

Written Testimony Presented Before the
Senate Committee on Economic Development and Technology
Senate Committee on Education

February 4, 2011, 1:15 p.m.
Conference Room 016
SB 1120 RELATED TO THE ECONOMY

By
Ian Kitajima
Marketing Director, Oceanit

Chair Fukunaga, Chair Tokuda, Vice Chair Wakai, Vice Chair Kidani and committee members:

Testimony in support of SB1120.

Thank you for this opportunity to provide testimony in support of SB 1120 to appropriate funds for science, technology, engineering and math related programs.

Oceanit currently employs about 160 scientists, engineers and support staff. We regularly host interns, school classes, and conduct numerous outreach activities for elementary thru college level kids to introduce them to science and engineering careers. We produce our own TV science show called "Weird Science with Dr. V" on Hawaii News Now, every Tuesday morning.

We let kids know that there are exciting, decent paying jobs for them in Hawaii if they pursue these careers. Many of them have returned to us, equipped with college degrees, wanting to work in science and engineering.

It is our hope that we can continue to offer an alternative to kids that want to work in an industry that is growing nationally as well as internationally - and to show them that world class technical work can thrive in Hawaii.

We strongly support the programs outlined in this bill to provide professional development for our educators and STEM curriculum for our students. Engaging students with technology skills throughout their educational term will better prepare them for the real world challenges.

Thank you for the continued support of education and workforce development and for your support of the industry.

Sincerely,

Ian Kitajima, Oceanit



From: mailinglist@capitol.hawaii.gov
To: [EDTTestimony](#)
Cc: karen.james@geminitech.net
Subject: Testimony for SB1120 on 2/4/2011 1:15:00 PM
Date: Friday, February 04, 2011 10:55:21 AM

Testimony for EDT/EDU 2/4/2011 1:15:00 PM SB1120

Conference room: 016
Testifier position: support
Testifier will be present: No
Submitted by: Karen James
Organization: GeminiTech
Address: 94-1221 Ka Uka Blvd #108-351 Waipahu, HI
Phone: 808-843-1000
E-mail: karen.james@geminitech.net
Submitted on: 2/4/2011

Comments:

GeminiTech has supported and participated in the robotics program for the past 6 years. We have seen some of the brightest and creative students work together to solve problems that went far beyond fact memorization. STEM education programs and robotics cover students from the gifted and talented to the most visually creative students that may face academic challenges. The programs in STEM and Robotics have no barriers to learning - they have barriers to funding. As a small technology firm in Hawaii I want the students that have a strong STEM background. They are my future employees. Regardless of what field they actually end up in, at least I know that they have thinking skills that other potential candidates lack. I want to train future employees to think. Please vote YES for STEM and Robotics education. I will personally and professionally support the creation and expansion of these areas.

To whom it may concern:

I am writing in behalf of STEMworks, a unique program that has been nurtured and further developed by Women in Technology, a branch of the Maui Economic Development Board (MEDB). As a second year facilitator of the STEMworks program here at McKinley High School, i have witnessed remarkable progress by my students in the areas of confidence, communication, teamwork and, mostly, follow-through.

The projects that they work on benefit either the school or community in some way or another. How are these projects different from others? Students take ownership in their projects, and find satisfaction in not only completing and turning in their projects, but taking it a step further. They follow through to see their projects take root and become a valuable and contributing part of the school and community.

Currently, my students are working on green technology. One group is working on a solar powered radio, another on designing a passive solar house. A third group is working on improving the efficiency of a solar oven, and another is working on developing a solar-powered USB charger. A fifth group is designing a hand-powered dynamo that can charge your cel phone and other small devices.

As you can see, my students are doing things in this class that seem far removed from a "normal" classroom setting. More importantly, they are learning by hypothesizing, testing and experimenting, evaluating, and re-hypothesizing. They are learning by thinking!

I encourage you to continue to support the STEMworks programs presently in many high schools throughout Hawaii. I am confident that you will see that funds appropriated to this program are well used and worthwhile.

Sincerely,

Alan H. Sekiguchi

McKinley High School

COMMITTEE ON ECONOMIC DEVELOPMENT AND TECHNOLOGY

Senator Carol Fukunaga, Chair
Senator Glenn Wakai, Vice Chair

COMMITTEE ON EDUCATION

Senator Jill N. Tokuda, Chair
Senator Michelle Kidani, Vice Chair

NOTICE OF HEARING

DATE: Friday, February 4, 2011
TIME: 1:15 p.m.
PLACE: Conference Room 016
State Capitol
415 South Beretania Street

RE: SB 1120 related to the economy

In Strong Support

Dear Chairs Fukunaga and Tokuda, Vice Chairs Wakai and Kidani and members of the Committees:

Thank you for the opportunity to testify today.

On behalf of the faculty and students at Waialua High and intermediate School, I write today in strong support for SB 1120, relating to the economy, which will, among other things,

- (1) Provide a permanent funding source for STEM experimental learning initiatives that have yielded strong student performance outcomes and expanded the reach of the program through teacher-driven efforts;
- (2) Provide recommendations to maximize the benefits of STEM and creative media experiential learning initiatives (e.g., expanded participation throughout Hawaii's public and private schools, opportunities to leverage public-private resources in broadening the reach of innovative experiential learning programs throughout the State);

Waialua High and Intermediate School was fortunate to receive \$10,000 in ARRA Funds through the Academy for Creative Media System and the College of Engineering, University of Hawai'i, Mānoa, which were used to establish our new Creative Media program.

Thanks to these funds students in grades 8 to 12 at Waialua High and Intermediate School now have access to video editing computers workstations and software allowing them to use creative media tools to tell their own stories and train them for the global digital economy.

Students at Waialua High and Intermediate School have immediately adopted their digital tool belts to create informative and entertaining public service announcements on topics ranging from global warming, teen pregnancy, healthy eating habits, avoiding drug and alcohol abuse and more. Students today have a natural affinity for technology and this program has given them the opportunity to speak to their peers through videos and computer animation that resonate through visual story-telling.

The ability to work with technology is essential for 21st century jobs as is the understanding of working in collaboration with others thru project based learning.

The Creative Media program is an invaluable new asset at Waialua High and Intermediate School and all of us appreciate the intent of SB 1120 to make this funding permanent.

Sincerely,

Andrew Cole
Multi-Media Center Instructor
Waialua High and Intermediate
67-160 Farrington Highway
Waialua, HI. 96791
808.637.8200



From: mailinglist@capitol.hawaii.gov
To: [EDTTestimony](#)
Cc: cindy.l.fong@gmail.com
Subject: Testimony for SB1120 on 2/4/2011 1:15:00 PM
Date: Friday, February 04, 2011 4:26:29 PM

Testimony for EDT/EDU 2/4/2011 1:15:00 PM SB1120

Conference room: 016
Testifier position: support
Testifier will be present: No
Submitted by: Cynthia Fong
Organization: Individual
Address: 1103 Ainalako Road Hilo, HI
Phone: 808-959-8531
E-mail: cindy.l.fong@gmail.com
Submitted on: 2/4/2011

Comments:

I am a regional co-coordinator for the MATE-Big Island Regional ROV competition for Underwater Robotics. Last summer, I was able to get the MATE Center to host their International Underwater Robotics competition in Hilo Hawaii at the UH-Hilo campus. It was beneficial for everyone visiting but especially for local families and the community - we were showcased and it has really peaked interest in having these type of STEM opportunities available for our community. It helps our kids dream bigger and tackle the harder courses to prepare more thoroughly. Teachers are expected to donate their own funds and their time to make this experience possible for our youth along with their own time to engage in their own learning and professional development. I know, because I have spent thousands of my own dollars to get properly trained as well as purchasing needed supplies and writing numerous grants. This is not sustainable for the long-term and it does not help us move our communities and economies forward if you must rely on the personal beliefs and vocations of a few. Real support with funds that directly impact teachers and students will be the most prudent manner of securing a good economic base for our island communities and keeping our keiki motivated and dreaming bigger. We are losing a lot of brain-power from our youth as they move elsewhere to find employment. Let's make it a real possibility here - it does take time to train up folks...start now and keep investing.

February 8, 2011

RE: Senate Bill SB1120, Strong Support

Being a part of the program Project EAST, which is supported by the MEDB and WIT, has been a true eye opener for myself as a teacher and for the students who have been involved. We, at Farrington High School, consider it an honor and privilege as this unique and well sculpted program provides resources for students at all levels, with diverse interests and backgrounds.

Project EAST/STEMworks allows students to landscape their passions through the venue of community service while using the high end technology as a tool, and permits students to marry basic skills of science and math with today's fast pace movement of technology.

When students are given permission to make a difference and solve problems in their community/world, when students are have opportunities to explore various hardware and software that is used in the real world and industry, when students are allowed to stimulate their senses, to inquire and be curious, the results are tremendous growth in each individual student which can't be measured by test scores and rubrics.

I have witnessed the shyest ELL student stand in front of an audience to give a power point presentation with confidence, I've watched students step out of their comfort zone and gleefully share their findings, I've listened to conversations of pride that a student accomplished a task that they would have never tackled, I've chuckled at students who ask permission to do a project and are speechless when I reply "of course!"

To be in a classroom with students fully engaged in what they are doing, problem solving among themselves, working collaboratively as a group, and sharing laughter and excitement is what teachers pine for in today's system. But this is what the model of EAST/STEMworks is about. And it works.

Given the resources that have been provided, it is with hope that there will be continued support and investments in STEMworks for our students to be positive contributors to their community while riding the wave of today's dynamic trends.

Thank you for your consideration.

With Appreciation,

Diane Tom-Ogata
Farrington High School
Project EAST Facilitator



From: mailinglist@capitol.hawaii.gov
To: [EDTTestimony](#)
Cc: koolrainhotrocks@gmail.com
Subject: Testimony for SB1120 on 2/4/2011 1:15:00 PM
Date: Friday, February 04, 2011 8:39:08 AM

Testimony for EDT/EDU 2/4/2011 1:15:00 PM SB1120

Conference room: 016
Testifier position: support
Testifier will be present: No
Submitted by: Eric J Hagiwara
Organization: Waiakea Robotics
Address: 294 Mikaele Place Hilo, Hawaii
Phone: 808-936-5498
E-mail: koolrainhotrocks@gmail.com
Submitted on: 2/4/2011

Comments:

I have been involved with the robotics program for the past 9 years. our program alone has had the most significant influence I have ever seen, in my 16 years of teaching, towards committing students to pursue careers in the math science and engineering programs. We can boast of three females within our first group of robotics participants who are working engineers today. One at the age of 25 has purchased her own home already because of her Chemical engineering job. This Robotics program does what the DOE has in plan to accomplish in 15 years. It already exists within the robotics programs...



February 8, 2011

RE: Senate Bill 1120 - Relating to the Economy

Date of hearing: Wednesday, February 9, 2011

Time: 1:15 pm Place: Conference Room 225; State Capitol, 415 S. Beretania Street

Dear Senator Jill Tokuda, Chair Senate Education Committee, Senator Michelle Kidani, Vice-Chair Senate Education Committee and members of the committee,

My name is Julia Segawa, teacher at Stevenson Middle School. I have had the opportunity to bring my sixth and eighth grade students to Challenger Center Hawaii. This program provides life-changing experiences for our students that are consistent with State Standards and the Middle School philosophy. It also provides our students with experiences, content, and skills associated with Science, Technology, Engineering, and Mathematics (STEM). The economic future of Hawaii lies in STEM careers. If we can prepare our students for the occupational rigors in these types of fields, our economy will benefit greatly. Also, Hawaii will not need to look outside of our state to employ qualified workers. We will inspire, prepare, and employ them right here in our state.

