Chairwoman of this committee is Michelle Rich of State Public Policy Group. Direct your feedback to MRich@sppg.com or to the Council's Executive Director Jeff Weld at jeff.weld@uni.edu. Thank you.

Iowa STEM Policy Recommendations
STEM Policy Matters Working Group
Draft as of May 31, 2012

CHARGE

Reform of STEM education for Iowa requires programmatic level intervention coupled to policy-level support. The Policy Action Plan Working Group is charged with developing an Action Plan to be presented to the Executive Committee of the STEM Council by March 12, 2012. This Action Plan will become the recommendation provided to the Governor for introducing policy measures to elevate Iowa's STEM education landscape to an internationally competitive level.

VISION

STEM learning occurs in a range of diverse classrooms and community settings in Iowa. STEM education starts in early childhood and continues through higher education and throughout life. STEM education and its impacts are important to all Iowans for economic health and well-being and stronger citizenry so we can all engage in solving the problems we face.

MISSION

To develop and propose policy to enable and sustain STEM education through high-quality strategies linked directly to the broad needs of Iowa's economy and citizens.

Values/Belief Statements

We believe:

…in the ability of all learners to benefit from STEM education.
…in the engagement of all learners in STEM education.
…in equity of resources and access regardless of where one lives in Iowa.
…in an ongoing collaboration of a broad group of stakeholders in STEM to provide sustainable success.
…in diversity (gender, ethnic, economic, opportunity) as a strength.
…in holistic STEM education, involving all institutions in the community.

Recommendations

Our review of Iowa's STEM landscape suggests that the state must develop or expand policies in the following areas:

- Converting the educational system to competency based learning
- Ensuring equality of STEM program quality and access across the state
- Improved incentives for collaboration between PK-12 and business
- Improving the preparation of educators in STEM
- Improving systemic focus on encouraging traditionally underrepresented groups to pursue STEM fields of post-secondary study and vocation

A few notes regarding the recommendations in this report: first, the Working Group recognizes that inspiring future STEM practitioners will require early and ongoing positive exposure beginning in early childhood and continuing throughout our lifetimes. Only where the distinction is necessary does the report intend to focus recommendations on a particular grade span. It will be critical that Iowa's education system comprehensively invest in high-quality, engaging, and challenging STEM experiences.

Second, the Working Group recognizes differences in opinion regarding what constitutes high-quality programming. The report uses the terms evidence-based, validated, and high-quality to indicate the need for criteria for scaling effective practices. As determined by the Scale-Up Working Group of the Advisory Council, scalable programs have the following characteristics:

- Evidence of previous impact on student interest and achievement in STEM, either directly or indirectly.
- Evidence of educational research conducted with the program (theoretical basis).
- Tie to the Iowa Core Curriculum.

Third, the Working Group has limited its recommendations to policies necessarily requiring legislative action to both jump-start and sustain implementation of these solutions. The enormity of the issue – raising Iowa to a global STEM competitor – required the Advisory Council to focus on systemic changes that impact "all ships," rather than identifying policies focused at the school or community level. Thus, this report represents high-level, high-impact recommendations for improving Iowa's STEM workforce through improvements in STEM education.

Each recommendation of the Policy Matters Working Group is summarized below. Best practices, resources needed, timelines, and indicators to support implementation are identified for each recommendation, as well.

Recommendation 1: Implement competency-based education in Iowa.

Goal: Students who are prepared for higher education and the workforce.

- Require standards-based assessment and reporting practices.
- Require institutions of higher education to develop admissions criteria based on 9-12 standards-based assessments and reporting. Develop framework to implement this policy.
- Ensure that a student's progress through education is based on mastery of learning, not dates, ages, or calendars.
- Enable students to move on only when they have demonstrated learning.
- Shift the focus from seat time to skills and competencies.

Best Practices/Models

The working group has identified the Chugach (Alaska) School District and the state of New Hampshire as models for implementing competency-based education systems and practices. The Chugach School District system is based on skill and knowledge mastery and progressive student leadership as the student moves through the PK-12 system. Project-based learning is utilized to integrate real-world challenges into core instruction. Students are expected to learn in different environments – in and out of the classroom.

> "Time was the constant and learning was the variable -- that's the old model," says Roger Sampson, president of the Education Commission of the States, who led Chugach's

transformation as district superintendent in the 1990s. "We switched. What's constant is learning. Time is the variable[1]."

According to the New Hampshire Department of Education, “not only do students need to know facts, they need to know how to apply those facts to new situations, how to solve problems, and how to expand their knowledge and opportunities[2].” As part of the Next Generation Learning partnership with the National Council of Chief State School Officers, New Hampshire has rallied behind educational approaches characterized by:

- ✓ Personalizing learning;
- ✓ Comprehensive systems of learning supports;
- ✓ World-class knowledge and skills;
- ✓ Performance-based learning;
- ✓ Anytime, everywhere opportunities; and
- ✓ Authentic student voice[3].

