2012, the campus established a STEM Leadership Committee to provide a conduit for STEM collaboration, discussions, and partnerships. The leadership committee is chaired by Dr. Neal Grandgenett, the Dr. George and Sally Haddix Community Chair in STEM Education. Membership on the committee includes UNO STEM disciplinary faculty, education faculty, the Director of the UNO Aviation Institute, a representative from the UNL Computer and Electronics Engineering faculty located at the Omaha-based Peter Kiewit Institute, the mathematics curriculum supervisor for the Omaha Public Schools, and the Past-President of the Nebraska Academy of Sciences. Additional STEM faculty, partners, and collaborators from across organizations, such as the Nebraska Space Grant, the Nebraska Strategic Air and Space Museum, the Applied Information Management Institute, and many others, have provided input into the planning process by participating in various conversations with these committee members and by reviewing drafts of the strategic plan. (A roster of the UNO team undertaking the STEM Priority strategic planning process and a list of faculty and community reviewers are provided in Appendix A.) The role of the STEM Leadership Committee includes leading campus efforts on the STEM Priority, strengthening ties to UNO's many current STEM partners, supporting other UNO faculty in STEM initiatives, and helping new STEM-related projects to evolve.

During the fall of 2012, the committee initiated a formal strategic planning process, with facilitation provided by

John Smith, a well-known Nebraska business leader and strategic planning expert. A technical writing specialist, Ms. Sarah Moulton, helped to produce drafts of the overall document. Committee members met frequently and conducted numerous small-group meetings with administrators and faculty at UNO as well as with representatives from various partner organizations. Over the course of the frequent meetings and with the help of collaborators, committee members identified the key components of a STEM mission statement by addressing the following three questions that were integrated systematically into the strategic planning process:

- What are we producing in our STEM programs?
- For whom are we producing it?
- What goals and values are we seeking to achieve?

In turn, the committee considered these components in the context of a broader strategic framework, which is illustrated below. Further, the key answers to these questions were summarized in a one-page planning grid to aid discussions and planning (see Appendix B).

Committee members then shared the strategic framework and planning grid with the deans, the associate vice chancellor for research and creative activity, faculty colleagues, and other stakeholders and conducted several smaller meetings to help develop the mission, goals, objectives, and target measures for UNO's STEM Priority. To help guide these discussions, the STEM Leadership

Committee conducted “SWOT” analyses, summarizing UNO’s strengths, weaknesses, opportunities, and threats in the areas of teaching, research, and service (Appendix C); identified existing STEM programs and resources in the Omaha metropolitan area (Appendix D); and reviewed a sample of STEM centers and programs across the nation (Appendix E). Based on these discussions, the committee framed four overarching goals—one each in the areas of teaching/learning, research, service/community engagement, and STEM infrastructure. By targeting these four areas, the plan will be a powerful and useful tool for faculty and administrators, allowing faculty to directly align their annual professional goals in the areas of teaching, research, and service with the STEM Strategic Plan, which in turn aligns with the university-wide mission and strategic plan.

To maintain alignment of the STEM Strategic Plan with the university-wide strategic plan, to ensure continued progress toward achieving the STEM strategic goals and objectives, and to facilitate oversight of the STEM Priority, the STEM Leadership Committee will review and refine the goals, objectives, and strategic tasks of this UNO STEM Strategic Plan annually. Outcomes of the annual review will be summarized in a STEM Annual Report that will be shared with stakeholders.

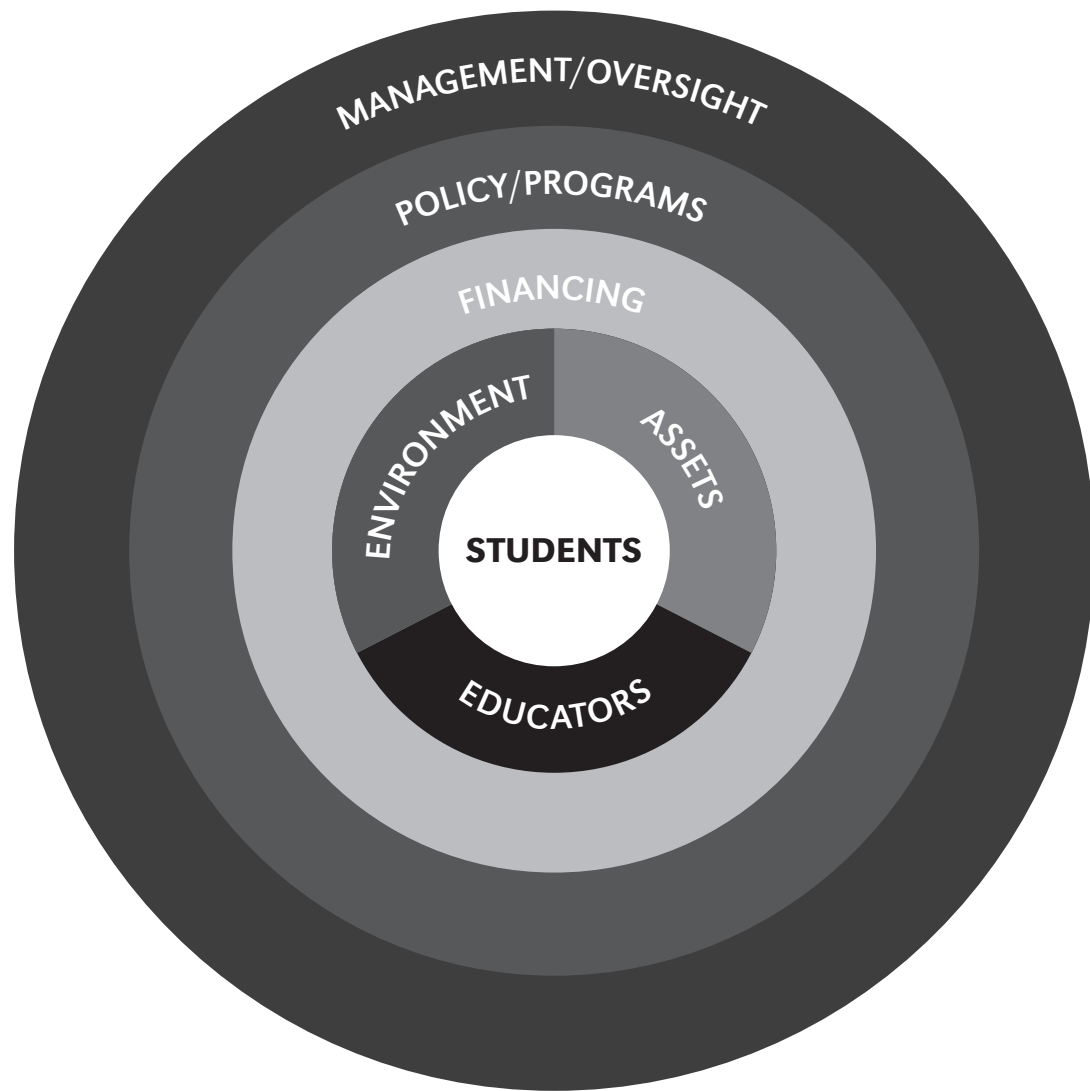


Figure 1. STEM Priority Strategic Framework

# STEM PRIORITY MISSION, GOALS, AND OBJECTIVES

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## STEM PRIORITY MISSION

*The mission of the UNO STEM Priority is to advance student understanding and success in STEM education by aggressively leading collaborative partnerships focused on increasing STEM capacity, competency, innovation, and literacy for the betterment of our metropolitan, regional, national, and international communities.*

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## STEM GOALS

1. *Teaching/Learning*
  2. *Research*
  3. *Service/Community Engagement*
  4. *STEM Infrastructure*
- 

UNO is a metropolitan university of distinction, and in that context, STEM represents an opportunity for national recognition, innovation, and leadership. The interdisciplinary nature of STEM and the need for close partnerships both within an institution and within its community make STEM a challenging endeavor for many universities across the nation. At UNO, we can build upon numerous past STEM successes to strengthen our existing learning strategies and to develop, research, and disseminate new innovative STEM education models. Maintaining a balanced focus between strengthening the core disciplines of STEM and supporting interdisciplinary STEM branches and efforts will be important. Our particular mission, goals, and objectives are outlined on the following pages. It is important to note that after numerous discussions among the committee members, administrators, faculty colleagues, and representatives of partner organizations, it was decided that the STEM Strategic Plan should focus on STEM education, or STEM learning, at UNO. It was decided that by focusing directly on STEM learning, the full spectrum of STEM interests at UNO would be best served. Thus, the scientific research elements of STEM at UNO will be served by strengthening the overall P16 STEM pipeline and developing a more effective STEM learning environment. An improved STEM learning environment will provide increased opportunities for engaging STEM undergraduates, graduates, and community partners in teaching, research, and service, thereby facilitating the broader impacts of STEM for our metropolitan area, state, and nation. Thus, our mission statement for the UNO STEM Priority is as follows:

In addition to the mission statement for the UNO STEM Priority, four overarching goals and a set of measurable objectives for each goal have been established through collaboration among the STEM Leadership Committee, UNO faculty, lead administrators, and key representatives of various community partners. Based on these interactions, the committee decided it was important for the selected goal areas to align with the categories of professional goals identified in faculty annual reviews in order to facilitate use of the plan and ensure ongoing alignment with the UNO mission. In addition, it was decided that the goal areas needed to address infrastructure development for a UNO STEM center. Thus, the four goal areas for this strategic plan are as follows: 1) teaching/learning, 2) research, 3) service/community engagement, and 4) UNO Center for Metropolitan STEM Learning.

## GOAL 1: TEACHING/LEARNING

To strengthen the P16 STEM educational pipeline through innovative and interdisciplinary UNO STEM learning initiatives and to thus increase interest, involvement, and success in the STEM disciplines among all UNO students, especially those from underrepresented groups.

### **Objective 1.1. STEM Learning Inventory.**

Engage an external consulting team to undertake a STEM Learning Inventory that would appraise the underlying strengths and challenges associated with the existing UNO STEM undergraduate pipeline and make written recommendations for alignment with best national practices.

**Objective 1.2. Create a STEM Summer Bridge**

**Program.** Develop a STEM Summer Bridge Program that offers engaging summer bridge courses in areas such as space, water, and mobile technology and that enrolls at least 200 high school and community college students within three years.

**Objective 1.3 Establish an Academic Learning Community for First-Year Students Interested in STEM Majors or Careers.**

In alignment with UNO's new initiative to establish academic learning communities in support of its strategic priorities, pilot a STEM academic learning community for first-year students that provides focused shared-learning experiences.

**Objective 1.4 Support New or Enhanced Courses that Innovatively Engage Students in STEM**

**Concepts.** Aligning with campus and faculty interests in new STEM coursework, particularly at introductory levels, support faculty collaboration for the development of innovative STEM coursework.

**Objective 1.5. Support Faculty Teaching Circles**

**Focused on STEM Curriculum Development.** Establish interdisciplinary and UNO-based STEM teaching circles, with faculty compensation options, to support the development of new STEM modules, workshops, courses, programs, certificates, degrees, and advising materials, as indicated by yearly increases in the number of STEM curriculum initiatives documented in the STEM Annual Report.

**Objective 1.6. Expand Tutoring and Support Services**

**for STEM.** Develop innovative student support models, such as enhanced STEM tutoring and student study-group services, that lead to increased student satisfaction with STEM-related academic support services, as documented by student surveys.

**Objective 1.7. Expand Faculty Professional Development in Active Learning Strategies for STEM Teaching.**

Expand professional development and instructional support opportunities for faculty members interested in using active learning strategies to improve their STEM-related teaching, especially in introductory coursework, as documented by course syllabi identifying the use of active learning strategies and increased student success in those courses.

**Objective 1.8. Establish an Interdisciplinary STEM Teaching Award.**

Increase annual faculty recognition for interdisciplinary STEM teaching success by creating an interdisciplinary STEM teaching award that directly supports the STEM Priority and that is awarded to a group of collaborating faculty.

**Objective 1.9. Expand Undergraduate Pathways for P12 STEM Teacher Certification.**

Expand the STEM teacher certification pathways at UNO associated with Bachelor of Science programs in mathematics, physics, chemistry, biology, geology, and computer science, and increase enrollment in those pathways by 30% within three years.

**Objective 1.10. Expand Graduate Program Pathways to Support STEM Leadership.**

Enhance graduate program pathways to support STEM leadership within P12 schools to enroll at least 5 new teacher leaders yearly in educational leadership master's and doctoral pathways starting in 2014.

**Objective 1.11. Expand Distance Education in STEM.**

Investigate and develop new online and blended learning models in STEM to support student engagement locally, nationally, and internationally.

**Objective 1.12. Expand Student Experiential**

**Opportunities in STEM.** Expand student experiential opportunities in STEM-related dual-enrollment coursework, student internships, service learning, and other teaching-related partnerships.

In the complexity of the P16 pipelines of today, data-driven decision making and system modeling have been identified as critical to enhancing the STEM pipeline of any university, particularly for undergraduate education (Anderson et al., 2011; Business Higher Education Forum, 2010; Fairweather, 2010; Nelson Laird, Sullivan, Zimmerman, & McCormick, 2011; Rundell Singer, 2011). To make good decisions, institutions must carefully examine data and solicit external perspectives, both of which are standard strategies for encouraging academic excellence, whether it is in the publication of a scientific article, the improvement of an instructional program, or the enhancement of overall services to students. During the course of this strategic planning effort, the idea surfaced that it would be useful to have an external consulting team examine UNO's undergraduate STEM pipeline so that we can optimally align the objectives and associated tasks outlined in this plan with national best practices. The STEM Learning Inventory will include a review of current recruitment, retention, and graduation data as well as course offerings and learning strategies. In addition, the interdisciplinary review team will communicate with STEM faculty and administrators and conduct focus groups with students. The team will then make recommendations for aligning the strategic efforts with best practices. The foundation for such a STEM Learning Inventory is found in this strategic plan, which includes data on national and local trends related to STEM recruitment and retention, as summarized below.

There is a well-recognized national trend related to losing STEM majors to other disciplines, and UNO has also experienced this trend (Gentile, 2011; National Research Council, 2010). For example, on a national scale, approximately 40% of undergraduate students leave engineering, 50% leave the physical and biological sciences, and 60% leave mathematics (Samueli, 2010; Seymour, 1997). The recognition and investigation of this at UNO (Table 1) will allow us to address this national trend at a local level and to develop and test innovative models for supporting STEM student recruitment, retention, and graduation.

Similarly, recent data retrieved for an NSF STEP proposal (Table 2) illustrate additional challenges and opportunities within the current UNO pipeline for STEM graduates, when examined by department. As UNO undertakes the STEM Priority, while also being sensitive to the need for 120-hour degree programs, it will be important to help interested departments across campus to self-assess their STEM-related curriculum, develop internal STEM action plans, and implement specific initiatives to enhance the recruitment, retention, and graduation of STEM majors as well as to increase competitiveness for external funding related to STEM learning. Such departmental support may well require the periodic engagement of discipline-specific outside mentors or experts that have successfully undertaken similar STEM work at other universities.

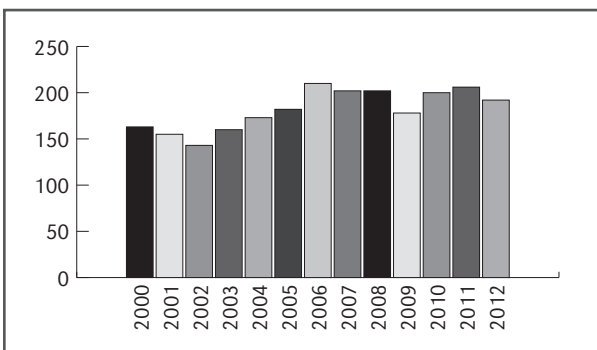


Table 1. UNO 2-Year Retention of First-Year First-Time STEM Students

DECLARED MAJOR	STUDENTS ENROLLED (2010)	1-YEAR RETENTION RATE	2-YEAR RETENTION RATE
Biology	47	60%	34%
Chemistry	15	53%	40%
Computer Science	63	56%	46%
Geology	3	100%	0%
Mathematics	8	25%	25%
Physics	3	33%	33%
TOTAL STEM	137	66%	56%

Table 2. UNO STEM Graduates

YEAR	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Biology	85	76	57	66	83	81	117	107	107	98	104	123	113
Chemistry	6	3	6	3	4	7	6	6	8	9	8	11	9
Computer Science	59	68	56	63	67	63	61	50	53	42	52	40	44
Geology	4	0	1	6	0	4	3	7	2	3	5	4	11
Mathematics	7	8	18	20	18	27	19	28	26	23	26	22	18
Physics	2	0	5	2	1	0	4	4	6	3	5	4	6
TOTAL STEM	163	155	143	160	173	182	210	202	202	178	200	206	192
MEAN	159/year			195/year			199/year						

As we seek to improve the recruitment, retention, and graduation of students in STEM-related areas at UNO, we must also consider the strengths and opportunities in our existing strategies and programs. For example, we recognize the national research that suggests that STEM students who are involved in active learning techniques can learn more effectively in their classes (Henry, 2010). We seek to assist faculty in integrating active learning techniques in both introductory and advanced STEM courses, thereby establishing such courses as the launch pad for student success in STEM and STEM-related careers. Many UNO faculty members are already striving for instructional innovation in their STEM courses. For example, in classes like applied linear algebra, students are taught with interactive video technologies and online homework support. Our faculty members are passionate about improving their STEM teaching skills, and we want to assist faculty members in these efforts as we seek to engage all students in more-effective STEM instruction, including students of all demographics and levels of achievement.