The Challenger Center curriculum is solidly based on General Learner Outcomes (GLOs) and HCPS III Standards and Benchmarks for Science, Math, Social Studies, and English. The interdisciplinary format is conducive to student learning, as students make relevant connections in different course areas. The latest in brain research supports this. It also reinforces inquiry based learning. We use Problem Based Learning (PBL) in our science classrooms. The PBL format presents a case study or scenario for students to investigate. We have shown gains in student achievement in our science classes through this method. Two of our school's case studies are based on the Challenger experience.

Challenger prepares our students for the global and technical workforce. It is an excellent example of STEM. The actual mission provides students the opportunity to apply what they learned in classroom lessons and activities. Students must engage in active thinking and critical problem solving while working together as a team. They are presented with realistic problems or challenges during the mission and must solve it on their own within a limited time frame. They use the latest in scientific equipment and technology, which requires difficult skills and mastery of knowledge. This is true rigor. These are the types of skills necessary in STEM careers.

The relevance to current NASA initiatives and rigor of the mission are priceless. Many students reflect and comment how they have a better understanding of not only the benchmarks, but how STEM is vital in today's global community at large. I still have high school students begging me to take them along as chaperones just so they can experience Challenger Center again. Former students tell me that they are pursuing degrees in Science, Engineering, Computers, Technology, Mathematics, and Research. Many of them attribute their interest in these areas to their experience at Challenger Center.

I encourage you to observe a mission in progress. Looking at data about the center will not truly reflect the impact Challenger has on our students. Pictures tell a thousand words, but being there, observing the students in action will give you chicken skin. I

have seen many students take charge and show a different side of themselves, which surprises everyone. Many of my proudest moments as a teacher are these memories, especially when other students congratulate them on a job well done. The positive psychological, emotional, and social impact cannot be expressed in words. You must witness it firsthand.

I urge you to pass Senate Bill 1120. It will help keep Challenger Center open for Hawaii's students. It will impact thousands of students and our Hawaii community in the present and future, academically, socially, and economically. This program is valuable, relevant, rigorous, and the impact is far reaching. Hawaii will gain in many ways.

This year is the 25th anniversary of the Challenger accident. Ellison Onizuka, teacher Christa McAuliffe, and the Challenger Crew's legacy live on through Challenger Center. Let's keep it alive!

Respectfully submitted,

Julia Yuan Segawa
Robert Louis Stevenson Middle School
Science Signature School
Science Teacher and Science Curriculum Coordinator



From: mailinglist@capitol.hawaii.gov
To: [EDTTestimony](#)
Cc: kkiwasaki@hotmail.com
Subject: Testimony for SB1120 on 2/4/2011 1:15:00 PM
Date: Friday, February 04, 2011 11:03:42 AM
Attachments: [ROV letter testimony.doc](#)

Testimony for EDT/EDU 2/4/2011 1:15:00 PM SB1120

Conference room: 016
Testifier position: support
Testifier will be present: No
Submitted by: Kellie Iwasaki
Organization: Hilo Underwater ROV (Remote Operational Vehicle)
Address: 232 Edita Street Hilo, HI
Phone: (808) 969-7720
E-mail: kkiwasaki@hotmail.com
Submitted on: 2/4/2011

Comments:
Attached please find the letter that is below:

February 4, 2011

Dear Committee,

My name is Kellie Iwasaki and I am a sophomore at Waiakea High School. I am a member of the Underwater ROV (Remote Operating Vehicle) Robotics team in Hilo. Underwater robotics gained much attention this summer because of the BP Gulf Coast oil spill crisis that caused far reaching and long lasting damage to the environment, industry and society. It is essential that underwater robotics research continue with the goal of serving real life applications.

Our team encouraged and promoted underwater robotics to Hilo youth by providing a hands-on, four-day workshop for students in the 4th – 6th grades December 20-23 called “Hilo Camp Eureka: Underwater ROV Winter Robotics Program.” We had 20 youth registered for the camp during the winter break. Each day, the participants had a full agenda of hands-on workshops presented by the ROV steering team. The students built individual mini ROV’s and on the last day of the camp, on Thursday, December 23, a competition at the school’s pool was held with one of the team’s coming in first place. Our team has experienced great success in the district and international ROV competitions, placing first in district and in the top five internationally. These opportunities have taught us to practice integrity, character and to become responsible and contributing members in our community in addition to researching and experimenting with underwater robotics.

On behalf of the Underwater ROV Robotics team, I would like to submit this testimony to encourage you to fund robotics education. Thank you for your kind consideration of this request. Please call me at (808) 969-7720 (home), (808) 987-4931 (cell) or email me at kkiwasaki@hotmail.com if you have any questions.

With Much Mahalo,

Kellie Iwasaki
Underwater ROV (Remote Operating Vehicle) Robotics team - Hilo
c/o 232 Edita Street
Hilo, HI 96720
(808) 969-7720 home
(808) 987-4931
kkiwasaki@hotmail.com

February 8, 2011

RE: Senate Bill 1120: Related to the Economy

Date of hearing: Wednesday, February 9, 2011

Time: 1:15 p.m. Place: Conference Room 225, State Capitol, 415 S. Beretania Street

Dear Senator Jill Tokuda, Chair of the Senate Education Committee, Senator Michelle Kidani, Vice-Chair of the Senate Education Committee, and the Education Committee Members,

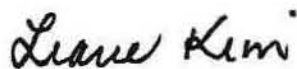
My name is Liane Kim, director of Challenger Center Hawaii (CCH). CCH as a STEM-initiative learning center has fostered critical thinking, problem solving and responsible decision-making skills for students throughout the State of Hawaii. Team-building activities enhance the quality education students receive in a real-life situation where they are challenged to work together to solve problems as well as to learn about the universe. CCH's mission is "to prepare students for the global and technological workforce." It advocates career-opportunities for students in the much needed areas of science, technology, engineering and mathematics. Since its inception in 1993, over 85,000 students in Hawaii have participated in the space missions at the CCH. Mission Control at the CCH mirrors the real Mission Control at NASA's Johnson Space Center. It is equipped with the latest technology and allows the students to communicate with their fellow student astronauts in the space station and vice-versa. The space station at the CCH provides students with hands-on experiences in conducting similar experiments as in the real International Space Station.

A large investment has been made to keep the CCH in working order. Initially, three classrooms at Barbers Point Elementary School were renovated to accommodate the necessary equipment and resources for the CCH. Software as well as hardware are constantly being upgraded to keep the CCH equipped with the latest technological advances. It would be a shame to see the demise of the CCH after such a large investment was made.

The CCH supports the NASA Educator Resource Center which provides research materials and supplemental curriculum resources to teachers to enhance their own professional growth. In addition, to date, the CCH provided direct professional development opportunities for 1,432 Hawaii teachers through a curriculum which is aligned to the State Standards and General Learner Outcomes (GLOs). This gave the teachers an additional opportunity to focus on the Standards and GLOs in a real-life situation.

I humbly request that you consider funding CCH through SB 1120 so the CCH can continue in its mission to assist students and teachers of Hawaii.

Sincerely,



Liane Kim

Challenger Center Hawaii

February 4, 2011

Dear Committee,

My name is Kellie Iwasaki and I am a sophomore at Waiakea High School. I am a member of the Underwater ROV (Remote Operating Vehicle) Robotics team in Hilo. Underwater robotics gained much attention this summer because of the BP Gulf Coast oil spill crisis that caused far reaching and long lasting damage to the environment, industry and society. It is essential that underwater robotics research continue with the goal of serving real life applications.

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Our team has experienced great success in the district and international ROV competitions, placing first in district and in the top five internationally. These opportunities have taught us to practice integrity, character and to become responsible and contributing members in our community in addition to researching and experimenting with underwater robotics.

On behalf of the Underwater ROV Robotics team, I would like to submit this testimony to encourage you to fund robotics education. Thank you for your kind consideration of this request. Please call me at (808) 969-7720 (home), (808) 987-4931 (cell) or email me at kkiwasaki@hotmail.com if you have any questions.

With Much Mahalo,

Kellie Iwasaki
Underwater ROV (Remote Operating Vehicle) Robotics team - Hilo
c/o 232 Edita Street
Hilo, HI 96720
(808) 969-7720 home
(808) 987-4931
kkiwasaki@hotmail.com

Dear Sirs:

I have been volunteering my time to mentor/coach an after school robotics program at Kealakehe Intermediate School for the past 5 years. Because I believe so strongly that robotics in general is the future that I also have been volunteering for the last 2 years as the mentor/coach for Kealakehe High School as well. I spend 5 days a week, volunteering after school, at two different school levels. Robotics programs are extremely hard to have funded by the schools. Especially with the budgets cuts in the Hawaii DOE. As well as convincing the Administration of its value.

Here is a quick rundown of the robotics competitions that I run for the students.

- Brushbot – Built with toothbrush heads and a cell phone vibration motor. Very low cost and simple construction. This is a great starter for the new students to get their interest going. This program is done at the middle school level.
- FIRST Lego - Built with a Kit from FIRST. Simple C programming is used to program the “brain” to perform on a predetermined game field. This is a great program to start interest in programming and problem solving what is required to complete the missions. Easy assembly your own robot design from the pool of Lego kit parts. Students must use parts from the kit only. This robot is fully autonomous. This program is done at the middle school.
- FIRST Robotics – Built with some parts from a kit. Most of the robot is built from scratch from various metals. Full scale C programming is used to program the “brain” to perform on a predetermined game field. This is a great program for more intermediate and advanced experienced robotics students. Programming must be done to the robot for both autonomous and remote control. This program brings together other class programs at the school. Since the machine is close to 140 pounds it is constructed with the joint help of the metal and auto shop programs at the school. The playing field and shopping container is constructed by the wood shop. This is our first year in this program.
Pros: Involves multiple classes (multimedia, metal, auto and wood shop)
Cons: High costs. Kits is very expensive as well as the stock materials needed for construction.
- VEX - Built with a Kit from VEX Robotics. Full scale C programming is used to program the “brain” to perform on a predetermined game field. This is a great program for more intermediate experienced robotics students. The competition has both an autonomous portion as well as a remote control portion. Students must use parts from the kit only. Programming must be done to the robot for both autonomous and radio control. This is done at both the middle and high school levels.

Botball - Built with a Kit from Botball. Full scale C programming is used to program the “brain” to perform on a predetermined game field. This is a great program for more advanced robotics students. More extensive sensors are available to use. This is a great program for more advanced experienced robotics students. Students must use parts from the kit only. This robot is fully autonomous. This program is done at the high school.

MATE ROV - Built with anything available. No Kit required. This is the first robotics program I started with. It is one of the easiest programs to encompass all of the STEM skills. Since there is no kit the students are free to brainstorm what available materials are needed to create a functioning Remote Operated Vehicle. Since the robot must be submerged there are more complications that the students have to work through. Our program has been very competitive using very simple design and components. Most of the time the ROV is comprised of PVC pipe and boat bilge motors. This is strictly remote operated and the ROV will have cameras with which to function. This program is remotely driven through a tether with any programming portions used for sensors to gather mission specific data. This is done at both the middle and high school levels.

In the last 5 years our team of 6th to 8th grade students have successfully competed and won many regional events. Most of our focus has been the MATE underwater ROV contest. This competition is one of the most affordable. You can build your robot out of PVC pipe and boat bilge motors. Since we are an after school program this works well within our budget. In addition the middle school has had the honor to go to many international championship events against better funded high school and colleges and have placed quite well!

In my second year running the high school program we have just recently won the Vex regional competition and are to compete in the world championship in April in Florida.

All these diverse competitions have created many opportunities for our students. The competitions focus on building life skills such as: teamwork, communication, problem solving, time scheduling, fundraising, public awareness on top of the standard STEM skills. At the international level the high placing teams have many scholarships and internships available that would not have been available to them otherwise.