There is significant national momentum building for the integration of competency-based education into traditional models. According to the National Governors Association (NGA) Center on Best Practices, by shifting the education system from focusing on inputs such as seat time and the number of days in a school year to outputs such as student mastery of academic skills and knowledge, states could realize gains in student achievement[4]. In addition, the Common Core State Standards (CCSS) initiative, once fully implemented, will make easier the realization of competency-based education in Iowa, as the CCSS initiative gives a uniform set of math and English standards for K-12 learning outcomes.

The specific impacts of competency-based education on STEM in our PK-12 schools have the potential to be significant and deep. The integration of competency-based models for learning would benefit high-achieving and low-achieving STEM students, alike, with challenging coursework individually-tailored to the unique interests and strengths of each student. Both student achievement and interest should rise with the increase in opportunities to explore and master STEM in different, more exciting ways that cross multiple disciplines.

Resources Needed

New investment would be required to support implementation at both state and local levels, including resources for a data warehouse for reporting. Strategies not requiring new investment

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[1] Rubenstein, Grace. "Northern Lights: These Schools Literally Leave No Child Behind." *Edutopia*. 31 08 2007: n. page. Web. 6 Mar. 2012. http://www.edutopia.org/chugach-school-district-reform.

[2] "New Hampshire High School Transformation." *New Hampshire Department of Education*. 2012. Web. 6 Mar 2012. http://www.education.nh.gov/innovations/hs_redesign/index.htm.

[3] “Next Generation Learning (NxGL)." *New Hampshire Department of Education*. 2012. Web. 6 Mar 2012. http://www.education.nh.gov/innovations/nxgl/.

[4] Grossman, Tabitha, and Stephanie Shipman. "State Strategies for Awarding Credit to Support Student Learning." *National Governors Association*. National Governors Association. Web. 6 Mar 2012. http://www.nga.org/files/live/sites/NGA/files/pdf/1202EDUCREDITBRIEF.PDF.

include the creation of a network of schools integrating competency-based practices and developing incentives for the adoption of competency-based policies and practices at the local level. Some districts and schools are already taking advantage of the waiver for this flexibility but additional investment will be needed to implement such a model systemically statewide. New investment will be required to expand services offered through the Area Education Agencies and other training agencies.

Timeline for Implementation

The working group identified two logical pathways for implementation.

1. A transitional competency-based model that fits within the current educational framework and continued reporting of GPA with some competency-based scoring. This approach could be adopted first in 9-12 grades and incrementally adopted in lower grades. The time frame for this approach would be three to five years.
2. Completely move over to competency-based assessment with no grades. The time frame for this could be implemented within five to 10 years.

The working group recognizes that the transition away from traditional grading will be challenging for all stakeholders, including PK-12 educators, students, parents, and higher education. This could potentially extend the timeline for implementation and will assuredly require support across the system.

Success Indicators

Given the scope of the recommendation, systemic impacts on student achievement and interest and teacher effectiveness should be expected across disciplines, including, but not limited to STEM. The breadth of success indicators will reflect the systemic scope of implementing a competency-based education model statewide. The state should expect both student achievement and interest, as measured by standardized test scores, identification of interest in STEM careers, and demonstration of STEM mastery, to improve as the competency-based education model is integrated into traditional education models. Indicators of student academic achievement are likely to adapt to a new education model based on demonstration of both knowledge and skill mastery. The skills and knowledge students demonstrate upon leaving Iowa secondary schools should also better reflect the needs of employers and post-secondary institutions, from better communication skills, critical thinking, and leadership to a more in-depth understanding of core subjects, including science, technology, engineering and math.

The indicators of teacher effectiveness will also be adapted to a new education model. The role of the teacher in a competency-based education model is that of facilitator, thus a different set of skills will be necessary for both teachers and students to be successful in this new model. Additionally, with the recognition and valuation of learning both in and out of the classroom, the expertise of real-world STEM practitioners will be even more critical to educator effectiveness. `

<u>Recommendation 2</u>: Increase quality PK-12 STEM practices equitably across the state through improvements in PK-12 school accreditation and STEM reporting.

Goal: Students who are better prepared for higher education and the workforce.

- Change the current accreditation and STEM reporting systems to support greater accountability in STEM education.
- Create a more aligned system of accreditation and STEM reporting that is responsive to the learning of students and adults that we value.
- Provide every learner with access to evidence-based/validated, high-quality programs.
- Improve teacher assessment evaluation and professional development.