The UNO dual enrollment program, in which high school students receive UNO credit for taking specific courses taught by highly qualified high school instructors, represents another strength and potential area of growth for UNO STEM course enrollments. Dual enrollment at UNO is already on a strong upward trajectory. As of May 2013, 2,320 high school students accounted for 4,227 enrollments in UNO dual-enrollment classes, with some students taking multiple classes. STEM areas account for approximately 30% of the overall enrollments, as shown in Figure 2. However, participation is relatively low in several STEM areas due to factors that include the following:

1) challenges for high schools in supporting college-level laboratory work, 2) high school instructors without adequate credentials for university-level teaching, and 3) a need for enhanced coordination between high school and college-level course standards. Significant potential exists for growth and innovation if these factors can be addressed.

Providing P12 teachers with adequate training and preparation in STEM areas represents a significant challenge. For example, within the national context of concern for competitiveness in STEM, school districts across the country, which are routinely close partners of metropolitan universities, are finding it increasingly difficult to fill vacancies for mathematics teachers with qualified

candidates, often leaving more than 20% of the vacancies unfilled (Ingersoll & Perda, 2010). Vacancies in Omaha, Nebraska mirror these national trends, as estimated by the administrators of the Omaha Public Schools, a diverse, high-need, urban school district of 48,692 students that surrounds the UNO campus and is the largest school district in Nebraska. Thus, innovation in STEM for our students and community needs to be continually implemented within the context of new and enhanced STEM curricula, including programs designed to prepare highly qualified P12 teachers. Many innovations in this area are already being conceptualized on campus, such as the new program collaboration between the Departments of Mathematics and Teacher Education to provide

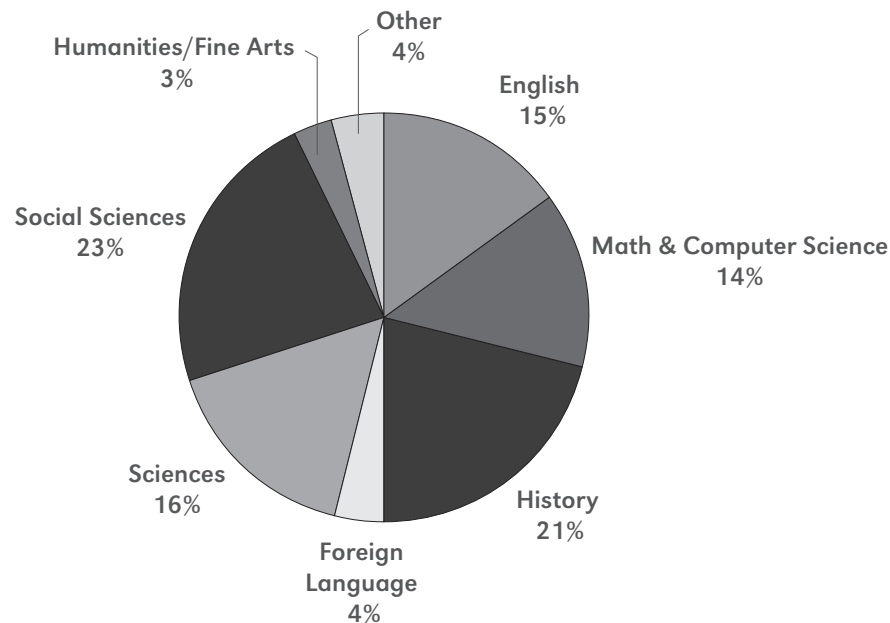


Figure 2. UNO Dual Enrollments by Discipline

an option for teacher certification within a Bachelor of Science in Mathematics program. Work in similar joint pipeline efforts are now being initiated with the Departments of Chemistry and Physics. Such collaborative strategies promise to directly enhance student choices and strengthen the P16 STEM pipeline.

We are, of course, not alone in striving for STEM excellence, and many organizations in our metropolitan community and across the state of Nebraska share our interest in STEM excellence for students. For example, Governor Heineman recently signed a proclamation declaring 2013 the “Year of STEM Discovery in Nebraska” (Cole, 2013), and at UNO, we have many great current and potential partners that can help us to refine and operationalize our plans for supporting STEM discovery and excellence. STEM curriculum components can benefit

from the direct involvement of community partners in aspects related to instructional design, use of datasets, and real-world examples, as well as in the use of more realistic field placements, internships, and student projects. Such mentoring opportunities for STEM students will be vital to improving student retention. Within STEM programs, there is also a need to develop strategies to mentor and train faculty in the many internship opportunities available to students, as well to connect faculty with internal and external experts in STEM and STEM-related fields to inform and enhance UNO program development. STEM curriculum components, which depend heavily on strong faculty collaboration, also provide great opportunities to refine new pedagogical strategies on the UNO campus, such as online or blended learning, flipped classrooms, flexible course scheduling, and team teaching.

In all of these efforts, UNO must continue to increase our support of a P16 pipeline for STEM education by recognizing and encouraging innovative STEM learning, research, and outreach initiatives by our faculty and institutional partners. That recognition can be provided through existing mechanisms, such as the daily campus e notes, as well as in new mechanisms, yet to be developed, such as an interdisciplinary STEM teaching award. Such recognition will provide a strong and ongoing opportunity to encourage and support faculty participation in new interdisciplinary curriculum efforts, the use of innovative learning technologies, contributions to collaborative research projects, and other STEM-related activities. The strategic plans for enhancing STEM teaching and learning at UNO are provided in the next page.



## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 1: TEACHING/LEARNING

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
<p><b>Objective 1.1. STEM Learning Inventory.</b> Engage an external consulting team to undertake a “STEM Learning Inventory” that would appraise the underlying strengths and challenges associated with the existing UNO STEM undergraduate pipeline and make written recommendations for alignment with best national practices.</p>			
<p>Working with organizations such as the Council on Undergraduate Research or the American Association of Colleges and Universities, identify and contract with an external team to undertake the STEM Learning Inventory</p>	<p>No external review of the undergraduate UNO STEM pipeline has been conducted</p>	<ul style="list-style-type: none"> <li>• Investigate team options</li> <li>• Contact team</li> <li>• Arrange consulting contract</li> </ul>	<p>Engage an external review team for fall of 2013</p>
<p>Working closely with deans, chairs, STEM faculty, and the UNO Research Office, support an external team in conducting the STEM Learning Inventory</p>	<p>No external review of the undergraduate UNO STEM pipeline has been conducted</p>	<ul style="list-style-type: none"> <li>• Retrieve data</li> <li>• Assist team with focus groups</li> <li>• Assist with reporting</li> <li>• Share with faculty</li> </ul>	<p>An external report will be completed during the fall of 2013</p>
<p><b>Objective 1.2. Create a STEM Summer Bridge Program.</b> Develop a STEM Summer Bridge Program that offers engaging summer bridge courses in areas such as space, water, and mobile technology and that enrolls at least 200 high school and community college students over the next three years.</p>			
<p>Develop a STEM Summer Bridge Program for college credit aimed at high school and community college students entering UNO</p>	<p>No official STEM Summer Bridge Program exists currently at UNO</p>	<ul style="list-style-type: none"> <li>• Research models</li> <li>• Create faculty teams</li> <li>• Develop/refine pilot</li> </ul>	<p>At least 40 students participate in 2014, 80 in 2015, and 80 in 2016</p>
<p><b>Objective 1.3. Establish an Academic Learning Community for First Year Students Interested in STEM Majors or Careers.</b> In alignment with UNO’s new initiative to establish academic learning communities in support of its strategic priorities, pilot a STEM academic learning community for first-year students that provides focused shared-learning experiences.</p>			
<p>Working with campus STEM leaders, further examine successful academic learning community (ALC) models involving first-year students in STEM</p>	<p>UNO does not currently have an ALC for STEM</p>	<ul style="list-style-type: none"> <li>• Investigate successful national ALC models</li> <li>• Plan features of UNO’s ALC pilot efforts</li> </ul>	<p>The 2014 STEM Annual Report will include detailed ALC plans</p>
<p>(Continued on the next page.)</p>			



## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 1: TEACHING/LEARNING

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
<p>Pilot a UNO ALC in Biology and STEM that engages students in connected experiences that involve coursework, career field trips, and socialization</p>	<p>Although UNO has no ALC for STEM, faculty efforts and interests exist, especially in Biology, for some features of an ALC</p>	<ul style="list-style-type: none"> <li>• Following design work, select student group</li> <li>• Work to operationalize an ALC for the pilot group of students within UNO Biology</li> </ul>	<p>By the end of 2014, a pilot group of 30 or more students will participate in a STEM ALC.</p>
<p><b>Objective 1.4. Support New or Enhanced Courses that Innovatively Engage Students in STEM Concepts.</b> <i>Aligning with campus and faculty interests in new STEM coursework, particularly at introductory levels, support faculty collaboration for the development of innovative STEM coursework.</i></p>			
<p>Provide incentives and mini-grants to faculty members to establish new interdisciplinary STEM coursework and to take risks for STEM innovations</p>	<p>Some UNO faculty support is already available but it is not STEM focused and is rarely interdisciplinary</p>	<ul style="list-style-type: none"> <li>• Develop a call for STEM course pilots</li> <li>• Develop budget</li> <li>• Extend call and fund</li> </ul>	<p>Fund at least two STEM course-development grants yearly, starting in 2014</p>
<p>Develop one or more interdisciplinary STEM courses for use as a general education (Gen Ed) requirement</p>	<p>Current Gen Ed STEM courses are limited and are not very interdisciplinary</p>	<ul style="list-style-type: none"> <li>• Form faculty team interested in effort</li> <li>• Support team in focused planning and pilot implementation</li> </ul>	<p>Develop and implement at least one interdisciplinary Gen Ed STEM course by the end of 2014</p>
<p><b>Objective 1.5. Support Faculty Teaching Circles Focused on STEM Curriculum Development.</b> <i>Establish interdisciplinary and UNO-based STEM teaching circles, with faculty compensation options, to support the development of new STEM modules, workshops, courses, programs, certificates, degrees, and advising materials, as indicated by yearly increases in the number of STEM curriculum initiatives documented in the STEM Annual Report.</i></p>			
<p>Undertake student focus groups to better understand retention issues</p>	<p>No student focus groups are currently underway</p>	<ul style="list-style-type: none"> <li>• Identify student sample</li> <li>• Conduct 2-3 focus groups</li> </ul>	<p>Student feedback will be summarized</p>
<p>(Continued on the next page.)</p>			

## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 1: TEACHING/LEARNING

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
Form interdisciplinary teaching circles to develop specific enhancements to STEM programs and curricula	Teaching circles have not been organized on interdisciplinary STEM efforts	<ul style="list-style-type: none"> <li>• Identify curriculum needs</li> <li>• Invite faculty to circles</li> <li>• Set goals for efforts</li> </ul>	At least three STEM interdisciplinary circles per year starting in 2014
Develop an advising brochure and website of UNO STEM undergraduate and graduate courses to generate student interest in STEM disciplines	Brochures are currently limited and not focused on STEM across departments	<ul style="list-style-type: none"> <li>• Establish work team</li> <li>• Inventory options</li> <li>• Design brochure</li> <li>• Distribute brochure</li> <li>• Design website</li> </ul>	Develop a brochure and website for STEM courses and update yearly starting in 2014
<p><b>Objective 1.6. Expand Tutoring and Support Services for STEM.</b> <i>Develop innovative student support models, such as enhanced STEM tutoring and student study-group services, that lead to increased student satisfaction with STEM-related academic support services, as documented by student surveys.</i></p>			
Plan and increase academic support services in the STEM areas for direct student assistance, to include assistance for students in upper-level courses and potentially online tutoring support services	Tutoring/study assistance is available in the Math-Science Learning Center and CIST but expansion is needed	<ul style="list-style-type: none"> <li>• Survey STEM students on tutoring, study groups, and needs</li> <li>• Investigate online options for tutoring</li> <li>• Publish needs/ideas in STEM Annual Report</li> </ul>	Student surveys show enhanced satisfaction with STEM tutoring, study groups, and related services
Establish an interdisciplinary STEM club for UNO students that engages STEM students from multiple departments in supporting each other	Some clubs exist in STEM areas (such as math) but students rarely interact with other STEM majors	<ul style="list-style-type: none"> <li>• Find faculty sponsors for a STEM club</li> <li>• Initiate meetings with students to begin club efforts</li> </ul>	A student STEM club is underway by 2015 with 50 or more students participating in the club either in person or online
<p>(Continued on the next page.)</p>			

## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 1: TEACHING/LEARNING

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
Further support and grow the Women in STEM (WiSTEM) group at UNO	The WiSTEM group has made a strong start but needs resources to further expand	<ul style="list-style-type: none"> <li>• Meet with WiSTEM leadership on needs</li> <li>• Discuss needs with UNO administration and NU Foundation</li> </ul>	The WiSTEM club will have enhanced resources by 2015 as documented in the STEM Annual Report
<p><b>Objective 1.7. Expand Faculty Professional Development in Active Learning Strategies for STEM Teaching.</b> <i>Expand professional development and instructional support opportunities for faculty members interested in using active learning strategies to improve their STEM-related teaching, especially in introductory coursework, as documented by course syllabi identifying the use of active learning strategies and increased student success in those courses.</i></p>			
Bring in national experts to lead campus discussions on strategies to support recruitment and retention across STEM departments	Experts are brought in inconsistently, and expertise is minimally shared among departments	<ul style="list-style-type: none"> <li>• Identify parameters</li> <li>• Specify budget</li> <li>• Identify experts</li> <li>• Identify timeline</li> </ul>	Bring in at least five STEM learning experts each year for campus-wide discussions and workshops
Develop a brown-bag series to share the uses of new technologies in STEM learning, such as “cloud computing,” and include partners, such as the Applied Information Management Institute (AIM)	Brown bags happen regularly, but there is not a focused track for STEM learning technologies	<ul style="list-style-type: none"> <li>• Engage UNO IS and AIM in planning</li> <li>• Engage UNO Faculty Development Office</li> <li>• Plan schedule</li> <li>• Advertise schedule</li> </ul>	Two brown-bag sessions focused on new technology for STEM learning will be offered each semester
Encourage interdisciplinary ideas that build bridges with historically non-STEM departments, such as “STEM to STEAM” art connections	Faculty of some non-STEM departments feel left out of the STEM Priority or do not see its relevance to their area	<ul style="list-style-type: none"> <li>• Meet with department chairs</li> <li>• Encourage participation</li> <li>• Record attendance</li> </ul>	STEM events will record attendee departments and show non-STEM representation
(Continued on the next page.)			

## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 1: TEACHING/LEARNING

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
<p><b>Objective 1.8. Establish an Interdisciplinary STEM Teaching Award.</b> Increase annual faculty recognition for interdisciplinary STEM teaching success by creating an interdisciplinary STEM teaching award that directly supports the STEM Priority and that is awarded to a group of collaborating faculty.</p>			
<p>Establish a STEM teaching award for interdisciplinary and innovative STEM teaching that is awarded to a team of collaborating faculty</p>	<p>No focused STEM teaching award currently exists</p>	<ul style="list-style-type: none"> <li>• Dialogue with deans</li> <li>• Dialogue with chairs</li> <li>• Set parameters</li> <li>• Establish award</li> </ul>	<p>At least one STEM teaching award will be awarded and showcased yearly, starting in 2014.</p>
<p><b>Objective 1.9. Expand Undergraduate Pathways for P12 STEM Teacher Certification.</b> Expand the STEM teacher certification pathways at UNO associated with Bachelor of Science programs in mathematics, physics, chemistry, biology, geology, and computer science, and increase enrollment in those pathways by 30% within three years.</p>			
<p>Further support parallel pathways to STEM teacher certification that allow a student to achieve teacher certification while earning a B.S. degree in a STEM discipline</p>	<p>The B.S. in Math/ Teacher Prep pathway is in place, and planning is underway for similar pathways in physics and chemistry</p>	<ul style="list-style-type: none"> <li>• Review status with teams from STEM departments</li> <li>• Expand to biology, computer science, and geology</li> </ul>	<p>Increase the number of pre-service teachers in these new pipelines by 20% by 2015</p>
<p>Explore parallel teacher certification pathway for engineering majors that crosses the University of Nebraska system</p>	<p>No teacher certification pathway supporting engineering majors currently exists</p>	<ul style="list-style-type: none"> <li>• Meet with PKI engineering faculty and administrators</li> <li>• Discuss options</li> </ul>	<p>Undertake focused dialogue by 2014 and decide on program feasibility</p>
<p>(Continued on the next page.)</p>			

## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 1: TEACHING/LEARNING

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
<p><b>Objective 1.10. Expand Graduate Program Pathways to Support STEM Leadership.</b> Enhance graduate program pathways to support STEM leadership within P12 schools to enroll at least 5 new teacher leaders yearly in educational leadership master’s and doctoral pathways starting in 2014.</p>			
<p>Continue working with the UNO Educational Leadership Department to refine and operationalize doctoral and master degree pathways for P12 educational leadership in STEM</p>	<p>Educational leadership graduate degrees exist, but a specialization for STEM learning is not yet available</p>	<ul style="list-style-type: none"> <li>• Develop coursework sequence for pathways</li> <li>• Get all needed approvals for pathways</li> <li>• Pilot with students</li> </ul>	<p>Formalize pathways by 2015 with at least five or six students entering each degree pathway</p>
<p><b>Objective 1.11. Expand Distance Education in STEM.</b> Investigate and develop new online and blended learning models in STEM to support student engagement locally, nationally, and internationally.</p>			
<p>Investigate development of new distance education models and certificates in STEM by creating a STEM Distance Education (DE) Task Force that helps faculty plan more interdisciplinary STEM-DE efforts</p>	<p>Some STEM-DE courses are created, but little cross-department planning among STEM faculty is currently underway</p>	<ul style="list-style-type: none"> <li>• Establish task force</li> <li>• Engage IS support</li> <li>• Plan STEM-DE coursework pilots</li> <li>• Refine pilots</li> <li>• Expand coursework</li> </ul>	<p>Develop at least one interdisciplinary STEM course in a distance learning format each year starting in 2014</p>
<p>Investigate opportunities to align UNO STEM DE efforts with NU Coursera partnerships</p>	<p>The Coursera partnership is a new NU initiative</p>	<ul style="list-style-type: none"> <li>• Investigate Coursera</li> <li>• Receive training</li> <li>• Consider in UNO STEM</li> </ul>	<p>At least one UNO STEM-DE course will pilot Coursera use by 2015</p>
<p>(Continued on the next page.)</p>			

## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 1: TEACHING/LEARNING

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
<p><b>Objective 1.12. Expand Student Experiential Opportunities in STEM.</b> <i>Expand student experiential opportunities in STEM-related dual-enrollment coursework, student internships, service learning, and other teaching-related partnerships.</i></p>			
<p>Investigate, discuss, and document expansion opportunities in STEM-related instructional partnerships that engage students in real-life learning</p>	<p>Some community organizations have expressed an interest in expanding instructional partnerships</p>	<ul style="list-style-type: none"> <li>• Bring partners to the table for discussions</li> <li>• Generate list of opportunities for expansion</li> </ul>	<p>A list of STEM partner opportunities for student learning will be included in 2014 STEM Annual Report</p>
<p>Work closely with the UNO Dual Enrollment office to determine how to continue to strengthen STEM-related dual enrollment options</p>	<p>STEM courses account for approximately 30% of dual enrollments, but some departments could participate more</p>	<ul style="list-style-type: none"> <li>• Meet with Dual Enrollment office</li> <li>• Develop ideas for increased STEM participation</li> </ul>	<p>STEM-related dual enrollment statistics will show significant growth by 2015</p>

## GOAL 2: RESEARCH

To become a national leader in the research, development, and refinement of STEM active learning models that particularly support student success in metropolitan settings across the P16 pipeline and into STEM careers.

**Objective 2.1. Support Active Learning Strategies for STEM Content.** Continue to support UNO's evolving national leadership in the research of STEM active learning strategies, including inquiry-based learning (IBL), particularly in STEM-related content areas such as calculus and introductory biology, chemistry, and computer science, as documented by yearly increases in publications and presentations related to active learning strategies for STEM.

**Objective 2.2. Develop and Research Technology-Enhanced STEM Learning Models.** Develop and research STEM learning models that build upon UNO's growing expertise in areas such as flipped classrooms, mobile technology, authentic scientific data collection and analysis, and educational robotics, as documented by an increase in external funding for the development of technology-enhanced STEM learning models.

**Objective 2.3. Emphasize the Bridge between STEM-Related Learning and Scientific Research.** Build nationally recognized interdisciplinary STEM curricula that directly support the broader impacts of funded UNO science projects, and strive to apply new ideas from UNO's growing scientific research endeavors into the P16 STEM learning pipeline, as documented in the STEM Annual Report.

**Objective 2.4. Develop Learning Strategies that Support Diversity in STEM.** Building upon UNO's many metropolitan partnerships, become nationally



recognized in the research and development of promising STEM learning strategies that support traditionally underrepresented populations, as identified by yearly increases in publications associated with diversity in STEM learning.

**Objective 2.5. Collaborate with Traditionally Non-STEM Disciplines.** Team with traditionally non-STEM disciplines, such as art, history, psychology, sociology, and political science, to refine models of UNO interdisciplinary collaboration related to metropolitan-based P16 STEM learning and to increase associated external funding.

In STEM today, research on new interdisciplinary learning models, tools for learning, student engagement strategies, and university-community partnerships are seen as critically important to the future of STEM and our country

(Banilower et. al, 2012; National Academy of Sciences, 2010; National Governors Association, 2012). UNO already has conducted significant research related to STEM learning and already works closely with area school districts, the other NU campuses, and area community colleges on such projects. Within these existing strong partnerships and successful initiatives, UNO has the opportunity to steadily grow into a national leader in the research, development, and piloting of innovative STEM learning models, and thus help to strengthen the STEM P16 pipelines into STEM careers, not only at UNO, but also across the country. We can also increasingly become more competitive in external funding opportunities associated with STEM education as our country strives to move forward in this critical area.

The United States is indeed moving toward efforts to build STEM literacy for all citizens, and UNO is positioned to increasingly become a national contributor to supporting such literacy. STEM literacy, or the use of STEM concepts in better understanding the world around us, provides the necessary foundation for applying the various ideas, concepts, and problem-solving approaches of STEM to real-life problems across all disciplines. STEM and STEM education have become a higher priority in the context of growing international competitiveness, and in support of this model, it will be important to conduct global research on effective STEM strategies and how students can learn STEM concepts more effectively and become more successful professionals.

University research today certainly needs to help us as a nation to understand, expand, and enhance the student pipeline leading to STEM careers (Fairweather, 2010; Rundell Singer, 2011). In Nebraska, the STEM career pipeline is in a rapid growth trajectory aligned directly with many STEM disciplines and keeping pace with national growth (Table 3). The Nebraska Department of Labor website has a significant amount of information on STEM careers in Nebraska (<http://www.dol.nebraska.gov/>).

The Nebraska Department of Labor also recently released (January 2013) a nice sampling of STEM career information, including wages and degree requirements, in a poster format that is included in Appendix F of this report.

On a national level, jobs of all types are increasingly relying on STEM foundations as a key piece of employment responsibilities. For example, when examining the Forbes list of the top 15 jobs in 2013 (Table 4), 8 of the jobs are directly related to STEM, and 4 others appear to need at least some STEM elements or background. The diversity of STEM-related jobs is becoming increasingly apparent.

How does research in STEM education contribute to this dynamic national context and need for STEM professionals? It is actually recognized by many organizations as a critically important element. For example, in the 2012 report by the National Governor's Association, *Building a STEM Education Agenda: An Update of State Actions*, STEM education research was identified as critical to answering questions related to P16 career pathways in education. Questions such as "Is our educational system providing a seamless trajectory from P12 through all postsecondary institutions to allow students to efficiently and cost-effectively build the skills they need for STEM careers?" and "Are we taking

advantage of all the opportunities and resources available from various public, private, and philanthropic institutions providing support to the STEM agenda?" (p. 38) provide both direction and context for reform efforts. Such research in STEM education is also increasingly being seen as critically important to U.S. scientific pursuits. For example, the prestigious *Science* magazine had a whole issue dedicated to the "Grand Challenges in Science Education" (Volume 340, Issue 6130, April 2013) that discussed the many aspects of STEM education that need significant research and that described these researchable challenges as ones that "the scientific community ignores at its peril" (p. 291).







Thus, there is a need at UNO to aggressively contribute to STEM research and to seek external funding for these research efforts as well as for STEM initiatives in the areas of teaching and service. In supporting STEM-related research at UNO, we would seem well positioned to increasingly build a national reputation in this important area of local, regional, and national research interest, particularly as it relates to STEM education or STEM learning. But what types of research topics are we talking about? In answer to that important question, and to provide faculty, community partners, and other stakeholders with a context for the objectives and strategic tasks that follow under the research goal, some of the

faculty working on this strategic plan generated the following table of potential research topics (Table 5).

STEM-related funding opportunities are growing rapidly as the U.S. Government strives to address our nation's critical needs in STEM, and various funding organizations, such as the National Science Foundation, increasingly include STEM in their calls for proposals. Recent 2013 recommendations for a federal realignment of STEM research and funding opportunities from the Committee on Science, Technology, Engineering, and Mathematics (CoSTEM) will no doubt also play a role in future STEM funding efforts. UNO is already well positioned to be competitive for such external funding opportunities, and

we have strong leadership and support from the Office of Research and Creative Activity. With this strategic plan and supporting efforts, we hope to encourage UNO faculty to seek funding for the development of model STEM curricula as well as for STEM-related research on topics such as student recruitment, retention, and graduation strategies. UNO also has significant strengths in areas such as inquiry-based learning, the use of new technologies for STEM learning, and metropolitan partnerships that allow us to increasingly specialize in specific contexts of STEM-related research. The recommended objectives and strategic tasks for research endeavors related to the UNO STEM Priority are presented in the following table.

## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 2: RESEARCH

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
<p><b>Objective 2.1. Support Active Learning Strategies for STEM Content.</b> Continue to support UNO’s evolving national leadership in the research of STEM active learning strategies, including inquiry-based learning (IBL), particularly in STEM-related content areas such as calculus and introductory biology, chemistry, and computer science, as documented by yearly increases in publications and presentations related to active learning strategies for STEM.</p>			
<p>Hold a series of workshops on successful grant writing focused on developing proposals for STEM learning</p>	<p>Grant writing workshops are available but none are directly focused on STEM learning</p>	<ul style="list-style-type: none"> <li>• Initiate series of grant proposal workshops focused on STEM learning</li> </ul>	<p>Increased number of successful STEM learning proposals</p>
<p>Involve more junior faculty in STEM learning research and grant proposals</p>	<p>Only a limited number of junior faculty are engaged in STEM learning proposals</p>	<ul style="list-style-type: none"> <li>• Invite junior faculty to serve as senior personnel on STEM learning proposals</li> </ul>	<p>Every STEM learning proposal team will mentor at least one junior faculty member in the process</p>
<p>Expand STEM learning research triangles related to presentation and publication efforts so as to include more diverse faculty teams across colleges</p>	<p>UNO STEM learning publications and presentations could benefit from more diverse coauthors</p>	<ul style="list-style-type: none"> <li>• Survey STEM faculty for possible research interests and opportunities related to STEM learning</li> </ul>	<p>Two research triangles on STEM learning will be facilitated each year</p>
<p><b>Objective 2.2. Develop and Research Technology-Enhanced STEM Learning Models.</b> Develop and research STEM learning models that build upon UNO’s growing expertise in areas such as flipped classrooms, mobile technology, authentic scientific data collection and analysis, and educational robotics, as documented by an increase in external funding for the development of technology-enhanced STEM learning models.</p>			
<p>Hold yearly workshops and seminars on integrating and measuring the impact of new technologies in STEM learning, in cooperation with the STEM Engagement Link effort</p>	<p>No organized series of workshops and seminars is currently established</p>	<ul style="list-style-type: none"> <li>• Develop a committee that plans a series of workshops focused on new technologies</li> <li>• Work closely with IS</li> </ul>	<p>At least two seminars or workshops offered yearly with a total of at least 50 faculty participants by end of 2014</p>
<p>Hold faculty workshops on selected requests for proposals (RFPs) focused on STEM learning and new technologies to invite faculty to participate, if interested</p>	<p>RFP opportunities are distributed by email</p>	<ul style="list-style-type: none"> <li>• Announce STEM learning RFPs with associated workshop opportunity for interested faculty</li> </ul>	<p>Submission of STEM proposals involving new technologies increased by 25% in next three years</p>

(Continued on the next page.)

## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 2: RESEARCH

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
<p><i>Objective 2.3. Emphasize the Bridge between STEM-Related Learning and Scientific Research. Build nationally recognized interdisciplinary STEM curricula that directly support the broader impacts of funded UNO science projects, and strive to apply new ideas from UNO’s growing scientific research endeavors into the P16 STEM learning pipeline, as documented in the STEM Annual Report.</i></p>			
<p>Facilitate meetings between STEM learning researchers and selected scientific communities, such as UNO neuroscientists and UNO biomechanics researchers, for a focused dialogue on broader impacts that STEM learning efforts can offer</p>	<p>Limited connection exists between STEM learning and STEM scientific research on campus</p>	<ul style="list-style-type: none"> <li>• Work with chairs and Office of Sponsored Programs and Research to identify potential research collaborations</li> <li>• Inform faculty</li> </ul>	<p>Use a yearly survey of UNO scientific and STEM learning researchers to document and share common interests</p>
<p>Develop a contact list of potential external evaluators for UNO STEM proposals who will help connect STEM learning and scientific research by assisting with the documentation of broader impacts</p>	<p>STEM proposal teams have difficulty finding external evaluators to help integrate STEM learning as a broader impact in proposals</p>	<ul style="list-style-type: none"> <li>• Invite evaluators to be on a suggested contact list for UNO</li> <li>• Share the list with UNO STEM faculty</li> </ul>	<p>List of possible evaluators is updated yearly with first list generated in 2014</p>
<p>Assist in efforts to increase statistical data and information science capacity at UNO, in which UNO researchers collaborate with business and industry in “big data” efforts.</p>	<p>There is significant interest among several UNO departments to move in this direction</p>	<ul style="list-style-type: none"> <li>• Interview interested faculty on plans/ideas</li> <li>• Create a list of ways that efforts might be assisted by STEM</li> </ul>	<p>The STEM Annual Report will provide an update and list ways faculty believe STEM efforts can help</p>
<p><i>Objective 2.4. Develop Learning Strategies that Support Diversity in STEM. Building upon UNO’s many metropolitan partnerships, become nationally recognized in the research and development of promising STEM learning strategies that support traditionally underrepresented populations, as identified by yearly increases in publications associated with diversity in STEM learning.</i></p>			
<p>Develop a contact list of diversity experts at UNO and in the Omaha community who are interested in STEM learning research</p>	<p>STEM faculty have little knowledge of diversity expertise available</p>	<ul style="list-style-type: none"> <li>• Invite diversity experts to be on a suggested coauthor contact list for STEM learning projects</li> <li>• Share with faculty</li> </ul>	<p>List of STEM diversity experts updated yearly and increased number of joint research programs</p>

(Continued on the next page.)

## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 2: RESEARCH

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
<p>Invite representatives from the research offices of Omaha-area school districts to discuss STEM diversity initiatives already underway and how UNO proposals might engage these for broader impacts</p>	<p>STEM faculty often do not have knowledge of the P12 initiatives already underway that might dovetail with UNO initiatives</p>	<ul style="list-style-type: none"> <li>• Invite representatives from P12 area research offices to STEM receptions</li> <li>• Share ideas and opportunities</li> </ul>	<p>A STEM reception for school district researchers will be held by the end of 2015</p>
<p><i>Objective 2.5. Collaborate with Traditionally Non-STEM Disciplines. Team with traditionally non-STEM disciplines, such as art, history, psychology, sociology, and political science to refine models of UNO interdisciplinary collaboration related to metropolitan-based P16 STEM learning and to increase associated external funding</i></p>			
<p>Organize a STEM learning faculty team that visits interested departments to brainstorm collaboration opportunities</p>	<p>Some traditionally non-STEM faculty feel left out of the STEM Priority and related initiatives on campus</p>	<ul style="list-style-type: none"> <li>• Approach interested departments</li> <li>• Invite interested faculty to collaborate</li> <li>• Share promising RFPs for collaboration</li> </ul>	<p>Each semester, engage at least one traditionally non-STEM department in developing a STEM learning proposal</p>
<p>Investigate potential STEM learning and research collaborations related to the campus Sustainability Center and related campus priority efforts</p>	<p>There is significant unexamined potential for collaboration between STEM and sustainability efforts</p>	<ul style="list-style-type: none"> <li>• Meet with sustainability faculty in CBA, A&amp;S, and CPACs</li> <li>• Brainstorm list of potential opportunities</li> </ul>	<p>A list of possible collaboration possibilities will be in the 2014 STEM Annual Report</p>
<p>Investigate potential STEM learning and research collaborations related to the campus Early Childhood Education Priority</p>	<p>UNO early childhood faculty have approached STEM faculty on shared efforts</p>	<ul style="list-style-type: none"> <li>• Meet with early childhood faculty</li> <li>• Brainstorm list of potential opportunities</li> </ul>	<p>A list of possible collaboration ideas will be in the 2014 STEM Annual Report</p>
<p>Build a list of emeritus faculty that can be a resource for various STEM projects and activities</p>	<p>Emeritus faculty are not well known outside of their own departments</p>	<ul style="list-style-type: none"> <li>• Identify emeritus STEM faculty</li> <li>• Create contact list</li> </ul>	<p>A list of emeritus STEM faculty will be distributed to faculty</p>

## GOAL 3: SERVICE/COMMUNITY ENGAGEMENT

To foster innovation in STEM service and community engagement in STEM learning through active, synergistic, and sustainable partnerships with the broader STEM community, including STEM educators, business professionals, and informal education partners.

**Objective 3.1. Strengthen and Expand High School Access to UNO-Based STEM Tutoring.** Strengthen and expand programs to provide area high school students with tutoring in the STEM disciplines, such as in calculus and introductory biology, physical science, and computer science, engaging 50% more students within the next three years.

**Objective 3.2. Expand UNO Thematic STEM Camps and Workshops.** Increase UNO based P12 STEM camps, particularly with innovative themes such as space, water quality, natural hazards, and data science, as represented by a 30% increase in the number of active P12 STEM camps and workshops offered within the next three years.

**Objective 3.3. Expand UNO STEM Workshops for P12 Educators.** Increase UNO based STEM workshops for P12 educators, particularly with innovative themes such as space, water quality, natural hazards, and data science, as represented by a 30% increase in the number of workshops offered to P12 educators within the next three years.

**Objective 3.4. Evolve Business and Industry STEM Partnerships.** Aggressively expand and evolve partnerships with area businesses for innovative joint initiatives, such as STEM internships, that contribute to STEM learning in Omaha and beyond, targeting promising

areas such as data science, data analytics, water quality, sustainability, mobile technologies, aviation, engineering, and information assurance, and as identified by a chart documenting yearly increases in STEM-related initiatives that include a focused business and industry partnership.

**Objective 3.5. Expand Participation in UNO Citizen Science.** Assist faculty in developing “citizen-science” outreach efforts that involve P12 students and other community members in UNO research-related initiatives, such as the Nebraska Watershed Network (NWN), the Glacier Creek Preserve (GCP), soil and water testing, and the use of mobile technologies for data collection, as indicated by yearly increases in the number of citizen-science outreach efforts coordinated by UNO faculty.

**Objective 3.6. Strengthen and Expand Informal Education Partnerships.** Strengthen and expand partnerships with informal education organizations, such as the Strategic Air and Space Museum, Out of School Time STEM, and the Henry Doorly Zoo and Aquarium, to increasingly undertake joint STEM initiatives, as identified by yearly increases in the number of STEM projects that include a focused partnership with an informal education organization.

**Objective 3.7. Expand Interdisciplinary Outreach with Traditionally Non-STEM Disciplines.** Expand STEM outreach events and increase the number of events that illustrate the STEM components of disciplines not traditionally recognized as STEM, such as psychology, sociology, art, political science, and history, to increase STEM visibility and engagement in the Omaha community, as documented in the STEM Annual Report.

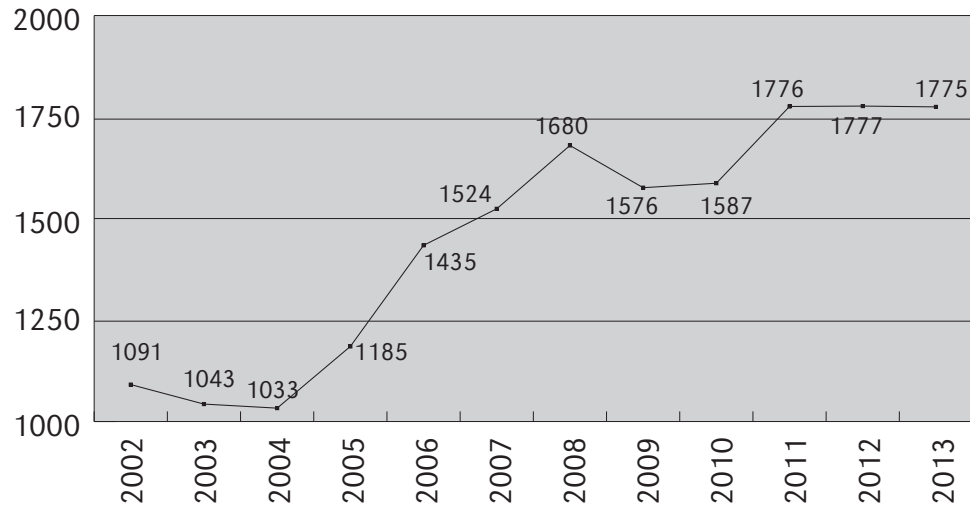
**Objective 3.8. Establish a STEM Learning Discussion Network.** Establish a STEM learning discussion network that invites Omaha-area representatives from the UNO

faculty, P12 schools, community colleges, businesses, part-time faculty, and informal education agencies to gather quarterly to discuss improving STEM learning across the P16 system, as documented by a web-based calendar of available networking and meeting opportunities.

UNO already has substantial STEM education outreach efforts underway that provide an excellent basis for building STEM outreach in the P12 environment to enhance the UNO STEM pipeline. For example, Aim for the Stars, which is managed by the UNO Physics Department, is quickly outpacing its ability to house all of the interested students, and registrations for particular camps close in a matter of hours (Figure 3). Similarly, the College of Information Science and Technology’s popular STEM Academy quickly fills sessions of more than 20 different camps each summer in diverse topics, such as programming, digital music, robotics, game design, bioinformatics, and 3D modeling.

UNO also routinely offers numerous community engagement experiences both on and off campus. For example, the planetarium, which is hosted by the Physics Department in the College of Arts and Sciences, engaged nearly 8,000 youth and adults in 2012 and is a popular destination for area school groups. Similarly, the CAPOW (Chemistry and Physics on Wheels) van routinely travels across the metropolitan Omaha area and the greater Midwest conducting very popular science shows. The Nebraska Watershed Network, as facilitated by the Biology Department, is expanding its research sites along Nebraska waterways and its outreach efforts to engage citizen scientists. The Glacier Creek Preserve (formerly called the Allwine Prairie Preserve) has similarly expanded land, facilities, and outreach to the community.

Figure 3. Aim for the Stars Participants, 2002-2013  
(Aim for the Stars is an 8-week program)



In addition to these diverse institutional programs, UNO facilitates service and community engagement efforts in collaboration with its many community partners, including STEM educators, business professionals, and informal education partners.

UNO has an excellent relationship with Omaha-area P12 school districts, as supported by the Metropolitan Omaha Educational Consortium. Nearly 60% of local secondary STEM teachers have degrees from UNO, and by working with these teachers and their districts, we have an opportunity to undertake STEM reform that engages the whole educational system. An example recommendation for improving the P16 STEM pipeline that has emerged from conversations with area teachers is to provide walk-in or web-based tutoring services for high school students in the UNO Math and Science Learning Center. Such services would support the academic success

of high school students and would encourage their interaction with UNO faculty and students. UNO's close relationship with area school districts has already resulted in numerous STEM education grants to UNO and local schools, and it represents an area of opportunity for UNO to be competitive for additional external funding that will expand upon innovative models of P16 STEM education.

UNO faculty across the various colleges also maintain strong relationships with area businesses, as formalized through campus organizations such as the Nebraska Business Development Center, the Center for Economic Education, the Center for Collaboration Sciences, and the Center for Innovation, Entrepreneurship, and Franchising. Such formal business collaborations provide a conduit for increased partnership and innovation in STEM that can position UNO at the forefront of innovative STEM education models that involve area businesses and their

employees. Such collaborative models help ensure that students who are successful in STEM programs at UNO will also be successful in finding a job in area businesses. In addition, many STEM classes might benefit from using business-related examples, datasets, or case studies. UNO is already expanding its numerous existing relationships with business and industry to offer STEM community engagement programs. For example, in 2013, the UNO College of Information Science and Technology worked closely with the First Data Corporation to hold the first annual IT Innovation Cup for area youth.

The context of STEM at UNO also represents a wonderful opportunity for building partnerships with informal educational institutions across the metropolitan community. For example, UNO currently works closely with the Henry Doorly Zoo and Aquarium on numerous research and education-related projects. In addition, UNO now has a formal presence at the Strategic Air and Space Museum, with a full-time UNO STEM specialist stationed there to support joint initiatives. This is particularly advantageous for external funding competitiveness, since many new requests for proposals are now requiring a relationship between formal and informal educational institutions. Thus, UNO is well positioned to blend these formal and informal educational paradigms in support of STEM innovation that can also bring in additional external funding.

The extensiveness and diversity of UNO STEM service and community engagement efforts are becoming an organizational challenge for faculty, and the objectives of this strategic plan are designed to improve the institution-wide coordination of these important UNO contributions to our metropolitan community. The recommended service and community engagement objectives and tasks for the STEM Priority are presented in the following table.

## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 3: SERVICE/COMMUNITY ENGAGEMENT

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
<p><b>Objective 3.1. Strengthen and Expand High School Access to UNO-based STEM Tutoring.</b> Strengthen and expand programs to provide area high school students with tutoring in the STEM disciplines, such as in calculus and introductory biology, physical science, and computer science, engaging 50% more students within the next three years.</p>			
<p>Expand tutoring in the Math Science Learning Center to include grades 7–12</p>	<p>Significant community interest exists in tutoring support for grades 7–12 but there is no UNO program</p>	<ul style="list-style-type: none"> <li>• Meet with districts</li> <li>• Conduct self study of options</li> <li>• Engage funders</li> <li>• Pilot tutor expansion</li> </ul>	<p>A UNO-facilitated tutoring option for grades 7–12 will be in place by 2015</p>
<p><b>Objective 3.2. Expand UNO Thematic STEM Camps and Workshops.</b> Increase UNO-based P12 STEM camps, particularly with innovative themes such as space, water quality, natural hazards, and data science, as represented by a 30% increase in the number of active P12 STEM camps and workshops offered within the next three years.</p>			
<p>Examine existing camp structures and make recommendations for the support and expansion of the important Aim for the Stars STEM outreach program.</p>	<p>Demand for the Aim for the Stars camps far exceeds capacity</p>	<ul style="list-style-type: none"> <li>• Prepare mini-study</li> <li>• Develop expansion and sustainability plan</li> <li>• Make administrative recommendations</li> </ul>	<p>A focused mini-study will make recommendations to UNO by 2015</p>
<p>Initiate conversations among STEM community engagement leaders across all colleges and UNO-based organizations, such as the NASA Nebraska Space Grant and Nebraska Watershed Network</p>	<p>Planning of STEM community engagement is typically not shared across colleges and outreach partners</p>	<ul style="list-style-type: none"> <li>• Identify community engagement leaders</li> <li>• Conduct meeting, document conversation</li> </ul>	<p>Meeting minutes will document shared conversation and next steps</p>
<p>Enhance UNO branding for all STEM youth camps, service efforts, and community outreach events</p>	<p>UNO branding across service areas is relatively inconsistent</p>	<ul style="list-style-type: none"> <li>• Meet with UNO marketing team</li> <li>• Assist marketing efforts</li> </ul>	<p>UNO branding will be consistent across all STEM service efforts</p>
<p>(Continued on the next page.)</p>			

## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 3: SERVICE/COMMUNITY ENGAGEMENT

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
<p><i>Objective 3.3. Expand UNO STEM Workshops for P12 Educators. Increase UNO-based STEM workshops for P12 educators, particularly with innovative themes such as space, water quality, natural hazards, and data science, as represented by a 30% increase in the number of workshops offered to P12 educators within the next three years.</i></p>			
<p>Similar to UNO’s P12 Math Teaching Circles, regularly offer UNO STEM Teaching Circles for P12 teachers in other STEM areas</p>	<p>P12 Math Teaching Circles are successful, but other STEM areas are not represented</p>	<ul style="list-style-type: none"> <li>• Offer STEM teaching circles for science, computer science, and engineering areas</li> </ul>	<p>Teaching circles for the remaining STEM areas established at UNO by 2015</p>
<p>Publish a list of recommended UNO courses and workshops for interested P12 STEM educators</p>	<p>P12 educators have difficulty locating information on UNO STEM opportunities</p>	<ul style="list-style-type: none"> <li>• Publish a list of UNO workshops and courses on P12 STEM learning</li> </ul>	<p>P12 STEM learning list published in print and online by the end of 2014</p>
<p><i>Objective 3.4. Evolve Business and Industry STEM Partnerships. Aggressively expand and evolve partnerships with area businesses for innovative joint initiatives, such as STEM internships, that contribute to STEM learning in Omaha and beyond, targeting promising areas such as data science, data analytics, water quality, sustainability, mobile technologies, aviation, engineering, and information assurance, and as identified by a chart documenting yearly increases in STEM-related initiatives that include a focused business and industry partnership.</i></p>			
<p>Create a STEM Learning Business and Industry Advisory Board that meets quarterly with STEM Leadership Team</p>	<p>Dialogue with STEM businesses and industry is currently not well organized</p>	<ul style="list-style-type: none"> <li>• Approach possible board members</li> <li>• Establish routine meeting schedule</li> </ul>	<p>A STEM Learning Business and Industry Advisory Board established by 2015</p>
<p>Create business and industry list of suggested initiatives, such as STEM business internships</p>	<p>No list of suggested initiatives is available</p>	<ul style="list-style-type: none"> <li>• Use advisory board to develop list</li> <li>• Share list with UNO STEM faculty</li> </ul>	<p>List of initiatives from STEM Learning Business and Industry Advisory Board sent to faculty</p>
<p>(Continued on the next page.)</p>			



## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 3: SERVICE/COMMUNITY ENGAGEMENT

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
<p><i>Objective 3.5. Expand Participation in UNO Citizen Science. Assist faculty in developing “citizen-science” outreach efforts that involve P12 students and other community members in UNO research-related initiatives, such as the Nebraska Watershed Network (NWN), the Glacier Creek Preserve (GCP), soil and water testing, and the use of mobile technologies for data collection, as indicated by yearly increases in the number of citizen-science outreach efforts coordinated by UNO faculty.</i></p>			
<p>Establish a quarterly UNO citizen-science event (similar to the famous Faraday lectures) where Omaha-area residents are invited to hear faculty present their research and, if useful, are invited to contribute to citizen-science research projects</p>	<p>There is no overall citizen-science event that might expand awareness of the NWN, GCP, and other UNO-based STEM efforts</p>	<ul style="list-style-type: none"> <li>• Establish leadership team for effort</li> <li>• Identify speakers</li> <li>• Schedule event</li> <li>• Advertise event</li> <li>• Survey for perceptions of success</li> </ul>	<p>P12 STEM learning list published in print and online by the end of 2014</p>
<p>Encourage students and faculty in the FUSE program to consider research efforts that involve citizen-science</p>	<p>Create a citizen science flyer that is available on the FUSE website</p>	<ul style="list-style-type: none"> <li>• Develop flyer</li> <li>• Share with FUSE</li> </ul>	<p>A citizen science flyer will be shared with FUSE in 2014</p>
<p><i>Objective 3.6. Strengthen and Expand Informal Education Partnerships. Strengthen and expand partnerships with informal education organizations, such as the Strategic Air and Space Museum, Out of School Time STEM, and the Henry Doorly Zoo and Aquarium, to increasingly undertake joint STEM initiatives, as identified by yearly increases in the number of STEM projects that include a focused partnership with an informal education organization.</i></p>			
<p>Building on the STEM Nebraska Research Initiative efforts, pilot jointly developed mobile apps for the Strategic Air and Space Museum (SASM) and Henry Doorly Zoo and Aquarium (Zoo/Aquarium)</p>	<p>A prototype mobile app for the SASM is nearly finished but none has yet been created for the Zoo/Aquarium</p>	<ul style="list-style-type: none"> <li>• Pilot SASM app</li> <li>• Create Zoo/Aquarium app</li> <li>• Refine apps usage</li> <li>• Advertise availability</li> </ul>	<p>SASM and Zoo/Aquarium surveys of visiting classes using the apps indicate new use and satisfaction</p>
<p>Co-sponsor a teacher workshop series with the SASM, Zoo/Aquarium, and other informal education partners to add STEM resources</p>	<p>Several teacher workshops have been held in the summer, but relatively little in the fall and spring</p>	<ul style="list-style-type: none"> <li>• Host joint meeting</li> <li>• Plan academic-year teacher workshops</li> <li>• Ensure “win-win” workshop scenarios</li> </ul>	<p>Calendar of UNO-based options for P12 teachers will show fall and spring opportunities</p>

(Continued on the next page.)

## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 3: SERVICE/COMMUNITY ENGAGEMENT

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
Participate in the new Nebraska “Out of School Time STEM” group that is seeking to organize informal STEM education efforts across many informal education organizations	The Out of School Time STEM group has recently formed and invited UNO to attend	<ul style="list-style-type: none"> <li>• Select UNO representatives</li> <li>• Begin to attend and participate in group</li> </ul>	Out of School Time STEM group’s calendar of events shows consistent UNO collaboration
Particularly expand interactions with Nebraska 4H as it relates to STEM events in Nebraska	Work with 4H has been limited but has included a joint Nebraska Robotics Expo event	<ul style="list-style-type: none"> <li>• Meet with 4H</li> <li>• Identify shared interests and possible collaborations</li> </ul>	A least one new event will be undertaken with 4H Extension by 2016
Actively participate as a campus in the new Nebraska Science Festival	The Nebraska Science Festival effort is new	<ul style="list-style-type: none"> <li>• Meet with organizers</li> <li>• Assist in planning</li> </ul>	UNO will be a partner in the festival in 2014
<p><i>Objective 3.7. Expand Interdisciplinary Outreach with Traditionally Non-STEM Disciplines. Expand STEM outreach events and increase the number of events that illustrate the STEM components of disciplines not traditionally recognized as STEM, such as psychology, sociology, art, political science, and history to increase STEM visibility and engagement in the Omaha community, as documented in the STEM Annual Report.</i></p>			
Establish a new “STEAM” collaborative effort (adding an Art context to selected STEM efforts) with the UNO art faculty that initiates innovative STEAM activities	The UNO art faculty are interested in STEM collaboration for joint STEAM event	<ul style="list-style-type: none"> <li>• Meet with art faculty</li> <li>• Plan STEAM event</li> <li>• Examine resources</li> <li>• Co-host event</li> </ul>	At least one UNO STEAM event will be held by the end of 2015
Host an event that illustrates “STEM is for everyone” and includes focused collaboration between STEM and traditionally non-STEM disciplines	Some faculty from traditionally non-STEM disciplines are interested in, but feel left out of, the STEM Priority efforts	<ul style="list-style-type: none"> <li>• Invite interested faculty to meeting</li> <li>• Develop list of ideas</li> <li>• Select idea(s) to further develop</li> </ul>	The STEM Annual Report will show new participation by traditionally non-STEM disciplines
<p>(Continued on the next page.)</p>			

## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 3: SERVICE/COMMUNITY ENGAGEMENT

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
Participate with other disciplines, such as the Social Sciences, to facilitate student interdisciplinary service learning opportunities	Sociology and psychology faculty have expressed an interest in collaborative work	<ul style="list-style-type: none"> <li>• Meet with interested departments</li> <li>• Meet with UNO Service Learning</li> </ul>	Ideas for interdisciplinary service learning will be included in the annual report
<i>Objective 3.8. Establish a STEM Learning Discussion Network. Establish a STEM learning discussion network that invites Omaha-area representatives from the UNO faculty, P12 schools, community colleges, businesses, part-time faculty, and informal education agencies to gather quarterly to discuss improving STEM learning across the P16 system, as documented by a web-based calendar of available networking and meeting opportunities.</i>			
Formalize a STEM Learning Discussion Network of UNO faculty and Omaha-area P12 schools, community colleges, businesses, and informal education partners	UNO has strong community partnerships but no formal network exists for STEM learning	<ul style="list-style-type: none"> <li>• Establish a planning committee</li> <li>• Plan and host networking events</li> </ul>	At least one STEM learning networking event will be held each quarter, starting in 2014

## GOAL 4: STEM INFRASTRUCTURE

To provide administrative leadership and support through a UNO Center for Metropolitan STEM Learning that plans, coordinates, and encourages STEM-related teaching, research, and service initiatives.

**Objective 4.1. Formalize a UNO-Based Center for Metropolitan STEM Learning.** Establish a UNO Center for Metropolitan STEM Learning focused on interdisciplinary STEM learning within metropolitan areas by 2015, as recognized by the NU Board of Regents.

**Objective 4.2. Become a National Leader in Innovative P16 STEM Learning Curricula.** Building on UNO's initial successes in STEM learning projects, help faculty to develop, fund, pilot, and publish innovative P16 curriculum models, as documented in the STEM Annual Report.

**Objective 4.3. Become a Campus of Innovation for the Use of New Technologies in STEM Learning.** Through aggressive faculty development, encourage and help establish the integration of new technologies into STEM teaching, research, and service at UNO, as documented in the STEM Annual Report.

**Objective 4.4. Engage Faculty in STEM Planning that Supports Professional Goals.** Encourage faculty to participate in and develop UNO STEM initiatives that align with their own annual professional goals for teaching, research, and service, as documented by a series of colleague-based workshops that engage 50 or more faculty per year within three years.



**Objective 4.5. Enhance STEM Recruitment, Retention, and Graduation at UNO.** Operationalize the teaching, research, and service efforts as represented by the STEM learning objectives of this strategic plan to aggressively support recruitment, retention, and graduation in STEM disciplines, as documented by a 25% increase in the number of STEM graduates within five years.

**Objective 4.6. Become a Founding Member of a Statewide STEM Effort.** Working closely with the Strategic Air and Space Museum (SASM), other NU campuses, area businesses, school districts, and other Nebraska stakeholders, become a founding member of a statewide STEM organization that would be housed at the SASM and that would ensure a strong and participatory UNO voice in statewide STEM efforts.

**Objective 4.7. Work Closely with the NU Foundation on STEM Learning.** Work closely with the NU Foundation in efforts such as jointly proposing UNO-based STEM professorships, community chairs, and scholarships, as documented in the STEM Annual Report.

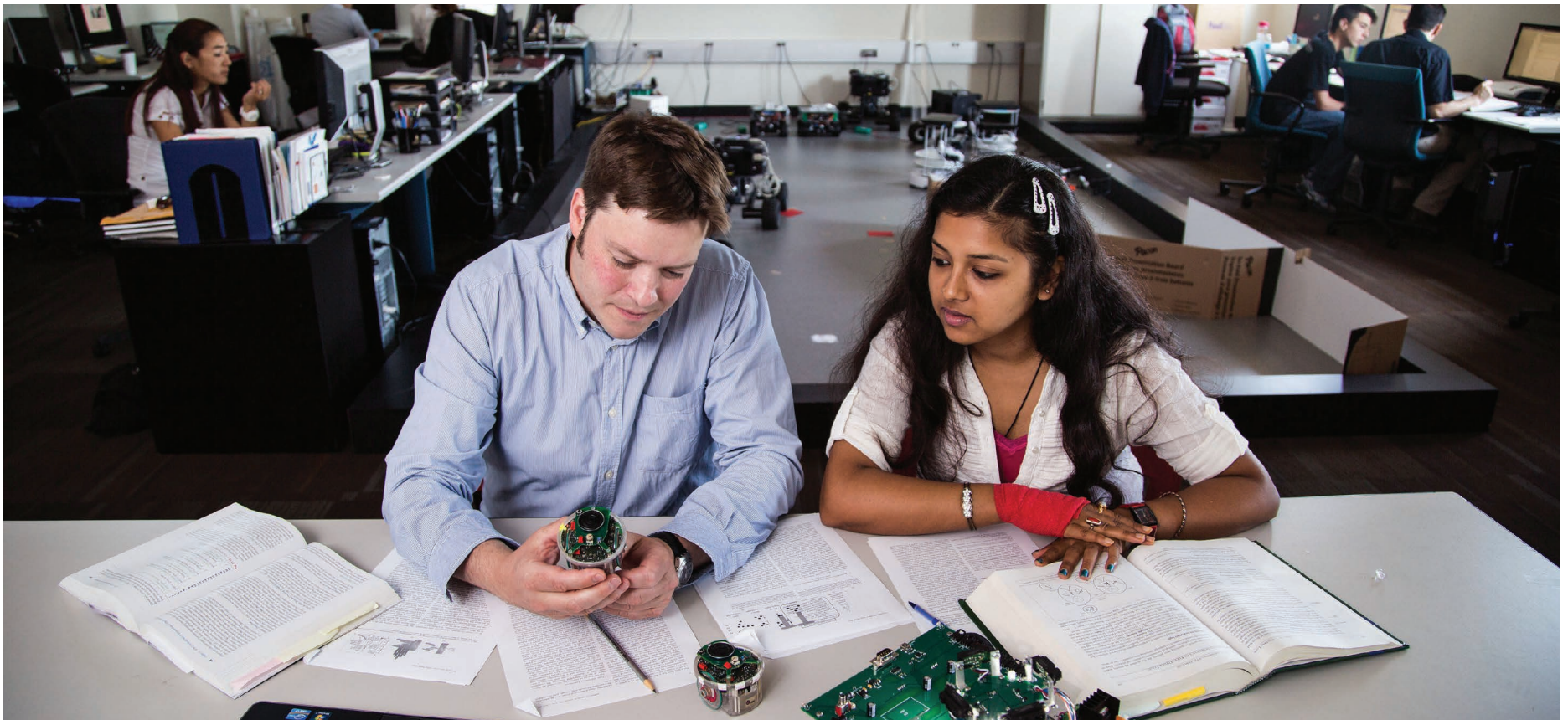
**Objective 4.8. Conduct Annual Reviews of the STEM Center.** Undertake a yearly review and refinement of the goals, objectives, and strategic tasks of the UNO STEM Strategic Plan and STEM Center that will ensure adequate documentation, planning, and flexibility for the joint oversight of the Center by the deans of Arts and Sciences, Education, and Information Science and Technology, as well as the associate vice chancellor for research.

To realize the vision of this STEM Strategic Plan, steps should be taken to establish a university-wide leadership entity leading to a formal UNO Center for Metropolitan STEM Learning. By formalizing STEM leadership within the context of a campus STEM Center, we will establish a more stable funding and operational environment for supporting STEM innovation. A STEM Center will also be symbolic to faculty, the community, and other institutions that UNO is striving for national distinction in this important area and that we are aggressively seeking to become a global model for STEM excellence. In addition, a STEM Center will be an excellent conduit for increased STEM research, grant writing, and curriculum development

within a context of increased interdisciplinary collaboration and enhanced connections to STEM partners and the community at large.

In many ways, success in STEM is a component for success across all disciplines at UNO and is an opportunity to enhance instructional innovation across campus by connecting STEM disciplines to other areas of study, such as the humanities, public administration, and criminal justice. A STEM Center, then, would support a broad range of interdisciplinary initiatives involving not only the STEM disciplines, but also those disciplines that have not been traditionally classified as STEM but

have important contributions to make in STEM, such as art, history, political science, psychology, sociology, and many others. The STEM Priority represents an opportunity to build the scientific literacy of other disciplines as well as to engage with those disciplines to bring innovation and creative thinking into the STEM disciplines themselves. Such synergy among disciplines is an excellent area of opportunity at UNO, since there is already interdisciplinary interest in STEM across all colleges. The recommended objectives and strategic tasks for developing the UNO Center for Metropolitan STEM Learning are presented below.



## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 4: STEM INFRASTRUCTURE

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
<p><i>Objective 4.1. Formalize a UNO-Based Center for Metropolitan STEM Learning. Establish a UNO Center for Metropolitan STEM Learning focused on interdisciplinary STEM learning within metropolitan areas by 2015, as recognized by the NU Board of Regents.</i></p>			
<p>Building on the STEM strategic plan effort, develop a formal proposal for a UNO Center for Metropolitan STEM Learning</p>	<p>The UNO Office of STEM Education exists but is not a formal NU Center</p>	<ul style="list-style-type: none"> <li>• Form team for Center proposal</li> <li>• Plan proposal</li> <li>• Submit paperwork</li> </ul>	<p>A UNO Center for Metropolitan STEM Learning will be formalized by 2015</p>
<p>Conceptualize budgetary needs and plans for a UNO Center for Metropolitan STEM Learning</p>	<p>A focused UNO STEM Center would require additional resources for operation</p>	<ul style="list-style-type: none"> <li>• Examine budgetary implications</li> <li>• Document needs</li> </ul>	<p>A budgetary implications summary for the STEM Center will be completed by December 2014</p>
<p><i>Objective 4.2. Become a National Leader in Innovative P16 STEM Learning Curricula. Building on UNO’s initial successes in STEM learning projects, help faculty to develop, fund, pilot, and publish innovative P16 curriculum models, as documented in the STEM Annual Report.</i></p>			
<p>Formalize a joint UNMC and UNO STEM committee to coordinate P16 STEM learning initiatives where interests between campuses overlap</p>	<p>An informal group of faculty and administrators meet now as needed</p>	<ul style="list-style-type: none"> <li>• Establish and staff joint committee</li> <li>• Build regular meeting schedule and begin to enhance coordination</li> </ul>	<p>A UNO/UNMC committee will be established and meet regularly by March of 2014</p>
<p>Undertake focused planning on how best to support faculty in P16 curriculum development efforts that are competitive for external funding and publication</p>	<p>Some of the largest STEM grants and efforts have been for P16 curricula, but additional potential resources remain untapped</p>	<ul style="list-style-type: none"> <li>• Host shared planning effort for STEM faculty</li> <li>• Advise faculty efforts for STEM projects</li> <li>• Assist in P16 STEM learning proposals</li> </ul>	<p>The STEM Annual Report will show expanded plans, projects, and grants for P16 STEM curricula</p>
<p><i>(Continued on the next page.)</i></p>			

## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 4: STEM INFRASTRUCTURE

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
Work with UNO Public Affairs to highlight STEM initiatives	Some STEM initiatives have been publicized, but there is a need to expand publicity	<ul style="list-style-type: none"> <li>• Meet with UNO Public Affairs on STEM</li> </ul>	Public Affairs highlights STEM efforts at least quarterly
Increasingly include the concepts of “adult learners” and “citizen scientists” as populations of interest in STEM initiatives	Adult learners and citizen scientists are lightly represented in STEM initiatives	<ul style="list-style-type: none"> <li>• Bring to campus a speaker on citizen science and engaging adult learners</li> </ul>	An expert speaker will be engaged on citizen science by the end of 2014
Increasingly engage students and faculty in the FUSE program in conducting research related to the STEM Priority	Students and faculty often do not think of STEM learning as a potential research area for FUSE proposals	<ul style="list-style-type: none"> <li>• Develop flyer with STEM FUSE ideas</li> <li>• Share with FUSE leadership</li> </ul>	The STEM Annual Report will show an increased number of FUSE proposals addressing STEM learning
<p><i>Objective 4.3. Become a Campus of Innovation for the Use of New Technologies in STEM Learning. Through aggressive faculty development, encourage and help establish the integration of new technologies into STEM teaching, research, and service at UNO, as documented in the STEM Annual Report.</i></p>			
Work with UNO’s IS and Faculty Development offices to undertake an aggressive and organized faculty development series associated with new technologies and their use in STEM learning	Many UNO STEM faculty have a strong interest in the use of new technologies and UNO is poised for innovation in this area	<ul style="list-style-type: none"> <li>• Plan monthly faculty development series on STEM technologies</li> <li>• Host brainstorming session on promising RFPs in this area</li> </ul>	A list of STEM learning efforts at UNO will showcase innovation with new technologies for STEM learning
Investigate uses of technology in better connecting STEM education at UNO to STEM careers, employers, and student employment opportunities	Opportunities exist, such as AIM’s Careerlink system, but there is not much use by UNO faculty	<ul style="list-style-type: none"> <li>• Meet with AIM and understand Careerlink</li> <li>• Investigate similar “education to employment” systems</li> </ul>	The STEM Annual Report will include an update on technology-based opportunities for career connections
<p>(Continued on the next page.)</p>			

## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 4: STEM INFRASTRUCTURE

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
<p><i>Objective 4.4. Engage Faculty in STEM Planning that Supports Professional Goals. Encourage faculty to participate in and develop UNO STEM initiatives that align with their own annual professional goals for teaching, research, and service, as documented by a series of colleague-based workshops that engage 50 or more faculty per year within three years.</i></p>			
<p>Host “Opportunities in STEM at UNO” brown bag sessions with faculty where the STEM Strategic Plan is reviewed in relationship to the annual professional goals of interested faculty members</p>	<p>Faculty are supportive of UNO STEM learning initiatives but many do not see how work in this area supports their annual goals</p>	<ul style="list-style-type: none"> <li>• Host brown bags that review STEM plans</li> <li>• Discuss STEM learning opportunities</li> <li>• Help faculty plan professional efforts</li> </ul>	<p>A list of faculty participation shows 50 or more faculty attendees by 2014 in brown bag discussions</p>
<p>Research formats for a STEM Action Plan review for STEM departments and make the process available to interested departments</p>	<p>UNO departmental reviews are typically conducted every seven years and are very general in content</p>	<ul style="list-style-type: none"> <li>• Dialogue with chairs</li> <li>• Set parameters</li> <li>• Establish budget</li> <li>• Pilot with interested departments</li> </ul>	<p>At least one STEM review offered to departments every three years starting in 2014</p>
<p>Assist faculty in attending and presenting at STEM conferences to support innovative efforts in UNO STEM teaching, research, and service</p>	<p>Travel to interdisciplinary STEM conferences is limited to just a few faculty</p>	<ul style="list-style-type: none"> <li>• Send conference notices to faculty</li> <li>• Assist them in finding funding for attending</li> </ul>	<p>A least 4 conference papers related to UNO STEM will be published each year</p>
<p><i>Objective 4.5. Enhance STEM Recruitment, Retention, and Graduation at UNO. Operationalize the teaching, research, and service efforts as represented by the STEM learning objectives of this strategic plan to aggressively support recruitment, retention, and graduation in STEM disciplines, as documented by a 25% increase in the number of STEM graduates within five years.</i></p>			
<p>Operationalize the strategic plan objectives in this document to support STEM recruitment efforts at UNO across disciplines</p>	<p>As of 2012, a total of roughly 300 students are entering within the UNO STEM pipelines</p>	<ul style="list-style-type: none"> <li>• Operationalize initiatives from STEM Strategic Plan that support recruitment</li> </ul>	<p>Increase number of UNO students entering pipeline by 25% in five years.</p>
<p>(Continued on the next page.)</p>			



## UNO STEM PRIORITY STRATEGIC TASKS AND SUCCESS INDICATORS—GOAL 4: STEM INFRASTRUCTURE

(Continued.)

STRATEGIC TASK	CURRENT STATUS	IMMEDIATE ACTIONS NEEDED	SUCCESS INDICATORS
Operationalize the strategic plan objectives in this document to support STEM retention efforts at UNO across disciplines	As of 2012, the UNO STEM-discipline Yr1 retention rate is an average of 66%	<ul style="list-style-type: none"> <li>Operationalize initiatives from STEM Strategic Plan that support retention</li> </ul>	Increase STEM Yr1 retention rate to a mean of 72% within next five years
Operationalize the strategic plan objectives in this document to support STEM graduation efforts at UNO across disciplines	As of 2012, the number of UNO STEM graduates is 192 (3 year mean of 198)	<ul style="list-style-type: none"> <li>Operationalize initiatives from STEM Strategic Plan that support graduation</li> </ul>	Increase the STEM graduation rate by 25% within the next five years
<p><i>Objective 4.6. Become a Founding Member of a Statewide STEM Effort. Working closely with the Strategic Air and Space Museum (SASM), other NU campuses, area businesses, school districts, and other Nebraska stakeholders, become a founding member of a statewide STEM organization that would be housed at the SASM and that would ensure a strong and participatory UNO voice in statewide STEM efforts.</i></p>			
Work with partner organizations to establish a statewide STEM effort that is based at the SASM and that has UNO as a key partner	As of 2013, there is no focused STEM partnership crossing Nebraska	<ul style="list-style-type: none"> <li>Support SASM leadership on effort</li> <li>Ensure strong UNO representation in effort</li> </ul>	By 2015, have strong UNO STEM representation in a statewide STEM effort
<p><i>Objective 4.7. Work Closely with the NU Foundation on STEM Learning. Work closely with the NU Foundation in efforts such as jointly proposing UNO-based STEM professorships, community chairs, and scholarships, as documented in the STEM Annual Report.</i></p>			
Formalize a regular quarterly meeting schedule with NU Foundation to review and plan for further support of UNO STEM learning efforts and initiatives	The meetings with NU Foundation have been very productive to date and have brought in significant resources	<ul style="list-style-type: none"> <li>Brainstorm best meeting structures</li> <li>Widen NU Foundation conversation to more UNO STEM faculty</li> </ul>	The UNO STEM Annual Report will show increased joint planning efforts
<p><i>Objective 4.8. Conduct Annual Reviews of the UNO Center for Metropolitan STEM Learning. Undertake a yearly review and refinement of the goals, objectives, and strategic tasks of the UNO STEM Strategic Plan and Center for Metropolitan STEM Learning that will ensure adequate documentation, planning, and flexibility for the joint oversight of the Center by the deans of Arts and Sciences, Education, and Information Science and Technology, as well as by the associate vice chancellor for research.</i></p>			
Formalize oversight of the UNO Center for Metropolitan STEM Learning through an annual report to the founding UNO deans and associate vice chancellor for research	UNO STEM faculty already work closely with lead administrators but no formal STEM reporting process exists	<ul style="list-style-type: none"> <li>Formalize UNO oversight structure for STEM efforts</li> <li>Create a UNO STEM Annual Report format and process</li> </ul>	By 2014, a formal UNO STEM oversight and reporting structure will be in place

# FINAL COMMENTS

As a metropolitan university of distinction, we will need to continually strive to enhance our “STEM Synergy,” as it relates to campus teaching, research, and service. By seeking to engage and welcome many faculty members and community partners into STEM education initiatives, we no doubt build the successes, efforts, and creativity in this important campus priority. Such innovation also takes both internal and external funding to help provide the time, resources, and experience to be successful. Internal funding support might include travel to innovative STEM learning opportunities, research in STEM and STEM education, and faculty professional development workshops. Expanded grant writing efforts in STEM, as related to each of the teaching, research, and service focus areas, will also become increasingly important as more faculty participate and bring their ideas and expertise to the table. The STEM initiatives at UNO will also benefit from an ever-closer working relationship with the NU foundation and from additional named professorships and community chairs designated for providing campus leadership in STEM. New positions, such as the STEM Community Chairs and STEM Professorships, exemplify community engagement and represent an excellent opportunity to formalize and expand campus leadership in STEM. To eventually serve expanding populations, some STEM investments will perhaps need to be made in physical infrastructure, such as laboratory space.

As this strategic plan becomes operationalized, no doubt discussions on the needed resources, infrastructure, and support mechanisms will become increasingly defined and effective and will be an important catalyst for further STEM innovation. It is also important to note that these discussions will need to be ongoing and involve additional stakeholders as new initiatives are undertaken. The strategic plan itself will then need to be a truly dynamic document and revisited frequently as the campus grows in its STEM initiatives and efforts and the UNO STEM community moves steadily forward on this important campus priority.

STEM is indeed a national crisis and a new “Sputnik moment” for our nation. UNO has both a responsibility

and an opportunity to contribute solutions to this national crisis. As a campus, we are well positioned not only for contributing to STEM solutions, but also for leading them. Our close partnerships with the metropolitan community, faculty expertise and passion, and the ongoing recognition of both our strengths and challenges position us to become a catalyst to STEM innovation at a local level as well as a model for STEM reform at a national level. The time is now for UNO to assume leadership in STEM and to embrace the STEM Priority with pioneering vision and aggressive action. There is a long and exciting road ahead of us; we have taken the first steps toward excellence, and we are well prepared for this exciting STEM journey that we will take together as a campus and with our many partners.



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# APPENDIX A

## ROSTER OF STEM LEADERSHIP COMMITTEE AND LIST OF FACULTY AND COMMUNITY REVIEWERS/CONTRIBUTERS FOR UNO STEM STRATEGIC PLAN

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# APPENDIX B

## UNO STEM STRATEGIC PLAN – MISSION STATEMENT COMPONENTS

### **UNO STEM Priority Mission**

The mission of the UNO STEM Priority is to advance student understanding and success in STEM education by aggressively leading collaborative partnerships focused on increasing STEM capacity, competency, innovation, and literacy for the betterment of our metropolitan, regional, national, and international communities.

### **UNO Mission Statement**

As Nebraska's metropolitan University, UNO is characterized by its strong academic foundations and creative community relationships that transform and improve the lives of constituents, the region, and the nation.

WHAT ARE WE PRODUCING? (PRODUCTS)	FOR WHOM? (CUSTOMERS/STAKEHOLDERS/POLICY MAKERS)	TO ACHIEVE WHAT VALUE? (GOALS/VALUES)
<p><b>Systems (and supporting processes)</b></p> <ul style="list-style-type: none"> <li>• Model STEM curricula and delivery systems (P16, student-centered pedagogy/teaching systems, integrated STEM content)</li> <li>• Improved professional development for STEM teachers and faculty</li> <li>• Effective recruitment and retention methods</li> <li>• Multiple STEM-learning pathways</li> </ul>	<p><b>Academic community (P16)</b></p> <ul style="list-style-type: none"> <li>• Students <ul style="list-style-type: none"> <li>- Preschool/Elementary</li> <li>- Middle school</li> <li>- High school</li> <li>- Undergraduates (current STEM majors, pre-med, potential STEM majors, non-STEM majors)</li> </ul> </li> <li>• Teachers and faculty; Administrators/staff</li> </ul>	<p><b>Competency</b></p> <ul style="list-style-type: none"> <li>• Deeper STEM content knowledge</li> <li>• Improved critical thinking and problem solving skills</li> <li>• Increased productivity (educating more learners more effectively)</li> <li>• Improved ability to effectively communicate STEM content knowledge and associated research</li> </ul>
<p><b>People</b></p> <ul style="list-style-type: none"> <li>• STEM students</li> <li>• STEM teachers and faculty</li> <li>• STEM employees</li> <li>• STEM innovators</li> <li>• STEM-literate non-majors</li> <li>• STEM community members</li> </ul>	<p><b>Professional community/Industry</b></p> <ul style="list-style-type: none"> <li>• Faculty at other institutions</li> <li>• Collaborative organizations (conferences, funders)</li> <li>• Employers</li> <li>• Industry partners</li> <li>• Adult learners (continuing education for STEM and STEM-education professionals)</li> </ul>	<p><b>Synergy</b></p> <ul style="list-style-type: none"> <li>• Effective and responsive collaboration within and across institutional and community partners</li> <li>• Improved capacity to respond quickly to changing STEM environment with new majors, interdisciplinary programs, etc.</li> </ul>
<p><b>Intellectual products</b></p> <ul style="list-style-type: none"> <li>• Instructional materials (lesson plans, delivery systems, workshops)</li> <li>• Research articles, monographs, books</li> <li>• Other intellectual and creative works related to: <ul style="list-style-type: none"> <li>- STEM learning/education</li> <li>- Interdisciplinary STEM research</li> <li>- Research within STEM disciplines</li> <li>- Community partnerships and STEM</li> </ul> </li> </ul>	<p><b>Broader community</b></p> <ul style="list-style-type: none"> <li>• Faculty at other institutions</li> <li>• Collaborative organizations (conferences, funders)</li> <li>• Employers</li> <li>• Industry partners</li> <li>• Adult learners (continuing education for STEM and STEM-education professionals)</li> </ul>	<p><b>Social impact</b></p> <ul style="list-style-type: none"> <li>• Increased market value for students in terms of: <ul style="list-style-type: none"> <li>- Overall employability (STEM content knowledge, understanding of STEM in broader context)</li> <li>- Improved leadership skills</li> <li>- Improved capacity to use STEM knowledge for problem solving and the betterment of society</li> </ul> </li> <li>• Improved STEM literacy among non-STEM learners and broader community</li> </ul>
	<p><b>Government</b></p> <ul style="list-style-type: none"> <li>• Local</li> <li>• Regional</li> <li>• State</li> <li>• National</li> </ul>	<p><b>Innovation</b></p> <ul style="list-style-type: none"> <li>• Creativity</li> <li>• Discovery</li> <li>• Problem-solving</li> </ul>

# APPENDIX C

## SWOT ANALYSES FOR STEM TEACHING, RESEARCH, AND SERVICE

### **SWOT**

SWOT is an acronym for strengths, weaknesses, opportunities, and threats. Strengths and weaknesses are recognized in internal factors while opportunities and threats are recognized in external factors. The following matrices present the SWOT analysis for each of the STEM goals.

# SWOT Analysis—Goal 1: Teaching/Learning

## STRENGTHS (INTERNAL FACTORS)

- Faculty are interested in striving for innovation in STEM coursework and some discussions are already underway
- Several STEM faculty have already initiated pilot work in flipped classroom and inquiry learning environments
- There has been good progress in developing a teacher certification pathway in Mathematics, while Physics and Chemistry are also now stepping forward for pathways
- The STEM faculty on campus have worked together in the past to establish several model curricula, such as in water analysis, robotics, and bioinformatics
- Computer science faculty are very interested in creating new workshops, courses, and programs for teachers
- The UNO Math Science Learning Center is fully operational and well respected by students
- STEM faculty have been responsive to FUSE research with students, showing the potential for the expansion
- Many STEM faculty have taken risks in undertaking coursework that integrates the use of new technologies
- Campus technical infrastructure in place to handle many current STEM technology requirements
- Several faculty have piloted flipped classroom strategies

## WEAKNESSES (INTERNAL FACTORS)

- Course retention in the STEM disciplines at UNO is 5% less than retention rates at UNO overall
- There are currently few examples of interdisciplinary STEM courses on campus, particularly introductory levels
- Developing shared faculty teaching load across interdisciplinary coursework can be a challenge
- Some coursework that might include an engineering component is hampered by no UNO engineering program
- The STEM departments on campus need faculty with more expertise in STEM learning within their departments
- High school students who would like to have some STEM content questions answered don't have a good UNO mechanism for answering these questions
- There is not a common listing of special STEM undergraduate or graduate courses across departments for students to select innovative STEM courses.
- Some classrooms where STEM courses are taught are not physically conducive to hands-on strategies
- Continued enhancements to the technical infrastructure will need to keep pace with STEM requirements
- Only some faculty are aware of instructional resources

## OPPORTUNITIES (EXTERNAL FACTORS)

- STEM teaching circles have been of interest to STEM faculty, and some have formed already across colleges
- STEM departments have shown interest in bringing in STEM learning external experts to advise them on course modifications
- Many students are coming to classes with their own laptops and mobile devices
- The IS&T College has expressed an interest in helping to develop a stronger P12 pathway in Computer Science
- There is a growing interest on campus in developing content courses for P12 teachers
- Area school districts are very willing to work with UNO in dual enrollment courses
- Area school districts, and particularly OPS, have expressed an interest in summer bridge programs
- STEM faculty have responded positively to Inquiry-Based Learning Workshops and STEM Engagement Links

## THREATS (EXTERNAL FACTORS)

- Interdisciplinary coursework load credit is often complex to ensure that faculty receive adequate load credit
- Coordination with UNL on STEM coursework that crosses the state often has political challenges
- Many students come to UNO less prepared in the STEM disciplines and struggle in introductory coursework
- The development of interdisciplinary STEM courses will take significant faculty time and coordination
- Some traditional non-STEM departments at UNO see potential for STEM instructional connections and collaboration but do not yet feel a part of the STEM Priority
- The full use of instructional technologies, such as the use of iPads, will require additional logistical planning on course integration