Sadly with the economy the schools are not funding these programs. These programs are presenting the children of Hawaii with high tech ideas and careers not before thought available to them. With jobs of the future not even heard of yet, these programs really need to be funded properly to generate the interest.

Fundraising is one of the hardest parts of this program. Taking time away from what the students want to do and learn. In addition it takes time away from instruction. Beating the bushes for enough money to buy the needed materials to be able to function is hurting the

program. The students do need to be aware of the costs of production and be responsible for it, but not to the point of it taking most of the limited time that is available to them.

Thank you for your time and consideration,
Any questions please feel free to contact me

Mike Hauck

Computer Technician / Technology Coordinator
Kealakehe Intermediate School
74-5062 Onipa'a Street
Kailua-Kona, HI 96740
phone: 808-327-4314 x309
fax: 808-327-4315



From: mailinglist@capitol.hawaii.gov
To: [EDTTestimony](#)
Cc: serenaon@hailischool.org
Subject: Testimony for SB1120 on 2/4/2011 1:15:00 PM
Date: Friday, February 04, 2011 8:58:33 AM

Testimony for EDT/EDU 2/4/2011 1:15:00 PM SB1120

Conference room: 016
Testifier position: comments only
Testifier will be present: No
Submitted by: Serena O'Neill
Organization: Individual
Address: 190 Ululani St Hilo Hawaii
Phone: 8089615026
E-mail: serenaon@hailischool.org
Submitted on: 2/4/2011

Comments:
To the Senate~

Our state has been blessed by the drive of specific educators and organizations to drive robotics programs across the state. Hawaii has a reputation of robotics excellence not only in our country but in other parts of the world. Funding for these programs is essential! Finances allows small private schools like Haili to teach our children about engineering. Please continue allocating funds to support robotics programs as it not only furthers our students ecuation and understanding of science and engineering, but it allows our state to be on the cutting edge of technology, creating future industry and jobs within the state.

Thank you,
Serena O'Neill
7th grade teacher at Haili Christian School

**Personal Testimony Presented Before the
House Committees on Economic Development and Technology and Education**

February 4, 2011, 1:15PM
Conference Room 016

By
Amber Imai
Undergraduate Student
University of Hawai'i at Manoa, College of Engineering

SB1120 – RELATED TO THE ECONOMY

Chair Representatives Fukunaga and Tokuda and Members of the Committees

My name is Amber Imai, Undergraduate Student at the University of Hawaii, College of Engineering.

I appreciate the opportunity to provide testimony **in support of SB1120** and the Legislature's commitment to STEM education and technology workforce development.

And these are the reasons why:

- As a student, both in grade school and college, I had a very hard time understanding concepts that I could not relate to real world applications. If my teachers did not have access to various devices, most of which they purchased with their own salary to aid their lessons, I would have lost interest in science and math completely. By providing teachers with the tools to help relate real world situations to the lessons they teach, many more students will be interested in a STEM related field.
- Many of Hawaii's teachers did not grow up in the age of technology. They spend hours outside of work planning lessons and grading papers, therefore, the last thing they want to do in their spare time is figure out a gadget which would complicate their lesson. By creating tutorials on how to use these science tools and integrate them into the lesson plans, the teachers who are uncomfortable with these tools will be able to quickly familiarize themselves with the device and use different types of media (paper or video tutorials) to teach their class how to use the device.
- In my experience, I have personally worked with teachers who do not regularly use technology in the classroom. Through meetings and email, I was able to get an idea of what the teacher wanted to get out of the tutorial and how to incorporate it into the lesson plan. The main concern that the teachers had was tech support, they wanted to be reassured that if they needed help, they could contact someone to assist them with the lesson in the case that they encounter a new problem. They were relieved when we assured them that we would be able to help them if they needed the help.

Thank you for the opportunity to share with you these thoughts and provide this supporting testimony.

LATE

From: mailinglist@capitol.hawaii.gov
To: [EDTTestimony](#)
Cc: watanabe@ifa.hawaii.edu
Subject: Testimony for SB1120 on 2/4/2011 1:15:00 PM
Date: Friday, February 04, 2011 6:28:55 AM

Testimony for EDT/EDU 2/4/2011 1:15:00 PM SB1120

Conference room: 016
Testifier position: support
Testifier will be present: No
Submitted by: Darryl Watanabe
Organization: Individual
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Phone: 808-981-2981
E-mail: watanabe@ifa.hawaii.edu
Submitted on: 2/4/2011

Comments:



From: mailinglist@capitol.hawaii.gov
To: [EDTTestimony](#)
Cc: koenig@hawaiiantel.net
Subject: Testimony for SB1120 on 2/4/2011 1:15:00 PM
Date: Friday, February 04, 2011 12:39:29 PM

Testimony for EDT/EDU 2/4/2011 1:15:00 PM SB1120

Conference room: 016
Testifier position: support
Testifier will be present: No
Submitted by: George Koenig
Organization: Individual
Address: Ainako Avenue Hilo, Hawaii
Phone:
E-mail: koenig@hawaiiantel.net
Submitted on: 2/4/2011

Comments:



From: mailinglist@capitol.hawaii.gov
To: [EDTTestimony](#)
Cc: barnard_lisa@yahoo.com
Subject: Testimony for SB1120 on 2/9/2011 2:45:00 PM
Date: Saturday, February 05, 2011 8:30:59 AM

Testimony for EDT/EDU 2/9/2011 2:45:00 PM SB1120

Conference room: 016
Testifier position: support
Testifier will be present: No
Submitted by: Lisa Barnard
Organization: Individual
Address:
Phone: 808-985-7217
E-mail: barnard_lisa@yahoo.com
Submitted on: 2/5/2011

Comments:

Please continue to allocated funding for STEM and Robotics projects and instruction for our students.
We need to keep our students engaged in learning in these areas to help them in their future!

I am a parent and a teacher and I know how important these programs are to our young people.

To: Senate Economic Development and Technology, Education Committee Members

From: Malcolm Kirkpatrick

In re: SB 1120

2011-02-04

Please DO NOT support SB 1120 as written. This bill would appropriate an undetermined amount of money for uncertain and ill-defined benefit. This bill subsidizes a demonstrably failed enterprise in pursuit of its stated goal. As governor Abercrombie observed in his State of the State address, the government of Hawaii faces a serious budget deficit. This is not the time for expensive new projects. Further, the Hawaii State government's attempts at economic planning have failed repeatedly. You take resources from profitable enterprises and subsidize loss-making enterprises and wasteful bureaucracy.

The Hawaii DOE operates one of the worst school systems in the US. Its employees misrepresent DOE performance and the DOE budget. We have seen schools called "Blue Ribbon schools one year and "failing" by NCLB measures the next. We have heard administrators complain of budget cuts when the DOE budget was growing, in absolute and per pupil terms. They are not to be trusted with one more dime of taxpayer money. Your Auditor repeatedly finds misallocation of funds and deceptive accounting within the DOE.

This bill provides: SECTION 6. There is appropriated out of the general revenues of the State of Hawaii the sum of \$ _____ or so much thereof as may be necessary for fiscal year 2011-2012 and the same sum or so much thereof as may be necessary for fiscal year 2012-2013 for the development of professional development programs in the science, technology, engineering, and mathematics disciplines for practicing teachers. The sums appropriated shall be expended by the University of Hawaii for the purposes of this part."

If the purpose of this bill is NOT a subsidy to the make-work program we call "public education", why are funds restricted to the government-operated university system?

This bill provides:...SECTION 7. There is appropriated out of the general revenues of the State of Hawaii the sum of \$ _____ or so much thereof as may be necessary for fiscal year 2011-2012 and the same sum or so much thereof as may be necessary for fiscal year 2012-2013 for the transition to teaching program to provide stipends to attract science, technology, engineering, and mathematics graduates to the University of Hawaii post baccalaureate certificate in secondary education program."

1. If this bill is NOT a subsidy to the make-work program we call "public education", why are funds restricted to the government-operated university system?

2. No evidence supports policies which require that teachers have College of Education credits on their transcript. Abundant evidence supports policies which give to Principals the power to determine for themselves the credential requirements of their staff.



From: mailinglist@capitol.hawaii.gov
To: [EDTTestimony](#)
Cc: mark.r.chun@gmail.com
Subject: Testimony for SB1120 on 2/4/2011 1:15:00 PM
Date: Friday, February 04, 2011 8:27:26 AM

Testimony for EDT/EDU 2/4/2011 1:15:00 PM SB1120

Conference room: 016
Testifier position: support
Testifier will be present: No
Submitted by: Mark Chun
Organization: Individual
Address: 250 Edita Street Hilo, HI
Phone: 1-808-934-7003
E-mail: mark.r.chun@gmail.com
Submitted on: 2/4/2011

Comments:

I am emailing to support State funding of STEM and robotics education programs. My son's eye's "light up" around all things "robotic". His interest via summer robotics camps (e.g. Hilo High School's excellent summer robotics program) have also inspired me to take part as a volunteer for an underwater robotics team at his elementary school. Via STEM and robotics education programs we have an opportunity to educate our children and give them experiences we wish we had when we were kids. Let's not miss this opportunity.

Sincerely,
-Mark Chun

Testimony for EDT/EDU 2/9/2011 2:45:00 PM SB1120

Conference room: 016
Testifier position: support
Testifier will be present: No
Submitted by: Perry Argyris
Organization: Individual
Address:
Phone:
E-mail:
Submitted on: 2/7/2011

Comments:
A very important and valuable educational program.

From: Philip Blackman mentor@alum.MIT.edu 9413901
To: Senate Committee on Economic Development and Technology and
Senate Committee on Education
(Chair Fukunaga, Chair Tokuda, Vice Chair Wakai, Vice Chair Kidani and committee members)
Date: 9 February 2011
Subject: Amendment to SB1120: a bill to appropriate funds for science-, technology-,
engineering- and math-related programs

I understand the committees received favorable testimony on each component presented by stakeholders of that component. However no agency reflected on the overall mix of programs, the fairness by which those groups, to the exclusion of others, came to be included for consideration of funds.

My testimony at the 4 February hearing urged wording that would establish oversight review responsibility, fair and open solicitation of ideas and projects, and competitive awards unrestricted and open to private and government entities. I believe the measures of effectiveness ought to be agreed to at time of award, and a report on expenditures and effectiveness measures be simple and uniform.

The projects currently listed in SB1120 were initiated thru legislative special funding dating back to 2007 and Act 111. There was a concern that the process of adopting new initiatives within the DOE to address statistically verified STEM deficiencies warranted this legislative intervention. SB 1120 with an appropriate amendment can wean the legislature from this role.

The amendment suggestion would mandate: The Department of Education is assigned oversight responsibility arising under SB1120, is given the requirement to publish and quantify in various measurable parameters, DOE STEM deficiencies, and to conduct a fair, expedient, and open (private and government) competitive solicitation of proposals and grant awards in the second year to address those deficiencies. The bill will contain a lump sum equal or more than the total for the first year, to be expended by the process identified in the proceeding sentence completed by the beginning of the second year. Allocation of funds during the current year will be by the Legislature as specified.

I recognize that the wording may be incomplete in format, clarity, and content. I hope the bill might be tabled long enough that an amendment can be crafted to fairly address concerns the SB1120 is a bill of earmarks.

MAHALO

The light sculpture called “the sun” hanging in the House chambers is based on a computer rendered design from software I developed, and the fabrication instructions asked for by the artist Otto Piene. The light is symbolic of my long embrace of STEM. Thank you for your consideration of an amendment to SB1120.