Best Practices/Models

Accountability measures must reflect higher expectations for STEM to encourage greater STEM focus at the local level. Current accreditation practices must be re-tooled to focus more on quality improvement than compliance to make the greatest use of a required procedure already in place. Measures should align with the Iowa Core and drive the alignment of teacher professional development with individual teacher and student needs, making it more purposeful and effective in raising STEM proficiency and interest.

Resources Needed

The working group recommends taking advantage of and expanding infrastructure already in place, thus requiring less significant monetary investment by the state. However, significant effort will be required to coordinate and better align existing activities, data reporting and initiatives at the Department of Education. New investment will be required to expand services offered through the Area Education Agencies and other training agencies.

Timeline for Implementation

Accreditation and other accountability requirements could be changed immediately. To see impacts at the programmatic level would require a longer timeline as districts and partners tailor education programs to meet new requirements.

Success Indicators

Indicators of success will include evidence of broader adoption of high quality, evidence-based/validated STEM programs such as Project Lead the Way, Authentic Intellectual Work, Every Learner Inquires, Science Writing Heuristic, 5 E learning cycle, modeling, and FOSS. Longer-term indicators would reflect greater student interest in STEM through identification of STEM careers and improved achievement as measured through standardized tests and demonstration of STEM mastery.

<u>Recommendation 3</u>: Engage and excite STEM learners through increased interactions, small and large, by incentivizing PK-12/higher education/business/non-profit partnerships.

<u>Goal</u>: A pipeline of qualified employees and greater relevancy in schools and in STEM learning experiences.

- There are incentives in place for business creation, but none that encourage collaboration between PK-12/higher education/business/non-profit. Increasing these interactions would give students experience in real world application of STEM.
- The state needs to improve and develop more programs like Lego League, PSEO, Hyper Stream, and Teacher Externships, and to connect programs like Start-Up City Des Moines to school-age students. For instance, the current Post Secondary Education Opportunity Act (PSEO) system offers very few exciting, engaging courses, and has the potential for great impact if improved through higher education/business/non-profit interactions.

Best Practices/Models

Many exemplary programs already exist across the state, but implementation is inconsistent statewide, creating pockets of opportunity in the state. These exemplary programs:

- ✓ are mutually beneficial to all partners;
- ✓ provide students the opportunity to gain real-world STEM experiences;
- ✓ provide students the potential to earn high school and college credit;
- ✓ encourage teacher and school leader interaction;
- ✓ generate student excitement about STEM careers; and
- ✓ expand teacher and school leader understanding of business world.

The New Hampshire Department of Education encourages schools to partner with businesses and non-profits to provide students a more enriching experience outside the classroom in what they term “extended learning opportunities (ELOs).” According to the Department, “extended learning means: the primary acquisition of knowledge and skills through instruction or study outside of the traditional classroom methodology, including, but not limited, to” internships, community service, and apprenticeships[5].

[5] "New Hampshire High School Transformation." *New Hampshire Department of Education*. 2012. Web. 7 Mar 2012. http://www.education.nh.gov/innovations/elo/index.htm.

Partnerships with industry groups, workforce development agencies, and community colleges are also a valuable vehicle for diversifying student STEM experiences beyond the traditional classroom. In regions across the state STEM employers endorse the National Career Readiness Certificate (NCRC) and the National Association of Manufacturers (NAM) certification. Incentivizing such partnerships can help boost student preparation for STEM fields and provide them the skills employers now prefer upon completion of high school.

ELO FOCUS: Causes and treatment of congestive heart failure
HIGH QUALITY TEACHER (HQT): Biology teacher
COMMUNITY PARTNER: Elliot Hospital
GOALS:

1. Cite implications of biotechnology of the medical fields.
2. Connect basic anatomy of related physical systems for cardiac surgery.
3. Explore career path, including financial needs, aptitudes and education requirements.

RESULT: ½ biology credit and deepened passion to pursue medical career in cardiac surgery.
Source: O'Malley, Michael. "Highlights of the New Hampshire Extended Learning Opportunities (NH ELO) Initiative." PowerPoint. 2010. http://www.education.nh.gov/innovations/elo/index.htm.

Resources Needed
New investment may be required to ensure incentives for business and non-profits to engage with K-12 and higher education (and vice versa) are sufficient.

Timeline for Implementation
Timeline for implementation would require one to two years. STEM hubs must be in place for coordination purposes and will be critical to implementation.

Success Indicators
Short-term indicators include increased program participation and expanded teacher/leader understanding of the business world through increased interactions with external partners. Longer-term indicators include increased academic achievement and STEM college and employment attainment.