## SWOT Analysis—Goal 2: Research

### STRENGTHS (INTERNAL FACTORS)

- Many UNO faculty show an interest in STEM
- UNO has been designated a research institution
- UNO faculty often strive to align teaching, research, and service goals
- UNO has expanded space to a three-campus environment
- UNO has excellent student research funding (FUSE)
- UNO has significant expertise in STEM learning
- UNO has a strong Office of Research and Creative Activity
- The designation of STEM as a priority has engaged faculty
- UNO hosts the NASA Nebraska Space Grant
- Significant expertise in program evaluation exists at UNO
- The UNO psychology department has significant expertise in measuring STEM-related problem-solving and higher-order-thinking skills
- There is significant inter-college collaboration and agreement among faculty and deans

### WEAKNESSES (INTERNAL FACTORS)

- STEM appears by some faculty to seem exclusive to four disciplines (science, technology, engineering, math)
- STEM appears to some faculty as not welcoming to collaboration outside of the core disciplines
- Infrastructure to support STEM research is still evolving
- UNO STEM needs clarification whether non learning-related STEM research is considered
- UNO space for focused research is limited
- No STEM strategic plan is in place for potential alignment with faculty annual reviews and efforts
- A limited number of STEM faculty currently mentor students for FUSE opportunities
- Faculty are sometimes reluctant to undertake leadership of large interdisciplinary grant proposals and research projects
- Decentralization of STEM coordination and resources makes it somewhat hard to mobilize STEM efforts
- Insufficient understanding by STEM faculty of their colleagues' STEM expertise results in missed collaboration opportunities and overlooking of expertise

### OPPORTUNITIES (EXTERNAL FACTORS)

- UNO leads the Metropolitan Omaha Education Consortium (MOEC)
- UNO hosts the Peter Kiewit Institute
- UNO has a strong relationship with informal education organizations
- UNO faculty regularly participate in research-based organizations such as the Nebraska Academy of Sciences
- UNMC has recently shown significant interest in partnering with UNO faculty for STEM education projects
- UNO has successfully partnered with UNL on STEM grants that involve statewide efforts
- OPS and other school districts are willing to partner on research and grant proposals that enhance the overall STEM pipeline impacting their students
- Faculty are very interested in research and grant writing professional development related to STEM
- Grant writing assistance is well embraced by faculty for large proposals
- UNO is increasingly being asked to partner with other metropolitan universities across the country
- UNO is active in the Nebraska Academy of Sciences

### THREATS (EXTERNAL FACTORS)

- MOEC schools often are unaware of UNO's research goals and mission
- Engineering programs are sometimes difficult to coordinate with due to different university infrastructures
- Some external partners, such as the zoo, do not always recognize the opportunity to partner on research grants with UNO.
- Citizen-based research opportunities are not well understood by faculty
- It is sometimes difficult to partner with UNL when UNO offers to take the leadership role on a STEM project
- STEM partnerships among NU campuses are sometimes hampered by divergent campus cultures
- Although there is some interest, not much has happened in STEM partnerships with UNK
- STEM partnerships with other NU campuses will need to be carefully focused on a "win-win" situation for the cross-campus partnerships to be sustainable and fully supported by faculty

## SWOT Analysis—Goal 3: Service/Community Engagement

### STRENGTHS (INTERNAL FACTORS)

- The Physics Department’s AIM for the Stars Summer Camps are well received by the public and some camps close in a matter of hours.
- The IS&T Camps are growing in breadth and numbers, and the demand is steadily increasing.
- The College of Education Girls Inc. Camps is becoming well known in the city, and is growing in numbers.
- The CAPOW Van is a well-respected outreach program well embraced by the schools.
- The Elkhorn River Research Station (ERRS) and Nebraska Watershed Network is growing potential.
- UNO has established a special relationship with the Strategic Air and Space Museum (SASM) for outreach.
- UNO frequently collaborates with the Henry Doorly Zoo and Aquarium for various outreach events.
- The Glacier Creek Preserve is increasingly being used by area schools, and facilities have been expanded there.
- UNO regularly partners with UNL for supporting some outreach efforts, such as 4H robotics camps

### WEAKNESSES (INTERNAL FACTORS)

- The UNO campus and A&S College is pressed for space to host youth at 80+ AIM for the Stars Camps as well as the growing number of IS&T camps.
- The IS&T camps are running out of space at PKI, and the camps often take computer lab-based environments significantly limiting locations of the camps.
- Space for the Girls Inc. camps is becoming a problem, since it is 4 weeks duration.
- The key presenters of the CAPOW efforts are retiring or in retirement, requiring new efforts and training.
- ERRS has little funding to support outreach effort and the supervision or interactions with youth and teachers.
- Although an organizational infrastructure for collaboration has been established for the SASM, no organizational infrastructure supports work with the Zoo/Aquarium.
- Funding for outreach supervision at the Glacier Creek Preserve is very limited to support increasing visits.
- The politics of UNO and UNL funding subcontracts sometimes hampers full collaboration on outreach.

### OPPORTUNITIES (EXTERNAL FACTORS)

- One time events and contests, such as the recent Calculus Bee and Calculus the Musical promise to provide high visibility for UNO and various STEM programs.
- Events such as the River City Rodeo and the Youth at Infotec Conference regularly seek UNO participation.
- Service related funding opportunities are becoming more prevalent, as funders recognize the importance of formal and informal education working closely together.
- The UNMC is expanding its outreach efforts, and is inviting UNO to increase its collaboration on Omaha area outreach events.
- UNMC’s High School Alliance already has significant interest and some history of collaborating with UNO
- The new Biomechanics Research Building that houses the Nebraska Biomechanics Core Facility and the Center for Research in Biomechanics have significant STEM outreach potential.
- High schools are desperate for tutoring assistance from UNO students in the STEM areas, making a shared collaboration for tutoring a real opportunity.
- Interests are surfacing for statewide STEM outreach coordination across the state.

### THREATS (EXTERNAL FACTORS)

- outreach that can be accomplished that bring youth to campus for special camps and events.
- The lack of overall coordination for STEM outreach makes it difficult for these initiatives to work together effectively to share resources and space.
- Event participation with organizations such as the River City Rodeo and Infotec Conference take significant UNO faculty/staff time, with little recognition for time spent.
- The differing faculty cultures between UNO and UNMC sometimes make it challenging to come together for a shared outreach effort, particularly when space is limited on both campuses.
- The Biomechanics Research building needs to stay focused on high-level research, and thus outreach could be a possible distraction if not managed effectively.
- Tutoring for high school students on the UNO campus will require significant funding increases to the Math and Science Learning Center.
- The politics of statewide coordination for STEM outreach may make it challenging to attain direct benefits to UNO in these efforts.

# APPENDIX D

## SAMPLE OF EXEMPLARY METROPOLITAN OMAHA STEM ACTIVITIES

### AWARDS/SHOWCASES

Metropolitan Science and Engineering Fair  
[www.msefomaha.org/](http://www.msefomaha.org/)

Nebraska Teacher of the Year Award (STEM areas)  
[www.education.ne.gov/toy/](http://www.education.ne.gov/toy/)

Nebraska 4H Foundation Awards  
[www.ne4hfoundation.org/](http://www.ne4hfoundation.org/)

Nebraska Loves Public Schools  
[www.nelovesps.org/](http://www.nelovesps.org/)

### AWARENESS

Nebraska Science Festival  
[www.nescifest.com/](http://www.nescifest.com/)

Nebraska Out of School Time STEM Initiative  
[www.nebraskaclnnetwork.org/resources/stem.html](http://www.nebraskaclnnetwork.org/resources/stem.html)

### INFORMAL EDUCATION ORGANIZATIONS

Fontenelle Forest and Neale Woods  
[www.fontenelleforest.org/](http://www.fontenelleforest.org/)

Henry Doorly Zoo and Aquarium  
[www.omahazoo.com/](http://www.omahazoo.com/)

Strategic Air and Space Museum  
[www.sasmuseum.com/](http://www.sasmuseum.com/)

Nebraska Watershed Network <https://www.facebook.com/nebraskawatershednetwork>

Glacier Creek Preserve  
[www.unomaha.edu/prairie/naturepreserves.php](http://www.unomaha.edu/prairie/naturepreserves.php)

### INITIATIVES/EVENTS

Nebraska Advanced Manufacturing Coalition  
Dream!tDo!t Initiative  
[www.dreamitdoitnebraska.com/](http://www.dreamitdoitnebraska.com/)

Nebraska Robotics Expo  
[www.ceen.unl.edu/neroboticsexpo/](http://www.ceen.unl.edu/neroboticsexpo/)

Infotec Conference  
[infotec.org/](http://infotec.org/)

Girls Inc. EUREKA! hosted at UNO  
[www.girlsinc.org/about/programs/eureka-goldman-sachs-gives.html](http://www.girlsinc.org/about/programs/eureka-goldman-sachs-gives.html)

Omaha Area Math Teachers Circle  
[www.mathteacherscircle.org/](http://www.mathteacherscircle.org/)

SPIRIT Robots Project  
[www.ceen.unomaha.edu/TekBots/SPIRIT2/](http://www.ceen.unomaha.edu/TekBots/SPIRIT2/)

### PROGRAMS

NASA Nebraska Space Grant  
[ne.spacegrant.org/](http://ne.spacegrant.org/)

Nebraska Math and Science Summer Institutes  
[scimath.unl.edu/nmssi/2013/](http://scimath.unl.edu/nmssi/2013/)

UNO Fund for Undergraduate Scholarly Experiences (FUSE)  
[www.unomaha.edu/orca/fuse.php](http://www.unomaha.edu/orca/fuse.php)

UNMC High School Alliance  
[www.unmc.edu/alliance/](http://www.unmc.edu/alliance/)

### PROFESSIONAL NETWORKS AND ORGANIZATIONS

AIM Institute  
[aiminstitute.org/](http://aiminstitute.org/)

Association for Computing Machinery (ACM),  
Nebraska  
[acm.unl.edu/](http://acm.unl.edu/)

Institute of Electrical and Electronics Engineers (IEEE)  
Nebraska Section  
[www.ieeene.org/](http://www.ieeene.org/)

Midwest Center for Information Technology  
[aiminstitute.org/mcit/](http://aiminstitute.org/mcit/)

Nebraska Academy of Sciences  
[nebraskaacademyofsciences.wildapricot.org/NJAS](http://nebraskaacademyofsciences.wildapricot.org/NJAS)

Nebraska Association of the Gifted  
[www.negifted.org/NAG/Welcome.html](http://www.negifted.org/NAG/Welcome.html)

Nebraska Association of Teachers of Mathematics  
[natmonline.clubexpress.com/](http://natmonline.clubexpress.com/)

Nebraska Association of Teachers of Science  
[nebraskaacademyofsciences.wildapricot.org/NATS](http://nebraskaacademyofsciences.wildapricot.org/NATS)

Nebraska Educational Technology Association  
[www.netasite.org/](http://www.netasite.org/)

Nebraska IDeA Networks of Biomedical Research Excellence (INBRE) Program  
[www.unmc.edu/inbre](http://www.unmc.edu/inbre)

Nebraska Society of Professional Engineers  
[www.nspenebraska.org/](http://www.nspenebraska.org/)

Society of Women Engineers,  
Eastern Nebraska Professional Section  
[www.swe-nebraska.org/](http://www.swe-nebraska.org/)

UNO Women in IT Engagement Link <https://sites.google.com/a/unomaha.edu/unowomenit/>

Women in Technology  
[www.womenintechnology.org/](http://www.womenintechnology.org/)



# APPENDIX E

## SAMPLE OF STEM PROGRAMS NATIONWIDE

PROGRAM NAME	DESCRIPTION	LEADERSHIP	PRIORITIES/THEME
<p><b>Iowa Governor’s STEM Advisory Council</b></p> <p><a href="http://www.iowastem.gov">www.iowastem.gov</a></p>	<p>A partnership of business, policy and education leaders from across the state convening to bolster STEM education and innovation and better position Iowa’s young people and the state’s economy for the future.</p>	<p>Council co-chaired by Lieutenant Governor and University of Northern Iowa’s President. The executive director of the Governor’s STEM Advisory Council was the director of the former Iowa Mathematics and Science Education Partnership at University of Northern Iowa.</p>	<ol style="list-style-type: none"> <li>1. Top Priority—Student Interest and Achievement</li> <li>2. Technology Enhanced Instruction for Global Learning</li> <li>3. STEM Teacher Recruitment and Preparation</li> <li>4. STEM Learner Readiness for Post-Secondary Education and Career</li> <li>5. STEM Education Policy</li> <li>6. Public Awareness of the Importance of STEM Education in Economy and Society</li> <li>7. Public/Private Partnerships for STEM Education to Economic Development</li> <li>8. STEM for ALL - the Highly-Abled, Under-Represented, and Nontraditional</li> </ol>
<p><b>Iowa State University Center for Excellence in Science, Mathematics and Engineering Education</b></p> <p><a href="http://cesmee.hs.iastate.edu/homepage.php">cesmee.hs.iastate.edu/homepage.php</a></p>	<p>A research and development center focusing on conducting innovative research to create change in STEM education in K12, community colleges, and universities</p>	<p>Housed in the School of Education within the College of Human Sciences.</p>	<p>Mission: To be the principal source for research, professional development, leadership, and advocacy STEM education.</p> <p>Goal 1: Build the capacity to conduct research and advance knowledge that will support excellence in STEM education.</p> <p>Goal 2: Lead research and advocacy efforts to influence the landscape of STEM education in K-12 schools, community colleges, and four-year colleges/universities.</p> <p>Goal 3: Collaborate with key stakeholders to increase STEM recruitment and retention.</p> <p>Goal 4: Strengthen CESMEE by making it a more responsive, vital, and sustainable organization in Iowa, the nation, and the world.</p>
<p><i>(Continued on the next page.)</i></p>			

PROGRAM NAME	DESCRIPTION	LEADERSHIP	PRIORITIES/THEME
<p><b>Texas Tech University T-STEM Center</b></p> <p><a href="http://www.depts.ttu.edu/tstem">www.depts.ttu.edu/tstem</a></p>	<p>Through exemplary teacher professional development trainings, the Center helps educators engage K 12 students in rigorous inquiry and project-based learning that emphasizes high-level application of mathematics, science, and technology as well as developing problem solving, critical thinking, and other skills.</p>	<p>Texas Tech Engineering faculty and T-STEM Center staff</p>	<p>By furthering pedagogical training, professional development, and recruitment opportunities for K-12 teachers in STEM fields, the center addresses the challenges of tomorrow's technology-driven economy by transforming teaching and learning methods, improving achievement in STEM education, and ensuring that all students are college-, career-, and life-ready. The mission of the center is to support educators in STEM disciplines by offering services and resources that support school districts and teachers. The center aims to research, create, and disseminate information on the best practices for innovative teaching and learning using the FRAME Engineering Design process as a framework.</p>
<p><b>Texas Tech University Center for the Integration of STEM Education and Research</b></p> <p><a href="http://www.towson.edu/cse">www.towson.edu/cse</a></p>	<p>The center is the home of the Bioscience Education and Outreach Program, which runs the SciTech Student Learning Laboratory and the Maryland Loaner Lab; the Baltimore Excellence in STEM Teaching (BEST) Project; and other efforts.</p>	<p>College of Engineering/ Department of Education</p>	<p>Current Programs:</p> <ul style="list-style-type: none"> <li>• Greater Boston South Shore Science Partnership (GBSSSP)</li> <li>• Young Scholars Program (YSP)</li> <li>• Research Experience for Teachers (RET)</li> <li>• CAPstone Unique Learning Experiences for Teachers (CAPSULE)</li> <li>• Retirees Enhancing Science Education through Experiments and Demonstrations (RE-SEED)</li> </ul>
<p><b>Portland Metro STEM Partnership</b></p> <p><a href="http://pdxstem.org">pdxstem.org</a></p>	<p>A regional collaboration of public and private organizations with a shared goal of transforming science, technology, engineering, and mathematics (STEM) education in local K-12 schools.</p>	<p>Housed in the Center for Science Education, PSU</p>	<p>The partnership places particular emphasis on schools and programs that serve traditionally underrepresented populations so that all students have pathways to achieving college and career readiness in STEM.</p> <p>The partnership employs an outcomes-based design that supports teachers as they develop and implement proficiency-based teaching and assessment practices that align with the outcomes of Oregon's 40-40-20 education initiative.</p>
<p><b>Great Lakes/Cleveland Center for Innovation in STEM Education</b></p>	<p>Created as a partnership among Great Lakes Science Center, Cleveland Metropolitan School District's MC2 STEM High School, Cleveland State University and the Ohio STEM Learning Network, CISE is dedicated to bringing exciting, new professional development opportunities to the region's educators.</p>	<p>One of the Co-Directors is Teacher Education Faculty at Cleveland State University</p>	<p>The center's unique programs are the result of the combined strengths of its partners, including Great Lakes Science Center's expertise in informal science education, MC2 STEM High School's nationally recognized success with project-based instruction and Cleveland State University's record of providing pre-service and in-service teacher training in the areas of science, technology, engineering and math (STEM). CISE also acts as the Northeast Ohio Hub for the Ohio STEM Learning Network, a statewide consortium of STEM hubs designed to share and scale up best practices in STEM education.</p>
<p><i>(Continued on the next page.)</i></p>			