From: mailinglist@capitol.hawaii.gov
To: [EDTTestimony](#)
Cc: bobleehnl@msn.com
Subject: Testimony for SB1120 on 2/4/2011 1:15:00 PM
Date: Friday, February 04, 2011 5:04:42 AM

Testimony for EDT/EDU 2/4/2011 1:15:00 PM SB1120

Conference room: 016
Testifier position: support
Testifier will be present: No
Submitted by: Robert Lee
Organization: Individual
Address: 98-1775 Halakea St Aiea, HI 96701
Phone: 8084861488
E-mail: bobleehnl@msn.com
Submitted on: 2/4/2011

Comments:

Supporting all robotics programs in the State of Hawaii is the quickest and most effective method of improving science, technology, engineering, and math in our schools and with our young people.

**DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT AND TOURISM
RESEARCH & ECONOMIC ANALYSIS DIVISION**

Response to the Legislature Regarding

HOUSE CONCURRENT RESOLUTION 297 CD 1, 2010

**REQUESTING REPORTS ON THE ECONOMIC VALUE OF EXPANDED WORKFORCE
DEVELOPMENT CAPACITY AND STEM INITIATIVES.**

House Concurrent Resolution 297 CD 1, 2010 Requested, among other things, that “a report on the economic value of expanded workforce development capacity be provided by the Department of Business, Economic Development, and Tourism.” The resolution further elaborated that the report should address “the economic value of expanded workforce development capacity of emerging industries in defense and dual use, astronomy, engineering, aquaculture, biotech, digital media, and related industries.”

In order to address this task, it was necessary for DBEDT to make some assumptions about the intent of that particular request in HCR 297, which was not elaborated on in the *Where As* section of the Resolution.

It is assumed that the request is linked with the primary thrust of HCR 297, which noted the Legislature’s support for, and interest in the expansion of educational programs focused on developing skills in Science, Technology, Engineering and Math (STEM skills). Based on this Legislative interest, the resolution requested updated reports on the progress towards this objective by the agencies and organizations conducting STEM initiatives.

This response also assumes that the specific request for the value of expanded workforce capacity is meant to provide the Legislature with some measure of the economic importance of how the successful expansion of STEM training might affect economic growth and development, particularly in emerging technology industries like the ones cited in the resolution.

STEM AND ECONOMIC DIVERSIFICATION

Measuring the ultimate economic impact of STEM programs is a challenging request that can, unfortunately be addressed only partially within the time limits of HCR 297, data availability and resource constraints of the current budget and staffing. However, some information has been assembled that may be of help to the Legislature.

The importance of increasing the proportion of workers in the economy with strong technical skills has been recognized for some time. Technical skills, particularly those concentrated in Science, Engineering, Technology and Mathematics, commonly known as STEM skills, are the key to raising living standards and for America’s competitiveness in the world economy. For Hawaii, an increasingly more skilled workforce opens up opportunities to diversify the economy into technology and innovation industries.

As HCR 297 noted, numerous efforts are underway involving many organizations and educational agencies to interest and engage elementary and secondary students in

activities and curricula that will build stronger STEM skills among high school graduates. Ultimately, what these efforts should lead to is an increasing proportion of post secondary degrees and certificate programs in formal STEM disciplines. That will increase the supply of labor force entrants with the technical skills needed to support the expanding technology, innovation, health care and other industries where these skills are pivotal for growth.

STEM OCCUPATIONS IN TECHNOLOGY AND THE ECONOMY

The Occupational Information Network (O*NET) sponsored by the U.S. Department of Labor, is the authoritative source for identifying occupations requiring STEM skills. The detailed list of those occupations includes more than 160 very specific occupations in which the skills of science, technology, engineering and math are the prime tools of the job (See Attachment 1).¹

Using the O*NET occupational codes (with some adjustments), DBEDT has utilized its data sources to compile the number of STEM jobs in the economy and how much the technology sector accounts for STEM labor force demand.² Summary results are shown in Table 1 below.³

Table 1. Distribution of STEM Jobs, Technology and Non Technology, 2009

	Hawaii Economy Civ. Jobs	Technology Sector	
		Civ. Jobs	% in Tech
All Occupations	839,393	25,412	3.0%
STEM	68,483	9,812	14.3%
Non STEM	770,910	15,600	2.0%
% In STEM Occupations	8.2%	38.6%	

Source: DBEDT, EMSI Data

The Table shows that while jobs in STEM occupations account for about 8 percent of total jobs in Hawaii, they account for nearly 39% of the jobs in the Technology Sector.⁴ Moreover, while the Technology Sector accounts for just a little over 3% of the workforce, including self employed and proprietors, it utilized 14% of Hawaii's STEM workforce.

The proportion of STEM jobs in technology verses the economy as a whole is interesting. It shows that while technology is a heavy user of STEM-skilled workers, the bulk of Hawaii's STEM workforce (86%) is employed outside of the Technology Sector.

It is also interesting that while the Technology Sector has a significantly higher proportion of STEM jobs in the economy, that proportion is not as overwhelming as one

¹ However, there are many other occupations, such as the health professions, that are not classified as STEM occupations, but which do require a strong background in elements of science and math education.

² The principal data source is provided by Economic Modeling Services, Inc. (EMSI) which utilizes a variety of official primary statistics sources.

³ These data are part of a forthcoming report by DBEDT, entitled *Hawaii's Technology Workforce*.

⁴ The Technology Sector was redefined for Hawaii through a 2007 joint project between the Hawaii Science and Technology Institute (HiSciTech), DBEDT, and other stakeholders. Updated measures of the technology sector may be found at: http://hawaii.gov/dbedt/info/economic/data_reports/emerging-industries.

might have thought. Instead of 100%, 75% or even 50% of the jobs, STEM occupations represent less than 40% of the Technology Sector’s overall job count. This indicates that while core technical skills may be essential for technology, the industry still relies heavily on non-STEM occupations.

VALUE OF EXPANDED WORKFORCE DEVELOPMENT CAPACITY

The economic impact of expanding workforce development capacity, leading to an increase in the supply of STEM trained workers depends upon a large number of factors.⁵ It would be necessary to conduct a formal, study with adequate resources to develop the new data and information to more fully address this question, especially for difficult-to-measure areas such as dual use and other market-defined activities.

However, if we assume that an overall increase in STEM training capacity results in an increase in the proportion of jobs in STEM occupations in Hawaii’s economy, we can make some partial inferences about potential economic value. In particular, we can estimate the increase in wages and salaries generated by a higher proportion of STEM jobs. One way to do this is by projecting how much of an increase in average and overall wages and salaries might be generated by different growth scenarios for STEM occupations over the next decade.

The base scenario is set out in Table 2 below. The projection for 2009 to 2019 is for an additional 73,800 jobs in Hawaii’s economy. This is a very conservative BLS-based projection, which assumes an annual increase in jobs per year of less than 1%. In 2009, 8.2% of all jobs were in occupations classified by O*NET as STEM related. The annual average wage for STEM occupations in 2009 was estimated at \$50,731, while non-STEM jobs averaged a lower \$39,634.⁶ This resulted in an overall average wage for all occupations of \$40,539 in 2009.

Table 2. Base Scenario

Scenario	Description	2009 Jobs	2019 Jobs	Change in Jobs	Aver. Ann. % chng in jobs	Est Ann Ave Wages 2009	Implied Ann Ave Wages 2019 (In 2009 dollars)	Change in Ave Wages from Base Scenario 2009-19	Change in Total Wages 2019 (\$bil.)
Base	All Occupations	839,393	913,182	73,789	0.8%	\$40,539	\$40,539	\$0	\$37.0 bil.
	Total STEM	68,483	74,503	6,020	0.8%	\$50,731	\$50,731		\$3.8 bil.
	% STEM	8.2%	8.2%	8.2%					
	Implied Non STEM	770,910	838,679	67,769	0.8%	\$39,634	\$39,634		\$33.2 bil.

Source: DBEDT, Data and Projections from EMSI.

If the proportion of STEM occupations remains the same at 8.2%, the additional 73,800 jobs will increase total real wages and salaries (from about \$34 billion in 2009 to \$37 billion in 2019, measured in constant 2009 dollars). However, there will be no real

⁵ For instance, would expanded capacity attract students? Would industry fully absorb more trained workers? What industries would absorb what STEM specialties? Would they be mainly technology industries or other industries that currently utilize 86% of the STEM workforce? How much more output value would be generated by a given increase in STEM occupations for a given industry?

⁶ Based on annualized hourly average wages for all workers in the occupation

gain in the overall average wage since the proportion of higher-paying STEM jobs remains constant.⁷

What we would like to know is how much more total and average wages would increase if more STEM graduates were supplied and absorbed into the economy. Scenarios 2 and 3 explore those implications. In these scenarios the overall increase in jobs is held constant for the 2009 to 2019 period, but the proportion of STEM jobs is allowed to increase.

Scenario 2 in Table 3 shows what might happen if the proportion of STEM jobs in Hawaii’s economy increased to the national proportion (9.8%) by 2019.⁸

Table 3, Scenario 2

Senario	Description	2009 Jobs	2019 Jobs	Change in Jobs	Aver. Ann. % chng in jobs	Est Ann Ave Earnings 2009	Implied Ann Ave Earnings 2019 (In 2009 dollars)	Change in Ave Earnings from Base Scenario 2009-19	Change in Total Earnings 2019 (\$bil.)
2	All Occupations	839,393	913,182	73,789	0.8%	\$40,539	\$40,726	\$187	\$170 mil.
	Total STEM	68,483	89,851	21,368	2.8%	\$50,731	\$50,731		\$779 mil.
	% STEM	8.2%	9.8%	29.0%					
	Implied Non STEM	770,910	823,331	52,421	0.7%	\$39,634	\$39,634		-\$608 mil.

Source: DBEDT, Data and Projections from EMSI.

In this scenario, 29% of the gain in jobs over the 2009 to 2019 period would be accounted for by STEM occupations. The average real wages of STEM and non STEM jobs remain constant, but the greater proportion of higher-paid STEM workers would raise the overall average by \$187 per year. Total real wages in 2019 would be about \$170 million more than had STEM and non STEM jobs increased proportionately as in the Base Scenario.

Scenario 2 is based on a modest increase in the proportion of STEM jobs from 8.2% to 9.8% of the workforce.

Scenario 3 in Table 4 takes the illustration to its maximum. This scenario explores the impact on wages if all of the additional jobs under the very conservative EMSI/BLS projections were to be in STEM occupations.

Of course, it is unlikely, but if all the roughly 73,800 projected jobs created between 2009 and 2019 were to be in STEM occupations, the STEM proportion would increase from 8.2% in 2009 to 15.6% of all jobs in 2019.

⁷ For presentation purposes in this illustration, it is assumed that there are no overall gains in real wages from productivity. There would likely be gains through productivity, but introducing estimates for those gains here would cloud the comparison of how changing proportions of STEM and non STEM jobs impacts total and average wages.

⁸ EMSI/BLS base projections expect Hawaii’s proportion of STEM workers to increase marginally to 8.4% by 2019. The same projections for the U.S. show no change in the 9.8% proportion over the 2009 to 2019 period.

With the average wage still held constant, the new mix of jobs would raise the overall average annual wage by \$824 per year over the base scenario of a constant STEM proportion.

In terms of total wages and salaries paid, there would be \$752 million more per year economy-wide under this scenario than under the base scenario.

Table 4. Scenario 3

Scenario	Description	2009 Jobs	2019 Jobs	Change in Jobs	Aver. Ann. % chng in jobs	Est Ann Ave Earnings 2009	Implied Ann Ave Earnings 2019 (In 2009 dollars)	Change in Ave Earnings from Base Scenario 2009-19	Change in Total Earnings 2019 (\$bil.)
3	All Occupations	839,393	913,182	73,789	0.8%	\$40,539	\$41,363	\$824	\$752 mil.
	Total STEM	68,483	142,272	73,789	7.6%	\$50,731	\$50,731		\$3.4 bil.
	% STEM	8.2%	15.6%	100.0%					
	Implied Non STEM	770,910	770,910	(0)	0.0%	\$39,634	\$39,634		-\$2.7 bil.