Recommendation 4: Better coordinate how PK-12 teacher professional development (PD) is accessed, delivered, and implemented statewide through a coordinated system that identifies models and best practices. Develop networks of PD professionals in AEAs and districts and other relevant professions to make PD impactful on STEM education.

Goal: Greater equity of access to high-quality/evidence-based/validated STEM practices across the state.

- Connect PD to teacher's individual needs, their performance evaluations and their license renewal.
- Align individual PD with the needs of the education system.
- Develop a statewide structure to align resources and increase coordination to provide access to individualized teacher professional development.

Best Practices/Models

Districts across the state are currently implementing a more intentional and planned approach to teacher professional development. In the Waverly-Shell Rock (Iowa) School District, school administrators utilize SMART (specific, measureable, attainable, results-based, time bound) goal setting to better align individual teacher PD and district needs. Contingent on changes in accountability systems at the state level, such a process would also spur increased focus on STEM professional development.

Resources Needed

Investment is needed in a statewide database of PD opportunities. This could be accomplished through an expansion of the existing Equella database. The database should align with the Iowa Core. New investment will be required to expand services offered through the Area Education Agencies and other training agencies.

Timeline for Implementation

This recommendation could be accomplished in five years.

Success Indicators

Indicators of success include increased student achievement, increased teacher retention, and increased teacher professionalism.

Recommendation 5: Improve the focus on encouraging traditionally underrepresented groups to pursue post-secondary study and vocation in STEM fields through greater incentives and accountability.

Goal: Students who are better prepared for higher education and the workforce.

- Identify and scale-up elements of high-quality STEM experiences that attract traditionally underrepresented groups, including, but not limited to, programs that promote greater educational retention, post-secondary transition, and educational attainment.
- Ensure accountability measures track student subgroups for STEM participation.
- Share best practices statewide through teacher PD, professional networks, and statewide clearinghouses.

Best Practices/Models

In order for Iowa to ensure its global competitiveness, a wide net must be cast for inclusion in the STEM workforce of the future. Iowa must do a better job of engaging *all* students in STEM educational opportunities to build these students' interest and competence in STEM fields. The state must, therefore, put a greater emphasis on engaging traditionally underrepresented groups, including women and minorities, to bring them into the fold at a greater rate. According to a report from the National Academies, the solution to expanding participation of underrepresented groups is four-fold: preparation; access and motivation; affordability; and academic and social support[6].

Clearly, improving the participation of traditionally underrepresented groups in STEM requires an intentional, multi-faceted approach. By definition, these groups reflect broad segments of our population and are multi-dimensional. Any solution to better engaging these groups of students must first identify what elements of STEM engagement practices work best and scaled-up in a manner to ensure that resources are directed to targeted student populations.

Resources Needed

Resources will be necessary to scale-up successful programs, curricula, and other STEM activities targeted to underrepresented groups, and may be sufficiently provided as a component or particular focus of the Working Group's additional four recommendations regarding competency-based education, accountability, equity, and teachers.

Timeline for Implementation

This recommendation can be implemented within five years.

Success Indicators

[6] Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline; Committee on Science, Engineering, and Public Policy; Policy and Global Affairs; National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. "Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads." *National Academic Press*, 2011.

Indicators of success include women and minority PK-12 STEM achievement and interest, post-secondary training and education completion (attainment), and STEM employment.

Appendix A: Working Group Roster

Representative Josh Byrnes, Iowa General Assembly, Osage
Lynne Campbell, Area Education Agency 267, Marshalltown
Lin Chapé, Vermeer Corporation, Pella
Tom Downs, Iowa Association of School Boards, Des Moines
Dr. Alissa Jourdan, Kemin Industries, Inc., Des Moines
Dr. Anita Micich, Mason City and Clear Lake Community School Districts, Mason City and Clear Lake
Dr. Craig Ogilvie, Iowa State University, Ames
Michelle Rich (Chair), State Public Policy Group, West Des Moines
Senator Brian Schoenjahn, Iowa General Assembly, Arlington
Representative Sharon Steckman, Iowa General Assembly, Mason City
Bridgette Wagoner, Waverly-Shell Rock School District, Waverly
Dr. Kichoon Yang, National Council of Teachers of Mathematics, Reston, VA
Dr. Isa Zimmerman, IKZ Advisors, Boston, MA

Meetings of the STEM Working Group:

- ✓ October 31, 2011; Advisory Council Meeting, Science Center of Iowa, Des Moines
- ✓ December 16, 2011; Conference call
- ✓ January 5, 2012; Conference call
- ✓ January 25, 2012; Advisory Council Meeting, Principal Financial Group, Des Moines
- ✓ February 15, 2012; STEM Working Group Meeting, AEA267, Marshalltown
- ✓ March 2, 2012; Conference call