IV. Discussion Items
   A. Presentation on Next Generation Science Standards (“NGSS”): Overview and update

Considerations in Development of any New Science Standards

H.E.P.C. supports ongoing re-evaluation of any standards, particularly in an area that is changing so quickly, such as science and science education. Hawai‘i students have not scored well in Hawai‘i science tests.

It is unlikely that student interest and achievement in science will change just by updating the standards if the delivery and approach does not change at the school, in the classroom, and for teacher preparation or continuing professional development.

HEPC encourages the Board to adopt standards with two fundamental school models and challenges in mind:
   a. Elementary school science standards that explicitly recognize the ongoing challenges of ensuring that each and every elementary teacher is prepared and willing to teach science as thoroughly as Language or Math or Music or Social Studies. There is widespread anecdotal evidence that not all elementary teachers are focusing on science at all.
   b. Middle and High School science standards that explicitly recognize that teacher preparation, licensing, and evaluations are done by specific subject or discipline, and are not yet integrated with other subjects. This is a barrier and a very different environment that at the elementary school level. There are few official classes identified by HDOE as interdisciplinary. Engineering is not an approved course. Project based learning that incorporates other subjects, including the arts along with science, may require more than an upgrade in science standards, as well developed as they may be.
HEPC notes that international and even national trends are moving towards *multidisciplinary, hands-on, project-based experiences*. At the higher education level, this is often referred to as **competency based credentials**. The following article in The Atlantic reviews this trend (http://www.theatlantic.com/education/archive/2015/01/getting-credit-for-what-you-know/384919/), and notes:

> Welcome to the world of competency-based alternative credentials, sometimes known as occupational certifications. They’re increasingly common in many fields, including IT, advanced manufacturing, health care, the energy sector, even hospitality and retail.

Recently, the UH College of Education made a presentation to the Board on this subject.

In many ways, this trend is very much in the realm of what is often referred to as S.T.E.M. In 2013, HEPC reviewed the many ways various organizations define STEM:


In the HEPC report, we cite the way in which The Georgetown University Center on Education and the Workforce breaks the definition of STEM into areas of Knowledge, skills, abilities, interests and work interests and values. The comprehensive analysis illustrates how complex and dynamic science can become.

Of special relevance is the HIDOE definition of STEM as reported to the legislature:

According to a 2012 Report to the Hawai‘i State Legislature, the Hawai‘i Department of Education has a working definition of S.T.E.M.:

*STEM education integrates the study of science, technology, engineering and mathematics by using scientific inquiry and engineering design as unifying processes. STEM emphasizes innovation and the development of problem-solving, critical thinking and collaboration skills through student-focused, rigorous, relevant, and authentic learning.*

Source: Hawai‘iStateDepartmentofEducation, Legislative Report: Relating to the State Budget (HB200 HD1, SD1 CD1, Section 132, 2011, at http://doe.k12.hi.us/reports/tolegislature_2012/06_HB0200HB1SD1CD1Section%20132Act%20164(SLH2011).pdf

HEPC has not had the opportunity to review the proposed new science standards in detail, but would hope that they are broad enough to embrace this definition.

**Competency---Based, Project---Based, & Authentically Assessed Learning**

**Basic Policy Questions**

There are many complex layers to implementing competency---based and project---based
learning, including creation of authentic assessments. This paper focuses on analysis and strategies that might be considered without needing to completely dismantle the current public school system. These apply to not only science, but other subjects as well.

- **The kind of school.** Is there a difference between competency and project based learning at the elementary level – where one teacher is responsible for all subjects – and a middle or high school environment – where there are distinct subjects, realms of knowledge, disciplines, and teacher credentials? If the answer is yes, how would we talk about and address these two educational delivery environments?

- **Out of school success.** Looking at middle and high schools, is it possible to recognize and incorporate authentic learning contexts, such as success in music performance, success in visual arts, **success in the science fair**, success in History Day, and success in the Speech League? If the answer is yes, are there ways to provide both funding and “equivalency credits” for success in these areas?

- **Progressive projects.** Is it possible to create a progressive series of competencies and projects from elementary through high school that does not require a major overhaul of the State’s GLOs, Learning Objectives and Benchmarks? If the answer is yes, can Complex Areas be tasked with creating these?