Source: DBEDT, Data and Projections from EMSI.

SUMMARY & CONCLUSIONS

This brief report has attempted to provide some information on the potential economic value of increased workforce development capacity for high skilled, STEM occupations. It was noted that time and resource constraints precluded a thorough, formal study of potential impacts.

Using information available from current data and studies in progress, this report showed that under very conservative assumptions, bringing Hawaii's proportion of STEM occupations just to the national average by 2019 could generate nearly \$190 per year more in average wages in the economy overall and increase total wages by \$170 million. Boosting the proportion of STEM occupation even more would result in proportionally more gain in both average and total wages.

Conservative as the projections may be, the key to determining if significant gains in incomes would result from an increase in the capacity to train STEM workers lies in what STEM occupations are targeted and how private industry would respond to the increased supply of STEM workers, as well as a number of other factors.

On the broader question of how the expansion of STEM training might affect economic growth and development, particularly in emerging technology industries like the ones cited in HCR 297, a quantitative answer cannot be provided at this time, pending a thorough study. It is noted, however, that the research work of the Hawaii Workforce Development Council, as well as organizations such as the Hawaii Institute for Public Affairs (HIPA), and Enterprise Honolulu has shown education levels, particularly in technical areas, to be the key ingredient supporting a more productive economy and higher living standards.

ATTACHMENT 1. ALL O*NET STEM OCCUPATIONS

Occupational Code	Occupation	STEM Discipline
13-2011.01	Accountants	Computer Science
15-2011.00	Actuaries	Mathematics
17-3021.00	Aerospace Engineering and Operations Technicians	Engineering
17-2011.00	Aerospace Engineers	Engineering
17-2021.00	Agricultural Engineers	Engineering, Life Sciences
25-1041.00	Agricultural Sciences Teachers, Postsecondary	Life Sciences
19-4011.01	Agricultural Technicians	Life Sciences
49-3011.00	Aircraft Mechanics and Service Technicians	Engineering
45-2021.00	Animal Breeders	Life Sciences
19-1011.00	Animal Scientists	Life Sciences
17-1011.00	Architects, Except Landscape and Naval	Engineering
17-3011.01	Architectural Drafters	Engineering
25-1031.00	Architecture Teachers, Postsecondary	Engineering
19-2011.00	Astronomers	Physics/Astronomy
19-2021.00	Atmospheric and Space Scientists	Physics/Astronomy
25-1051.00	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary	Geosciences, Mathematics, Physics/Astronomy
13-2011.02	Auditors	Computer Science
17-3027.01	Automotive Engineering Technicians	Engineering
49-3023.01	Automotive Master Mechanics	Engineering
49-3023.02	Automotive Specialty Technicians	Engineering
49-2091.00	Avionics Technicians	Engineering
17-2199.01	Biochemical Engineers	Chemistry
19-1021.00	Biochemists and Biophysicists	Chemistry, Life Sciences, Physics/Astronomy
11-3051.03	Biofuels Production Managers	Life Sciences
11-9041.01	Biofuels/Biodiesel Technology and Product Development Managers	Environmental Science, Life Sciences
43-9111.01	Bioinformatics Technicians	Life Sciences
25-1042.00	Biological Science Teachers, Postsecondary	Life Sciences
19-4021.00	Biological Technicians	Life Sciences
19-1020.01	Biologists	Life Sciences
11-3051.04	Biomass Production Managers	Life Sciences
17-2031.00	Biomedical Engineers	Engineering
15-2041.01	Biostatisticians	Life Sciences
11-9199.11	Brownfield Redevelopment Specialists and Site Managers	Environmental Science
15-1099.10	Business Intelligence Analysts	Computer Science
25-1011.00	Business Teachers, Postsecondary	Computer Science, Mathematics
17-2041.00	Chemical Engineers	Chemistry, Engineering
51-9011.00	Chemical Equipment Operators and Tenders	Chemistry
51-8091.00	Chemical Plant and System Operators	Chemistry
19-4031.00	Chemical Technicians	Chemistry, Life Sciences
25-1052.00	Chemistry Teachers, Postsecondary	Chemistry, Geosciences

19-2031.00	Chemists	Chemistry, Physics/Astronomy
17-3011.02	Civil Drafters	Engineering
17-3022.00	Civil Engineering Technicians	Engineering
17-2051.00	Civil Engineers	Engineering
19-2041.01	Climate Change Analysts	Environmental Science
19-3031.02	Clinical Psychologists	Life Sciences
15-1011.00	Computer and Information Scientists, Research	Computer Science
11-3021.00	Computer and Information Systems Managers	Computer Science
17-2061.00	Computer Hardware Engineers	Computer Science, Engineering
15-1021.00	Computer Programmers	Computer Science
25-1021.00	Computer Science Teachers, Postsecondary	Computer Science
15-1071.01	Computer Security Specialists	Computer Science
15-1031.00	Computer Software Engineers, Applications	Computer Science, Engineering
15-1032.00	Computer Software Engineers, Systems Software	Computer Science, Engineering
15-1041.00	Computer Support Specialists	Computer Science
15-1051.00	Computer Systems Analysts	Computer Science
11-9021.00	Construction Managers	Engineering
35-2012.00	Cooks, Institution and Cafeteria	Life Sciences
13-1051.00	Cost Estimators	Engineering
19-3031.03	Counseling Psychologists	Life Sciences
11-9011.02	Crop and Livestock Managers	Life Sciences
15-1061.00	Database Administrators	Computer Science
29-2051.00	Dietetic Technicians	Life Sciences
29-1031.00	Dietitians and Nutritionists	Life Sciences
17-3023.03	Electrical Engineering Technicians	Computer Science, Engineering
17-3029.02	Electrical Engineering Technologists	Engineering
17-2071.00	Electrical Engineers	Engineering
17-3029.03	Electromechanical Engineering Technologists	Engineering
51-2023.00	Electromechanical Equipment Assemblers	Engineering
17-3023.01	Electronics Engineering Technicians	Computer Science, Engineering
17-3029.04	Electronics Engineering Technologists	Engineering
17-2072.00	Electronics Engineers, Except Computer	Engineering
11-9041.00	Engineering Managers	Chemistry, Computer Science, Engineering, Geosciences, Life Sciences, Physics/Astronomy
25-1032.00	Engineering Teachers, Postsecondary	Chemistry, Computer Science, Engineering, Geosciences, Life Sciences, Physics/Astronomy
13-1041.01	Environmental Compliance Inspectors	Life Sciences
17-3025.00	Environmental Engineering Technicians	Engineering, Environmental Science
17-2081.00	Environmental Engineers	Engineering, Environmental Science
19-2041.02	Environmental Restoration Planners	Life Sciences
19-4091.00	Environmental Science and Protection Technicians, Including Health	Environmental Science
25-1053.00	Environmental Science Teachers, Postsecondary	Environmental Science
19-2041.00	Environmental Scientists and Specialists, Including Health	Environmental Science
19-1041.00	Epidemiologists	Life Sciences

45-4021.00	Fallers	Life Sciences
25-9021.00	Farm and Home Management Advisors	Life Sciences
11-9012.00	Farmers and Ranchers	Life Sciences
13-2099.01	Financial Quantitative Analysts	Computer Science
17-2111.02	Fire-Prevention and Protection Engineers	Engineering
45-1011.07	First-Line Supervisors/Managers of Agricultural Crop and Horticultural Workers	Life Sciences
45-1011.08	First-Line Supervisors/Managers of Animal Husbandry and Animal Care Workers	Life Sciences
45-1011.06	First-Line Supervisors/Managers of Aquacultural Workers	Life Sciences
35-1012.00	First-Line Supervisors/Managers of Food Preparation and Serving Workers	Life Sciences
33-3031.00	Fish and Game Wardens	Life Sciences
45-3011.00	Fishers and Related Fishing Workers	Life Sciences
51-3092.00	Food Batchmakers	Life Sciences
19-4011.02	Food Science Technicians	Life Sciences
19-1012.00	Food Scientists and Technologists	Life Sciences
19-4093.00	Forest and Conservation Technicians	Life Sciences
45-4011.00	Forest and Conservation Workers	Engineering, Life Sciences
19-1032.00	Foresters	Engineering, Life Sciences
19-1029.03	Geneticists	Life Sciences
17-1022.01	Geodetic Surveyors	Engineering
19-2042.00	Geoscientists, Except Hydrologists and Geographers	Geosciences
27-1024.00	Graphic Designers	Computer Science
25-1071.00	Health Specialties Teachers, Postsecondary	Life Sciences, Physics/Astronomy
25-1192.00	Home Economics Teachers, Postsecondary	Life Sciences
17-2112.01	Human Factors Engineers and Ergonomists	Engineering
19-2043.00	Hydrologists	Geosciences
17-3026.00	Industrial Engineering Technicians	Engineering
17-2112.00	Industrial Engineers	Engineering
17-2111.01	Industrial Safety and Health Engineers	Engineering
19-3032.00	Industrial-Organizational Psychologists	Life Sciences
45-4023.00	Log Graders and Scalers	Life Sciences
45-4022.00	Logging Equipment Operators	Life Sciences
17-2199.04	Manufacturing Engineers	Engineering
17-2121.02	Marine Architects	Engineering
17-2121.01	Marine Engineers	Engineering
17-2131.00	Materials Engineers	Engineering
19-2032.00	Materials Scientists	Engineering
25-1022.00	Mathematical Science Teachers, Postsecondary	Mathematics
15-2091.00	Mathematical Technicians	Mathematics
15-2021.00	Mathematicians	Mathematics
17-3027.00	Mechanical Engineering Technicians	Engineering
17-3029.07	Mechanical Engineering Technologists	Engineering
17-2141.00	Mechanical Engineers	Engineering
17-2199.05	Mechatronics Engineers	Computer Science, Engineering

19-1042.00	Medical Scientists, Except Epidemiologists	Life Sciences
19-1022.00	Microbiologists	Life Sciences
17-2199.06	Microsystems Engineers	Engineering
17-2151.00	Mining and Geological Engineers, Including Mining Safety Engineers	Engineering
19-1029.02	Molecular and Cellular Biologists	Life Sciences
17-2199.09	Nanosystems Engineers	Physics/Astronomy
11-9121.00	Natural Sciences Managers	Chemistry, Computer Science, Engineering, Geosciences, Life Sciences, Mathematics, Physics/Astronomy
15-1081.00	Network Systems and Data Communications Analysts	Computer Science
19-3039.01	Neuropsychologists and Clinical Neuropsychologists	Life Sciences
17-2161.00	Nuclear Engineers	Engineering
19-4051.01	Nuclear Equipment Operation Technicians	Engineering, Physics/Astronomy
29-2033.00	Nuclear Medicine Technologists	Physics/Astronomy
19-4051.02	Nuclear Monitoring Technicians	Engineering, Physics/Astronomy
51-4012.00	Numerical Tool and Process Control Programmers	Computer Science
11-9011.01	Nursery and Greenhouse Managers	Life Sciences
15-2031.00	Operations Research Analysts	Computer Science, Mathematics
19-1031.03	Park Naturalists	Life Sciences
17-2171.00	Petroleum Engineers	Engineering
17-2199.07	Photonics Engineers	Physics/Astronomy
19-2012.00	Physicists	Mathematics, Physics/Astronomy
25-1054.00	Physics Teachers, Postsecondary	Mathematics, Physics/Astronomy
19-4099.02	Precision Agriculture Technicians	Life Sciences
17-2111.03	Product Safety Engineers	Engineering
19-3039.00	Psychologists, All Other	Life Sciences
25-1066.00	Psychology Teachers, Postsecondary	Life Sciences
19-1031.02	Range Managers	Life Sciences
13-2099.02	Risk Management Specialists	Mathematics
19-3031.01	School Psychologists	Life Sciences
13-1199.02	Security Management Specialists	Computer Science
19-1013.00	Soil and Plant Scientists	Chemistry, Life Sciences, Physics/Astronomy
19-1031.01	Soil and Water Conservationists	Life Sciences
15-2041.00	Statisticians	Life Sciences, Mathematics
15-1081.01	Telecommunications Specialists	Computer Science
17-2051.01	Transportation Engineers	Engineering
19-3099.01	Transportation Planners	Engineering
53-6051.07	Transportation Vehicle, Equipment and Systems Inspectors, Except Aviation	Engineering
17-2199.02	Validation Engineers	Engineering
15-1099.13	Video Game Designers	Computer Science
11-9121.02	Water Resource Specialists	Engineering
17-2051.02	Water/Wastewater Engineers	Engineering
49-9099.02	Wind Turbine Service Technicians	Engineering
19-1023.00	Zoologists and Wildlife Biologists	Life Sciences

Source: O*NET On Line, All STEM Disciplines, <http://online.onetcenter.org/> November 2010.