PROGRAM NAME	DESCRIPTION	LEADERSHIP	PRIORITIES/THEME
<p><b>The University of Texas Pan American Center of Excellence in STEM Education</b></p> <p>portal.utpa.edu/utpa_main/daa_home/coecs_home/stemgrant_home</p>	<p>The University of Texas-Pan American recently received a \$3.7 million award for four years with a possible \$1 million for the fifth year from the U.S. Department of Defense (DoD) HBCU/MI program to establish a Center of Excellence in STEM Education (Science, Technology, Engineering, and Mathematics). UTPA was one of three institutions across the nation to receive the award.</p>	<p>The University of Texas-Pan American, along with its South Texas collaborators (South Texas College, Texas A&amp;M International University-Laredo, Texas A&amp;M-Corpus Christi, University of Texas-Brownsville, and University of Texas-San Antonio) will provide activities to strengthen STEM academic programs and to increase the number of STEM graduates.</p>	<p>The center builds a community of faculty who are leaders in Challenge-Based Instruction and student programs in the Science, Technology, Engineering, and Mathematics (STEM) fields.</p> <p>With the new DoD grant, five activities will be implemented: Three of the activities pertain to the incorporation of Challenge-Based Instruction (CBI) into STEM curriculum, faculty professional development in CBI, and the development of a fourth-year CBI curriculum for the Texas Pre-Freshmen Engineering (TexPREP) program. The fourth activity consists of involving undergraduate students in research activities to encourage them to pursue STEM careers and graduate school. Finally, the fifth activity involves establishing a central location for a STEM Student and Faculty Resource Program focusing on STEM .</p>
<p><b>Oregon State University Center for Research on Lifelong STEM Learning</b></p> <p>stem.science.oregonstate.edu/</p>	<p>A collaborative effort spanning the OSU community that broadly tackles issues of academic learning and public understanding of STEM fields. The Center is particularly interested in the development of critical thinking, complex reasoning, and other higher level cognitive processes crucial to professionals and citizens of the 21st century.</p>	<p>Director is faculty in Science Education; affiliates include education and STEM disciplinary faculty</p>	<p>Mission: The Center for Research on Lifelong STEM Learning conducts research and development that leads to enhanced understanding of the processes that underlie how individuals become lifelong STEM learners, STEM practitioners and STEM researchers as well as the structures and mechanisms that lead to achieving these outcomes.</p> <p>Overall Goals:</p> <ol style="list-style-type: none"> <li>1. To promote excellence in lifelong STEM learning research.</li> <li>2. To create a nexus for investigating and communicating about significant lifelong STEM learning issues at OSU that will attract investigators and resources from across OSU, Oregon, the nation and the world.</li> <li>3. To support teaching and research at OSU.</li> </ol>
<p><b>Ohio STEM Learning Network</b></p>	<p>The network is composed of five major groups: core staff; regional hubs; embedded staff; training centers and many platform schools. All of these network components are committed to helping the State of Ohio inspire and train the next generation of scientists and technology leaders.</p>	<p>OSLN's core team is composed of personnel from Battelle, which sponsors STEM learning networks across the nation.</p>	<p>OSLN is transforming from a network that assists in starting up STEM schools and programs to one that leverages existing STEM schools and programs to spread effective practices and tools. OSLN supports the growth and quality of STEM education in Ohio by:</p> <ol style="list-style-type: none"> <li>1. Connecting the best STEM schools, teachers and administrators to each other and to national resources;</li> <li>2. Assisting schools and communities that want to create new STEM schools and programs; and</li> <li>3. 3) Driving STEM innovations through a network approach.</li> </ol>
<p><i>(Continued on the next page.)</i></p>			

PROGRAM NAME	DESCRIPTION	LEADERSHIP	PRIORITIES/THEME
<p><b>Stephen F. Austin State University STEM Research and Learning Center</b></p> <p><a href="http://stem.sfasu.edu/">stem.sfasu.edu/</a></p>	<p>First, the Center will facilitate the increase of research capacity within the STEM disciplines, and between STEM and non-STEM fields. Second, the Center will consolidate SFA's support for STEM education, particularly by coordinating STEM efforts in EC-12, undergraduate, and graduate education and teacher development at all levels.</p>	<p>Associate Dean for STEM Education and Assessment</p>	<p>The STEM Center will catalyze research communication and collaboration within the sciences as well as between the sciences and other disciplines. Particular attention will be given to facilitating research collaboration in partnership with industry, university faculty, staff and students, and stakeholders in the public school system.</p> <p>In keeping with research findings regarding inhibitors to STEM engagement, the Center will focus on: Increasing STEM awareness and public perception, facilitating innovation in STEM university education, providing support for student mentoring during transitional periods in their education, guiding STEM teacher induction during the first three years in the classroom, empowering STEM teacher-leaders to transform their districts from within.</p>
<p><b>Purdue University Discovery Learning Research Center</b></p> <p><a href="http://www.purdue.edu/discoverypark/learningcenter">www.purdue.edu/discoverypark/learningcenter</a></p>	<p>The DLRC is a unique center that bridges the innovative research work at Purdue with the fundamental educational mission of the University.</p>	<p>Director is a professor of chemistry and science education; has internal and external advisory committees.</p>	<p>Mission: To advance research that revolutionizes learning in the STEM disciplines.</p> <p>The DLRC is guided by three goals:</p> <ol style="list-style-type: none"> <li>1. Catalyze large-scale, interdisciplinary research programs in teaching and learning, especially in STEM and STEM-related fields.</li> <li>2. Promote articulation between the scholarship of teaching and learning and actual classroom practice at all levels.</li> <li>3. Provide leadership in influencing STEM public literacy and educational policy.</li> </ol>
<p><b>University of Memphis Center for Research and Innovation in STEM Teaching and Learning</b></p> <p><a href="http://www.memphis.edu/cristal">www.memphis.edu/cristal</a></p>	<p>An interdisciplinary university center chartered by the Provost to advance the university's efforts to recruit, retain, and prepare the next generation of STEM researchers, educators, and industry professionals.</p>	<p>Steering Committee is composed of the Director, Associate Directors, and a select group of faculty representing the Colleges of Arts and Sciences, Engineering, and Education, Health and Human Sciences.</p>	<p>The role of the Center is to:</p> <ol style="list-style-type: none"> <li>1. Provide coordination and support for STEM education related programs on campus,</li> <li>2. Connect projects on campus with partners in local and regional industries,</li> <li>3) Provide a point of contact between local and regional school districts and the University for K-12 STEM related initiatives,</li> <li>3. Connect projects with funding sources, coordinate recruiting of local and regional students into STEM disciplines, and</li> <li>4. Connect faculty with University resources for the reform of classroom instruction.</li> </ol>
<p><i>(Continued on the next page.)</i></p>			

PROGRAM NAME	DESCRIPTION	LEADERSHIP	PRIORITIES/THEME
<p><b>NORC at the University of Chicago Center for Advancing Research and Communication in STEM</b></p> <p>portal.utpa.edu/utpa_main/daa_home/coecs_home/stemgrant_home</p>	<p>ARC is a National Science Foundation (NSF) funded initiative that supports education research focused on core scientific questions about learning in STEM. ARC investigators conduct research and provide technical assistance in support of over 300 STEM investigators across the U.S. funded by NSF's Research and Evaluation on Education in Science and Engineering (REESE) program.</p>	<p>ARC is directed by Kevin Brown, Senior Research Scientist at NORC at the University of Chicago. Leading the project are Principal Investigator and NORC Senior Fellow Barbara Schneider (Michigan State University) and Co-Principal Investigators Larry Hedges (Northwestern University) and Colm O'Muircheartaigh (University of Chicago).</p>	<p>ARC's mission is to build capacity to:</p> <ol style="list-style-type: none"> <li>1. Produce rigorous evidence of what works to improve STEM instruction and learning,</li> <li>2. Encourage discovery and innovation across disciplines and institutions, and</li> <li>3. Accumulate, synthesize, and disseminate findings to stakeholders.</li> </ol> <p>Research Topics include:</p> <ol style="list-style-type: none"> <li>1. Establishing principles for educational research accounting for judgments and evidence,</li> <li>2. Developing criteria for establishing the rigor of investigations at all stages of the research and development cycle,</li> <li>3. Determining and measuring meaningful effect sizes,</li> <li>4. Identifying and addressing factors that impede and strategies that enhance knowledge accumulation,</li> <li>5. Establishing the broader impacts of both individual research investigations and broad and diverse portfolios of funded research,</li> <li>6. Investigating educational links among transitions between formal schooling and careers in STEM,</li> <li>7. Encouraging women, minorities, and other underrepresented groups to pursue education and careers in STEM</li> </ol>
<p><b>University of Arizona STEM Learning Center</b></p> <p>stem.arizona.edu</p>	<p>Brings together researchers, educators, business/industry, community organizations, and regional policy leaders to realize an economic and civic future that holds at its heart the rich economic and human potential of STEM innovation.</p>	<p>Collaborative effort between the UA colleges of education and science</p>	<ul style="list-style-type: none"> <li>• Improve communication, coordination and advocacy between UA personnel and the community at large</li> <li>• Improve teacher recruitment, preparation, professional development and retention</li> <li>• Improve PreK-20 STEM pipeline programs, including both classroom-based (formal) and free-choice (informal) STEM education efforts</li> <li>• Improve research and evaluation around STEM learning</li> </ul>
<p><b>The Maine Center for Research in STEM Education</b></p> <p>umaine.edu/center</p>	<p>The Maine RiSE Center provides an integrated approach to University-based research and professional development in science and mathematics education.</p>	<p>Joint effort of Colleges of Liberal Arts &amp; Sciences, Education &amp; Human Development, and Natural Sciences, Forestry &amp; Agriculture.</p>	<ul style="list-style-type: none"> <li>• Reevaluating and reforming introductory level science and mathematics courses</li> <li>• Establishing new practices for K-12 science teacher preparation</li> <li>• Building infrastructure with teachers, schools, and administrators throughout the state</li> </ul>
<p><i>(Continued on the next page.)</i></p>			

PROGRAM NAME	DESCRIPTION	LEADERSHIP	PRIORITIES/THEME
<p><b>STEM Education Center at Saint Xavier University's Orland Park campus</b></p> <p><a href="http://www.sxu.edu/academics/resources/stem">www.sxu.edu/academics/resources/stem</a></p>	<p>An initiative aimed at strengthening the quality of STEM education, increasing the number of students graduating in STEM disciplines, and building the university's capacity to advance knowledge in STEM disciplines.</p>	<p>College of Education faculty</p>	<ol style="list-style-type: none"> <li>1. Increase the number of well-qualified STEM teachers in south suburban schools in the Chicago metropolitan area by providing professional development opportunities for teachers;</li> <li>2. Improve the knowledge and skills of university faculty who prepare teacher candidates in mathematics, science and technology;</li> <li>3. Increase the number of teachers and students who participate in programs that encourage careers in STEM fields.</li> </ol>
<p><b>Millard Oakley STEM Center for the Teaching and Learning of STEM</b></p> <p><a href="http://www.sxu.edu/academics/resources/stem">www.sxu.edu/academics/resources/stem</a></p>	<p>Cutting-edge STEM-education facility supports campus-wide initiative to enhance existing models and develop new educational strategies in STEM.</p>	<p>Interdisciplinary faculty team from education and STEM disciplines</p>	<p>The Oakley STEM Center improves the teaching and learning of science, technology, engineering, and mathematics (pre-school through university) by acting on goals in three areas: outreach, academics, and research.</p>
<p><b>University of Colorado Boulder Center for STEM Learning</b></p> <p><a href="http://www.colorado.edu/csl">www.colorado.edu/csl</a></p>	<p>Coordinates and leads: efforts to transform STEM education, discipline-based STEM education research, and STEM teacher preparation (K20)</p>	<p>Interdisciplinary faculty team from education and STEM disciplines</p>	<p>Maintain an infrastructure of institutional support to transform STEM education; support education research within STEM fields and departments; promote K20 faculty recruitment, preparation, and professional development; facilitate change in STEM education by integrating an interdisciplinary community of scholars.</p>

# APPENDIX F

## THE PERIODIC TABLE OF STEM OCCUPATIONS IN NEBRASKA

The Periodic Table of Science, Technology, Engineering, and Math (STEM) Occupations In Nebraska															
Atmospheric & Space Scientists 2 \$43.05 Bachelor's degree							Compliance Officers 66 \$29.84 Bachelor's degree								
Nuclear Medicine Technologists 4 \$30.73 Associate's degree	Architectural & Engineering Managers 16 \$59.79 Bachelor's degree	<b>STEM Disciplines:</b> <table border="1" style="margin: 10px auto;"> <tr> <td>Physics/ Astronomy</td> <td>Life Sciences</td> </tr> <tr> <td>Mathematics</td> <td>Chemistry</td> </tr> <tr> <td>Geosciences</td> <td>Environmental Science</td> </tr> <tr> <td>Computer Science</td> <td>Engineering</td> </tr> </table>				Physics/ Astronomy	Life Sciences	Mathematics	Chemistry	Geosciences	Environmental Science	Computer Science	Engineering	Forest & Conservation Technicians 12 \$15.66 Associate's degree	Dietitians & Nutritionists 27 \$22.97 Bachelor's degree
Physics/ Astronomy	Life Sciences														
Mathematics	Chemistry														
Geosciences	Environmental Science														
Computer Science	Engineering														
Statisticians 11 \$25.70 Master's degree	Natural Sciences Managers 11 \$53.13 Bachelor's degree	<table border="1" style="margin: 10px auto;"> <tr> <td colspan="2" style="text-align: center;"><b>Occupational Title</b></td> </tr> <tr> <td colspan="2" style="text-align: center;">Average Annual Openings:</td> </tr> <tr> <td colspan="2" style="text-align: center;">Average Hourly Wage:</td> </tr> <tr> <td colspan="2" style="text-align: center;">Typical Education Level:</td> </tr> </table>				<b>Occupational Title</b>		Average Annual Openings:		Average Hourly Wage:		Typical Education Level:		Soil & Plant Scientists 23 \$27.69 Bachelor's degree	Chemists 13 \$32.99 Bachelor's degree
<b>Occupational Title</b>															
Average Annual Openings:															
Average Hourly Wage:															
Typical Education Level:															
Operations Research Analysts 10 \$33.56 Bachelor's degree	Hydrologists 2 \$30.45 Master's degree	Postsecondary Atmospheric, Earth, Marine, & Space Sciences Teachers 1 *Annual: \$78,454 Doctoral or professional degree	Geoscientists, Except Hydrologists & Geographers 4 \$32.93 Bachelor's degree	Environmental Scientists & Specialists, Including Health 39 \$23.84 Bachelor's degree	Environmental Engineering Technicians 4 \$25.09 Associate's degree	Environmental Engineers 13 \$36.60 Bachelor's degree	Chemical Equipment Operators & Tenders 10 \$19.59 High school diploma or equivalent								
*Hourly wages not available															
		Computer Support Specialists 164 \$24.09 Some college, no degree	Computer Programmers 93 \$32.68 Bachelor's degree	Graphic Designers 79 \$19.31 Bachelor's degree	Automotive Service Technicians & Mechanics 167 \$17.43 High school diploma or equivalent	Civil Engineers 53 \$36.92 Bachelor's degree	Avionics Technicians 30 \$27.93 Postsecondary non- degree award								



Produced by the Nebraska Department of Labor, Office of Labor Market Information; Wages: Occupational Employment Statistics, 3<sup>rd</sup> Quarter 2012  
 Annual Openings: 2010-2020 Long-term Occupational Projections; STEM Disciplines: O\*NET OnLine

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