- **Doing what adults do.** Is it possible to look at how adults use specific areas of learning as a guide for constructing the progressive series of competencies and projects culminating in a mature portfolio upon graduation? For example, rather than learning about history, would it be possible to require students actually write history – a biography, a history research paper, the history of an event or a place? Rather than learning how to read and write **English in a generic sense**, would it be possible to require students to produce a set of poems, short stories, a novel, a screen play, a play? Rather than learning about biology, would it be possible to require that all students pose a scientific hypothesis and then design and implement experiments to prove or disprove it?

- **Authentic assessments.** We do not judge competency in music through a written test – experts listen to the audition or performance. We do not judge a hula competition through a written test – experts, kupuna – watch and judge. We do not admit any athlete to a team via a written exam – they must try out. And for awarding high quality teachers a special national credential – great and experienced teachers observe and judge. The essential question is whether it is possible to use experienced and expert assessors – such as the judging at the science fair – as a supplement to traditional assessments.
The World Bank Analysis

In 2003, The World Bank articulated what it felt were the shifts needed in public education: The World Bank’s publication, *Lifelong Learning in the Global Knowledge Economy*, contrasted the characteristics of traditional and lifelong learning models in this way: (World Bank, 2003, p. 29)

<table>
<thead>
<tr>
<th>Traditional Learning</th>
<th>Lifelong learning</th>
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</thead>
<tbody>
<tr>
<td>The teacher is the source of knowledge.</td>
<td>Educators are guides to sources of knowledge.</td>
</tr>
<tr>
<td>Learners receive knowledge from the teacher.</td>
<td>People learn by doing.</td>
</tr>
<tr>
<td>Learners work by themselves.</td>
<td>People learn in groups and from each other.</td>
</tr>
<tr>
<td>Tests are given to prevent progress until students have completely mastered a set of skills and to ration access to further learning.</td>
<td>Assessment is used to guide learning strategies and identify pathways for future learning.</td>
</tr>
<tr>
<td>All learners do the same thing.</td>
<td>Educators develop individualized learning plans.</td>
</tr>
<tr>
<td>Teachers receive initial training plus ad hoc in-service training.</td>
<td>Educators as lifelong learners. Initial training and ongoing professional development are linked.</td>
</tr>
<tr>
<td>“Good” learners are identified and permitted to continue their education.</td>
<td>People have access to learning opportunities over a lifetime.</td>
</tr>
</tbody>
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THE CURRICULUM DEVELOPMENT PERSPECTIVE: The Importance of Inquiry

Many educators are coming to embrace the importance of inquiry in the development of educational policymaking, systems development, governance, curriculum development, professional development, and student learning. These levels of inquiry speak not only to an individual student or classroom, but the very process by which educational systems and schools change. Any educational system or curriculum that does not set as its goal these in-depth levels of inquiry is at a great disadvantage. The following was developed by the University of Hawai‘i’s Curriculum Research and Development Group:
Comprehensive Assessments

Many educators embrace a broad and comprehensive definition of assessment and evaluation. The importance of high quality, innovative, inquiry-based and project based assessments and evaluation methods are central to the holistic development of a system, a school and a student. An important lesson of No Child Left Behind is that a narrow definition of assessment (i.e. high stake multiple choice tests in two or three subjects) leads to a narrow and counterproductive curriculum that cannot speak to the needs of the whole child.

Comprehensive, Articulated Curricula

Central to the promotion of 21st century learning may be development of a fully articulated, sequential, discipline-based inquiry curriculum from preschool through grade 12. This curricular component might embrace the themes of many forms of literacy for Citizen and Society. Student citizens evolve out of a broad and authentic experience in the sciences, technologies, and humanities. As products of this curricular experience, students meet local,
national and international standards, become prepared for post-secondary studies, become sophisticated and critical users of electronic and other informational media, become eager continuing learners, become able contributors to society, and become ready to take leadership roles when needed. There is a spirited ongoing debate on how to connect the dots between theoretical broad

**IN SUMMARY**

HEPC encourages HIDOE and the Board to ensure that project-based, hands-on engagement of students be promoted in the new standards, that S.T.E.M. has a logical and comfortable place among them, and that these and other standards embrace larger trends towards competency-based, problem solving. HEPC also encourages examination of the acronym: STEAM, which is STEM along with the Arts. Can art, innovation, and creativity be promoted and encouraged at the classroom level?