HOUSE CONCURRENT RESOLUTION

REQUESTING REPORTS ON THE ECONOMIC VALUE OF EXPANDED WORKFORCE
DEVELOPMENT CAPACITY AND STEM INITIATIVES.

WHEREAS, in 2007, the National Governors Association made improving the nation's economic competitiveness through innovation its primary focus, and in a report titled, "A Benchmarking of the Hawaii Educational System," Monitor Group and the National Governors Association Center for Best Practices profiled how Hawaii's educational system was performing relative to national averages; and

WHEREAS, although Hawaii's high school graduation rate is close to the national average, its postsecondary completion rate is below the national average, and significantly below the highest-performing states; and

WHEREAS, the 2007 Legislature strongly endorsed initiatives related to science, technology, engineering, and math (STEM) fields, and creative media education as the most practical, hands-on means of increasing students' interest in pursuing math and science and technology careers; and

WHEREAS, emphasizing the need to build upon solid performance outcomes, the Legislature enacted:

- (1) Act 111, Session Laws of Hawaii 2007, which expanded existing STEM programs like robotics (including FIRST Lego League, Junior FIRST Lego League, botball, underwater ROV, VEX, Micro-Robot, and robotics camps) and Research Experiences for Teachers - Middle School; and
- (2) Act 271, Session Laws of Hawaii 2007, which expanded the Environmental and Spatial Technology program (Project EAST);

and

WHEREAS, the initial legislative targets for 2007-2008 were to double the existing 48 STEM, Research Experiences for Teachers - Middle School, Project EAST, and robotics programs within public schools to achieve a level of 84 school initiatives, and these goals were far exceeded during 2008-2010; now, therefore,

BE IT RESOLVED by the House of Representatives of the Twenty-fifth Legislature of the State of Hawaii, Regular Session of 2010, the Senate concurring, that a report on the economic value of expanded workforce development capacity be provided by the Department of Business, Economic Development, and Tourism (DBEDT), which is responsible for tracking growth of emerging industries in defense and dual-use, astronomy, engineering, aquaculture, biotech, digital media, and related industries; and

BE IT FURTHER RESOLVED that an update on STEM initiatives, including Research Experiences for Teachers - Middle School, Project EAST, Hi-EST, and FIRST academies, and other robotics within Hawaii schools, is requested from the following:

- (1) University of Hawaii College of Engineering;
- (2) Department of Education;
- (3) DBEDT;
- (4) Robotics Organizing Committee; and
- (5) Economic Development Alliance of Hawaii Inc., and the Hawaii 3Ts School Technology Laboratories Fund, under section 302A-1314, Hawaii Revised Statutes;

and

BE IT FURTHER RESOLVED that these entities provide their respective written reports to the Legislature no later than 20 days prior to the convening of the 2011 Regular Session on:

- (1) The economic value of expanded workforce development capacity of emerging industries in defense and dual-use, astronomy, engineering, aquaculture, biotech, digital media, and related industries; and
- (2) The status of each entity's STEM initiatives, activities, and recommendations for long-term expansion and funding requirements;

and

BE IT FURTHER RESOLVED that certified copies of this Concurrent Resolution be transmitted to the Dean of the University of Hawaii College of Engineering; Superintendent of Education; Director of the Department of Business, Economic Development, and Tourism; Executive Director of the Robotics Organizing Committee; and Chair of the Economic Development Alliance of Hawaii Inc.



DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

LINDA LINGLE
GOVERNOR

THEODORE E. LIU
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Introduction

Through Acts 111 and 271, SLH 2007, the Legislature appropriated funds for the 2007 – 2009 biennium for the development and implementation of various STEM initiatives. This report discusses the current status of three of the programs funded under Act 111, and provides a breakdown of expenditures for each program:

- \$110,000 per year was appropriated to the Department of Business, Economic Development, & Tourism (DBEDT) to establish a business/education internship and mentorship program;
- \$175,000 per year was appropriated to the University of Hawaii (UH) for the development of professional development programs in STEM disciplines; and
- \$175,000 per year was appropriated to UH to maintain the Transition to Teaching program

In addition, this report provides a breakdown of expenditures for the \$500,000 National Governors' Association (NGA) grant, recommendations for continuing the programs described above and costs for continuing those programs for another five years, and a brief description of the Creativity Academies and MELE program and how they relate to the STEM initiatives funded under Act 111.

Current status of the business/education internship & mentorship program and recommendations for continuation/funding

Act 111, SLH 2007, provided \$110,000 for each year of the 2007 – 2009 biennium to DBEDT to establish a business/education internship and mentorship program. The purpose of this program was to establish, with the cooperation of educational institutions, internships, mentorships, and other experiential learning arrangements for Hawaii high school students and Hawaii high school graduates attending college in Hawaii or elsewhere. The goals of this program were to provide Hawaii students with experience in the working world to improve their career choices and to provide opportunities for Hawaii employers to establish relationships with students who represent an essential source of skills for Hawaii's future economic growth and prosperity.

The Act 111 funds for FY 08 were leveraged by supplementing an existing contract with the University of Hawaii for EPSCoR matching funds to establish the STEM Workforce Development Program within UH's Office of Technology Transfer and Economic Development (OTTED). Working with the Sustainable Saunders (now Sustainable UH) program a number of internship programs were developed, including the Student Sustainability Internship Program (SSIP), the Vertical Garden Program, Olelo's Youth Exchange, the U.S. Department of Energy's Real World Design Challenge (RWDC), and the Hawaii Department of Education's (HIDOE) Senior Project program. Act 111 funds appropriated for FY 09 were never released.

Although there was no legislative funding for the Workforce Development Program for FY 09 and beyond, many of the internship programs that were established continue to operate and expand. Two of these programs, RWDA and SSIP/RISE are discussed below.

Real World Design Challenge (RWDC)

The Real World Design Challenge (RWDC), which began in 2009, is an annual competition that provides high school students, grades 9-12, the opportunity to work on real world engineering challenges in a team environment. Student teams are asked to address a real world challenge that confronts the nation's leading industries. Students partner with industry mentors and utilize professional engineering software to develop solutions, which are presented at state and national-level competitions. Hawaii teams have performed very well at the national competition, capturing first place in 2009 and second place in 2010. Currently, seven Hawaii teams from six schools are registered to participate in the 2011 RWDC.

SSIP/RISE

The SSIP initiative, now called Rewarding Internships for Sustainable Employment (RISE), provides Hawaii college students paid interdisciplinary educational internships funded directly by the sponsors of each internship. Working with different private and public agencies in the State of Hawaii and coordinated by Sustainable UH, students continue to see gains in confidence, business and industry connections, and careers. Some of the current and planned internship activities from 2009 to 2012 include:

- 2 RISE interns performed a waste audit of the U.S. Coast Guard Sand Island Base and provided a 35 page report with recommendations for their 5-year refuse contract adding to savings of \$16,000/year. (2009-2010)
- 6 RISE interns performed a sustainability assessment of a Department of Education (DOE) K-6 school in Ewa Beach that included water, waste, electricity, renewable energy, and energy star assessments, as well as educational programs for the DOE students and identified \$84,000 in annual no to low cost savings. (2009-2010)

- RISE has just hired a full time staff member through an EPA grant, which will provide support to mentor 9 paid interns to perform internships with various State Agencies that support a variety of aspects of the Hawaii Clean Energy Initiative (HCEI). (2011-2012)
- 8 RISE interns will perform a sustainability assessment of a DOE Highschool (Kalani) in the Spring 2011 semester. (2011-2012)
- Multiple RISE interns will work with various private organizations including Sopogy and Ulupono in Spring 2011. (2011-2012)

The only factor limiting the growth of the RISE program, which has proven repeatedly successful, is funding, which includes a director’s salary, mentor’s salary, some equipment, and potentially intern salary. Currently, all the funding for these internships comes directly from the sponsors of the internships. The following table offers a proposed budget and more details of the program. The ideal annual amount for the program would include 14 paid internship positions making the total program cost per year around \$300,000. Funding for the administrative positions and necessary equipment is estimated at \$200,000 per year. In both cases, legislative funding could be used to leverage additional private sector monetary support.

Table 1. Proposed annual budget for RISE program.

ITEM	COST	TOTAL	COMMENT
Director’s Salary	\$64,724	\$64,724	
Director's Fringe	\$25,482	\$25,482	Calculated at 39.37%
Manager Salary	\$45,584	\$45,584	Mentor and manager
Manager Fringe	\$17,946	\$17,946	Calculated at 39.37%
Intern Salaries	\$7,200	\$100,800	14 interns, \$15/hr, 15 hours/wk, 32 wks/yr
Intern Fringe	\$216	\$3,024	Calculated at 3%
Equipment	\$7,000	\$7,000	Energy audit equipment
Events	\$2,500	\$2,500	Event with sponsors and public

Web Site	\$2,500	\$2,500	Web portal for connecting students
Career Center Processing	\$17,250	\$17,250	0.25 FTE for processing hiring etc.
Admin fringe	\$6,791	\$6,791	Calculated at 39.37%
Supplies	\$3,000	\$3,000	
Marketing	\$3,000	\$3,000	
TOTAL		\$299,601	

Breakdown of the uses of the Act 111 funds appropriated for the business/education internship and mentorship program.

Funds were used to establish a STEM Workforce Development Program at UHM within the Office of Technology Transfer and Economic Development (OTTED) and to hire a program coordinator in March 2008 through June 2009. The coordinator developed the programs listed below, including a STEM portal (mystemhawaii.org), as well as the STEM internship program which became the foundation for SSIP (now RISE). The following table shows a preliminary breakdown of the Act 111 funds used to supplement the EPSCoR grant. DBEDT is still awaiting the final EPSCoR grant report from the University of Hawaii.

Table 2. Breakdown of expenditures of Act 111 funds appropriated for the business/education internship and mentorship program.

PROJECT	April-June 2008	July-Sept 2008	Oct-Dec 2008	Jan-March 2009	April-June 2009	Cumulative
UH System (JPIC)/Industry Internship Workshop	\$500.00					\$500.00
STEM Prog (curriculum) Seeding	\$6,500.00					\$6,500.00
Misc Travel & Expenses	\$1,021.51	\$932.65	\$863.20			\$2,817.36
STEM Portal Design (Student Stipend)		\$2,938.66				\$2,938.66

STEM Workforce Development Survey		\$10,000.00				\$10,000.00
Summer Interns		\$7,826.31				\$7,826.31
STEM Portal Database		\$1,126.35				\$1,126.35
Verticle Growing Project			\$3,537.38			\$3,537.38
STEM Portal Phase 2						
Interns			\$7,500.00		\$11,300.00	\$18,800.00
Olelo Youth Exchange						
Real World Design Challenge						
Coordinator Salary (A)				\$9,583.50	\$9,583.50	\$19,167.00
Mentoring Initiative				\$1,000.00	\$3,000.00	\$4,000
Internship Initiative					\$180.00	\$180.00
Mentoring Web Tool				\$10,000.00		\$10,000
Total Direct Costs	\$8,021.51	\$22,823.97	\$11,900.58	\$20,583.50	\$24,063.50	\$87,393.06
Indirect Costs						\$18,257.52
Total						\$105,650.58

Breakdown of the uses of the National Governors Association (NGA) \$500,000 grant to support STEM outreach via an Outcomes Accountability System (OAS), Professional Development, and STEM Web Portal.

Hawaii was one of six states to successfully compete for the prestigious STEM grants from the NGA. The three deliverables included an Outcomes Accountability System (OAS) to assess the effectiveness of STEM programs, professional development for teachers to acquaint them with new STEM opportunities, and a STEM web Portal to broadly provide information on the importance of STEM and STEM activities in Hawaii. The following table provides a breakdown of the uses of the \$500,000 NGA grant.

Table 3. Breakdown of expenditures of \$500,000 NGA grant.

	TOTAL PAID
NON PERSONNEL	
Consultants	
Project Management (Enterprise Honolulu)	\$159,995.77
OAS system design/testing/implementation	\$230,000.00
Teacher training sessions	\$24,600.00
Other	
Fiscal Services	\$20,000.00
Office services/utilities	
Hardware/software/design/support	\$54,286.60
Miscellaneous	\$10,160.24
TOTAL NON PERSONNEL	\$499,042.61
PROJECT TOTALS	\$499,042.61

\$230,000 was allocated to the Hawaii P-20 Partnerships for Education (Hawaii P-20) to develop an Outcomes Accountability System (OAS). In supporting the OAS development, Hawaii P-20 enhanced the Hawaii Partnership for Student Success (HI-PASS) reporting capability, produced reports related to STEM education, and developed plans for a “P20 Longitudinal Data System” (P20 LDS) which will serve as an inter-agency longitudinal data system to track students’ participation, progress and outcomes over time and throughout Hawaii’s educational pipeline.

\$24,600 was used to provide professional development courses for teachers.

\$54,286.60 was spent on creating a STEM web portal, www.mystemhawaii.org. Discussions with the UH College of Engineering were conducted in order to develop a synergistic relationship with the SIP site, but the organization declined, citing it was for internal UH use only. Currently, UH is in the process of developing yet another STEM web portal as one of the deliverables under the new EPSCoR IMUA III Grant. This web portal, known as the “STEM Pathways Matrix,” is envisioned as a database of resources for K-12 programs, agencies, and organizations statewide that provide STEM activities and help build the STEM pathway. DBEDT recommends that a single STEM portal be developed that services the needs of the state, such as Ohio, Colorado, Pennsylvania, Idaho and other states have done. DBEDT is working with Kaleialoha Lum-Ho Noguchi, the education program coordinator for the EPSCoR IMUA III Diversity, Education, and Workforce (DEW) initiative, and UH College of Engineering leadership to achieve this. The site is expected to be launched early next year and will provide one centralized portal for STEM education programs and activities statewide.

Current status of the Professional Development Program, under the University of Hawaii College of Education, to provide practicing elementary, middle, and high school science and mathematics teachers with opportunities to increase their knowledge and understanding of recent developments in science, technology, engineering, and mathematics and recommendations for continuation/funding.

Act 111, SLH 2007, provided \$175,000 in each year of the 2007 – 2009 biennium, to be expended by the University of Hawaii, College of Education, to establish within the University of Hawaii, a professional development program to provide practicing elementary, middle and high school teachers of science and mathematics with opportunities to increase their knowledge and understanding of recent developments in science, technology and mathematics and improve their ability to provide inquiry-based education.

With the FY 08 funds, intensive training was provided to 20 elementary and 6 secondary mathematics teachers, and 175 elementary and 75 secondary science teachers, impacting an estimated 3,800 elementary and 7,800 secondary students. FY 09 funds provided training for 111 math teachers and 125 science teachers, impacting an estimated 5,208 elementary students 11,200 Secondary students. Late release of the funds in both years of the biennium, particularly in FY 09, when funds were not available until March, likely reduced the number of teachers that could be recruited/participated. By March/April each year teachers have generally already made plans for professional development they attend in the subsequent summer.

There were no additional funds appropriated or released in 2010. Despite reduced funding, the Curriculum Research and Development Group (CRDG) of the UH College of Education continues to provide professional development opportunities, funded primarily by grants obtained by CRDG faculty. Both mathematics and science faculty continue their work with DOE and charter schools statewide. The following tables summarize the CRDG STEM professional development efforts since January 2010.

Table 4. CRDG STEM Professional Development in 2010 (Science)

Dates	Project Title	Island	Grade Levels	Number of Participants	Total Hours	Funding Source
March-June 2010	Teaching Science as Inquiry, Island Energy Inquiry	Oahu	Middle High	15	30	U.S. Department of Education
March 15-17, 2010; June 7-17, 2010	Background Enrichment for Technical Education and Out-of-Field Teachers Assigned to Physics-Based Courses	Oahu, Maui, Kauai, Hawaii	High	21	40	U.S. Department of Education
April-August 2010	Teaching Sci. as Inquiry, Island Energy Inquiry	Hawaii	Middle High	18	30	U.S. Department of Education
June 22-July 2, 2010	Foundational Approaches in Science Teaching FAST 1	Oahu, Hawaii, Kauai, Pacific Islands	Middle	16	54	National Institute of Health (NIH)
July 6-16, 2010	Foundational Approaches in Science Teaching FAST 2	Oahu, Hawaii, Kauai, Pacific Islands	Middle	14	54	National Institute of Health (NIH)

July-October 2010	Teaching Science as Inquiry, Island Energy Inquiry	Kauai	Middle High	14	30	U.S. Department of Education
August 2010	Developmental Approaches in Science, Health, and Technology	Niihau	Elem	5	20	Hawaii Department of Education
August 2010	Developmental Approaches in Science, Health, and Technology	Oahu	Pre-K and K	5	25	UH Curriculum Research & Development Group
October 2010	Teaching Science as Inquiry	Oahu, Hawaii,	Middle	17	30	U.S. Department of Education
January 2011	Physical Aquatic Science	Maui, Kauai	High			Education

Table 5. CRDG STEM Professional Development in 2010 (Math)

Dates	Project Title	Island	Grade Levels	Number of Participants	Total Hours	Funding Source
January 4-5, 2010	Measure Up Math	Oahu	Elem Middle High	5	10	UH Curriculum Research & Development Group
January-November 2010	Mathematics Lesson Study	Oahu	Elem Middle	35	89	U.S. Department of Education
January-March 2010	Mathematics Lesson Study	Oahu	Elem	11	44	Harold K.L. Castle Foundation
January-November 2010	Developing Algebraic Resources for Teachers	Oahu	Middle High	33	32	U.S. Department of Education
January-March 2010	Linking Instruction in Networked Classrooms	Oahu	Middle High	18	18	U.S. Department of Education
January-May 2010	Measure Up Math	Hawaii	Elem Middle High	16	18	UH Curriculum Research & Development Group
January-May 2010	Formative Assessment in a Networked Classroom	Oahu, Maui, Kauai, Hawaii	Middle	31	18	National Science Foundation
February-May 2010	Teaching and Learning Geometry	Oahu	High	10	24	National Science Foundation
February 23-25, 2010	Integrating Mathematics Across Content Areas	Oahu	Middle	60	12	UH Curriculum Research & Development Group
May-June 2010	Formative Assessment and Technology	Kauai	Middle	10	32	Kauai Economic Devel. Board, Texas Instrument, Inc.
June 2010	Educative Curriculum Materials Mathematics and Pedagogy	Oahu	Elem	20	30	U.S. Department of Education

June 21-25, 2010	Understanding Elementary Mathematics and Pedagogy	Oahu	Elem	18	30	U.S. Department of Education
June 28-July 2, 2010	Calculator Training (Blanche Pope)	Oahu	Elem	2	30	Harold K.L. Castle Foundation
August-November 2010	Kapalama Elementary Mathematics Lesson Study	Oahu	Elem	28	40	U.S. Department of Education

The state’s recent adoption of Common Core Standards in mathematics, with science soon to follow, will require a significant increase in professional development and funding allocations for same, over the next five years. Because implementation will require substantial teacher content knowledge upgrades and changes in methodology and approaches to teaching, a system wide effort in professional development for teachers must be launched. Implementation of mathematics Common Core Standards is scheduled to begin in Spring 2011, followed by science, for which Common Core Standards are expected to be adopted by the end of 2011 and implemented by Spring 2012.

Professional development funding will require a significant investment first in mathematics, followed the next year by simultaneous implementation of science. Each will require new curricula be adopted for teachers.

The estimated cost of providing professional development for the implementation of STEM Common Core Standards is \$6.3 M, based on information from Donald Young, director of CRDG. This will be allocated over the next 4 years in preparation for the implementation of common state assessments in mathematics and science in Spring 2015.

Another ongoing issue is how to support teachers to become highly qualified by federal definitions. There are 251 science teachers statewide who are not considered highly qualified based on federal standards. Additional professional development is required to bring these teachers into compliance and provide ongoing support for future teachers to become highly qualified. The estimated cost of this professional development is \$2,050,000, broken down as follows:

Prepare Highly Qualified Science Teachers:

- Prepare an on-line Praxis tutorial ~\$300,000
- Prepare and conduct on-line content courses in physics, biology, chemistry, and general science ~\$750,000
- Prepare and provide content tutors ~\$1,000,000

Breakdown of the uses of the Act 111 funds appropriated for the development of professional development programs in the STEM disciplines for practicing teachers.

Table 6. Professional Development FY 08 Act 111 Funds (\$175,000)

MATHEMATICS	Number of Teachers	Personnel	Stipends	Materials	Supplies	Travel	Total
Understanding Elementary Mathematics and Pedagogy	12	\$5,000	\$5,500	\$889	\$2,676	\$536	\$14,601
Increasing Teacher Content Knowledge in Mathematics	24	\$8,000	\$3,300	\$600	\$600	\$12,216	\$24,716
Math Subtotal	36	\$13,000	\$8,800	\$1,489	\$3,276	\$12,752	\$39,317
SCIENCE	Number of Teachers	Personnel	Stipends	Materials	Supplies	Travel	Total
Meeting Hawai'i Content and Performance Standards Grade 3	24		\$6,000	\$2,450	\$250		\$8,700
Meeting Hawai'i Content and Performance Standards Grade 4	24		\$6,000	\$2,450	\$250		\$8,700
Meeting Hawai'i Content and Performance Standards Grade 5	24		\$6,000	\$2,450	\$250		\$8,700
Meeting Hawai'i Content and Performance Standards Grade 6	24		\$6,000	\$2,450	\$250		\$8,700
Developing Science, Health & Technology PreK/K	20		\$6,000	\$7,300	\$200		\$13,500
Developing Science, Health & Technology Grade 1	20	\$1,100	\$6,000	\$7,050	\$150		\$14,300
Developing Science, Health & Technology Grade 2	20	\$1,100	\$6,000	\$7,050	\$150		\$14,300
Developing Science, Health & Technology Grade 3	20	\$1,100	\$6,000	\$7,050	\$150		\$14,300
Teaching Science as Inquiry: Aquatic Science OAHU	24		\$3,600	\$900			\$4,500
Teaching Science as	24		\$1,178	\$1,325			\$2,503

Inquiry: Aquatic Science MAUI							
Teaching Science as Inquiry: Matter, Energy, and the Environment for Middle Schools	12		\$3,600	\$900	\$150		\$4,650
Science Subtotal	236	\$3,300	\$56,378	\$41,375	\$1,800		\$102,853
Evaluation Contract (Pacific Resources for Education & Learning)							\$24,500
Total Direct Costs							\$166,670
Admin. Costs @ 5%							\$8,329
Total	272						\$175,000

Table 7. Professional Development FY 09 Act 111 Funds (\$175,000)

MATHEMATICS	Number of Teachers	Personnel	Stipends	Materials	Supplies	Travel	Total
Understanding Elementary Mathematics and Pedagogy	22	\$12,000	\$10,890	\$4,600	\$2,600	\$9,650	\$39,740
Mathematics Content Collaboration Communities (MC3)	7	\$776	\$7,840	\$2,000		\$8,100	\$18,716
MET/CRDG Professional Development Collaboration	21	\$8,400					\$8,400
Professional Development to Extend Formative Assessment into more Connected Middle School Classrooms	33	\$3,000	\$24,000	\$1,000			\$28,000
Math Subtotal	83	\$24,176	\$42,730	\$7,600	\$2,600	\$17,750	\$94,856
SCIENCE	Number of Teachers	Personnel	Stipends	Materials	Supplies	Travel	Total
Developing Science, Health & Technology K-6	79	\$7,677		\$37,904	\$1,800		\$37,381
Foundational	17			\$5,200	\$200		\$5,400

Approaches in Science Teaching for Middle Schools							
Teaching Science as Inquiry: Aquatic Science	46	\$1,228	\$3,600	\$2,000	\$500	\$2,800	\$10,128
Teaching High School Physics, Physiology and Technology	10	\$10,000		\$6,250	\$2,500		\$18,750
Science Subtotal	152	\$19,057	\$3,600	\$41,354	\$5,000		\$71,811
Total Direct Costs							\$166,667
Admin. Costs @5%							\$8,333
Total	235						\$175,000

Current status of UH’s participation in the federal Transition to Teaching program and recommendations for continuation/funding.

The Transition to Teaching (TTT) program was established within the University of Hawai‘i at Manoa (UHM) in 2003. The TTT program provided support for individuals who graduated from college with a degree in a subject area other than education and wished to pursue a teaching career in science or mathematics through the UHM College of Education’s Post-Baccalaureate Certificate in Secondary Education (PBCSE) Program. The TTT program was initially funded for five years by a grant from the United States Department of Education. Before this federal grant expired in 2008, the Legislature appropriated \$175,000 for each year of the 2007 – 2009 biennium (FY08 & FY09) to UHM to continue the TTT program. FY08 funds for TTT were not released until March 2008, reducing the College’s ability to recruit and retain STEM students. Despite the late release of funds, the Office of Student Academic Services received over 100 inquiries and identified 18 qualified applicants in science or mathematics that met the admissions criteria for entry into the PBCSE program. Of those 18 qualified applicants, 15 were accepted into the TTT program. FY09 funds were never released.

The TTT program has made significant contributions to the teaching profession throughout Hawai‘i. For the past few decades, there has been a shortage of qualified and licensed mathematics and science teachers in the Hawaii Department of Education, particularly in rural areas. In response to this need, the TTT program has offered a viable solution to alleviate these challenges by implementing a comprehensive support program that consists of tuition stipends throughout the PBCSE program, PRAXIS support, availability of a program through hybrid delivery models (meaning the program is available statewide), professional development workshops, and experienced mentoring support.

Unfortunately, the TTT program has been discontinued due to lack of funding. In light of the program’s past success and the benefits to STEM education and workforce development,

DBEDT recommends FY12-13 biennium funding totaling \$350,000 to continue this work (\$175,000 per year). Table 8 shows a proposed expenditure plan for FY 12.

Table 8. Expenditure Plan for Transition to Teaching Program FY 12 Act 111 Funds

Budget Item	Planned Expenditure
Personnel Project manager \$48,000 Three mentor teachers \$30,000 Student assistant \$6,000	\$84,000
Travel Neighbor islands and Oahu mileage	\$5,780
Student Stipends	\$79,220
Supplies	\$4,000
Workshops for TTT students and graduates	\$2,000
Total	\$175,000

Recommendations for continuing the programs listed above and costs associated with continuing the programs for another five years.

These recommendations are included in the current status of each program listed in this document.

Please explain the relationship between Creativity Academies and MELE programs in conjunction with STEM initiatives funded through Act 111 and other funding sources, and the outcomes produced by the number of students involved in STEM/Creativity Academies and/or MELE programs.

Creativity Academies

The Creativity Academies (CA) program was developed in 2008, after the enactment of Act 111, in partnership with the University of Hawaii Community Colleges (Kapiolani Community College STEM and New Media Arts leadership), Department of Education, Career and Technical Education (CTE), Project EAST, DBEDT, and industry. CA has worked closely with existing STEM programs administered by DBEDT’s Science & Technology branch, such as Project EAST, to align and integrate where possible the core elements in Act 111 and the NGA grant.

The establishment of the CA program and its innovative curriculum pathway provides both the rigor and relevance needed for Hawaii students to continue their education in STEM related careers at the college level, helping to launch careers and develop an innovation-based workforce comprised of entrepreneurs and new business models for the 21st century.

Core skill sets for the 21st century require critical, cognitive, and creative thinking, as well as dexterity with various visual and communication skills, which include digital media and new technology applications. Creativity Academies' pilot curriculum blends Art 112 and Physics 100 in standards-based modules designed to engage a broad spectrum of students in STEM education, while integrating current STEM education programs such as Project East.

The Creativity Academies Alliance has trained 35 high school, middle school and elementary school teachers statewide and piloted the curriculum in 12 DOE and Charter School classrooms, reaching 180 students in 2009. Without funding available in 2010, teachers continued to apply the CA modules in classrooms including charter schools such as Hawaii Tech Academy, Oahu.

Initially seeded with \$370,000 from DBEDT in FY09, the CA initiative will work with existing STEM programs to integrate CA modules where applicable. CA will continue to build additional blended STEM/Creativity-based curriculum modules as a result of \$1.9M in federal stimulus funding to DOE/UH through December 2012. Additional funding to maintain and grow the program statewide will be required for FY12-13, an estimated appropriation of \$350,000 per year. CA will work collaboratively with the established STEM programs to provide tailored lesson plans and curriculum modules as applicable for EAST, FIRST, HiEST, and Robotics programs.

MELE

Academic Year 2010-2011 marks the third year of provisional status for the Music & Entertainment Learning Experience (MELE) program. As a program that integrates technology, math, and physics, MELE's core courses support the skill sets necessary for students to succeed in the 21st century. The program first offered classes in Fall 2007 on an experimental basis. On January 23, 2008, the Council of Chief Academic Officer approved the program proposal move to the Board of Regent for review. The Board of Regents of the University of Hawai'i approved the proposal at its March 13, 2008, meeting. MELE will submit a request in 2011 for permanent status starting Academic Year 2011-2012 to the Board of Regents.

The MELE program has experienced phenomenal growth during the past three years with more than 330 students taking classes during the last five semesters (Fall 2008 through Fall 2010). The future direction for the program includes the introduction of a songwriting track, subject to Board of Regent approval, to complement the existing music business and audio engineering MELE tracks. MELE has received \$1.2M in ARRA SFSF funds in order to expand curricula in Physics of Sound and Songwriting and to establish an ongoing mentorship program.

LEGISLATIVE REPORT

SUBJECT: Requesting Reports on the Economic Value of Expanded Workforce Development Capacity and STEM Initiatives

REFERENCE: HCR 297, SD1, CD1
SR 86, SD1

ACTION REQUESTED: Report on: (1) The economic value of expanded workforce development capacity of emerging industries in defense and dual-use, astronomy, engineering, aquaculture, biotech, digital media, and related industries; and (2) The status of each entity's STEM initiatives, activities, and recommendations for long-term expansion and funding requirements.

DOE REPORT:
Introduction:

The Department of Education (DOE) continues to support Science, Technology, Engineering and Mathematics (STEM) initiatives by infusing STEM resources into standards-based curriculum, assessment and instruction in schools. Currently all K-8 students and teachers and students and teachers of 20 high schools, including three secondary public charter schools, have access to the digital media resources of Discovery Education in science and literacy until 2013. STEM is an integral component of Hawaii's Race To The Top plan in which students will graduate career and college ready; have an opportunity to receive a diploma with STEM distinction and pursue STEM related post-secondary options.

The DOE encourages students and teachers to participate in STEM programs coordinated by Honolulu Community College and co-curricular and extra-curricular activities sponsored by external agencies, and partners with Institutes of Higher Education (IHE) and Pacific Resources for Education and Learning (PREL) in pursuit of grants from the National Science Foundation and National Aeronautics and Space Administration (NASA) Opportunities in Education and Public Outreach for Earth and Space Science. Currently, the DOE has a grant with the National Oceanic and Atmospheric Administration to develop on-line science courses for middle level students and teachers to provide rigorous coursework and access to students in remote locations.

FINDINGS:

In 2009-10, funds to support STEM initiatives were not released to the DOE for oversight. The Office of the Governor worked with the University of Hawaii at Manoa and the Community Colleges to oversee HiEST and provided funds for the program through Honolulu Community College. In addition, agencies external to the DOE received funds to support robotics, botball, Project EAST, and FIRST academies.

As the DOE was not the coordinator, nor provided oversight for these initiatives, there are no reports submitted to the DOE for review and subsequent submittal to the Legislature.

RECOMMENDATIONS:

Closer collaboration and coordination among the entities involved in STEM-related activities and programs are necessary to ensure capacity within a P-20 framework. Without oversight by the DOE within the framework of the P-20 educational system, activities and programs operate outside of the mainstream of the education system.

Recommendations for long term-expansion and funding requirements are attached to this report.

Hawaii Department of Education
 Recommendations for Long Term Expansion and Funding Requirements
 For HCR,297, SD1, CD1 and SR 86, SD1

Recommendation:

The number of Highly Qualified (HQ) science teachers must be increased to meet increased science course requirements for a college and career ready diploma.

Proposed Budget to support professional development, mentorship, accompanying projects and coursework total \$ 5,089,882.

Data:

Table 1 indicates the Number of HQ and Non-Highly Qualified (NHQ) Science Teachers in 2010. (Twelve teachers are double counted because they teach high school science and middle school science at multi-level schools.)

Table 1 – Number of Highly Qualified and Non-Highly Qualified Science Teachers in 2010

School Level	Highly Qualified (HQ) Teachers for Science	Non-Highly Qualified (HQ) Teachers for Science
High School	378 (78.3%)	105 (21.7%)
Middle Level	255 (63.1%)	149 (36.9%)
Total	633	254

Table 2 displays the Hawaii secondary schools with NHQ Teachers in SY 2010-11.

Table 2 - Hawaii Secondary Schools with Non-Highly Qualified Science Teachers in SY 2010-11

High Schools w/ Non-HQ Teachers		Middle Schools w/ Non-HQ Teachers	
Honolulu District	Hawaii District	Honolulu District	Windward District
1. Anuenue School	23. Hilo High	1. Anuenue School	22. Kahuku H/I
2. Kaimuki High	24. Honokaa H/I	2. Central Mid	23. Kailua Inter
3. Kaiser High	25. Keaau High	3. Dole Mid	24. King Inter*
4. Kalani High*	26. Kealakehe High	4. Jarrett Mid	25. Olomana School
5. McKinley High	27. Kohala High	5. Kaimuki Mid*	26. Waimanalo E/I
6. Roosevelt High	28. Konawaena High	6. Kalakaua Mid	
	29. Laupahoehoe	7. Niu Valley Mid	Hawaii District
Central District		8. Stevenson Mid*	22. Honokaa H/I

<p>7. Aiea High 8. Leilehua High 9. Mililani High* 10. Moanalua High 11. Radford High 12. Waialua H/I</p> <p>Leeward District 13. Campbell High 14. Kapolei High* 15. Nanakuli H/I* 16. Pearl City High 17. Waipahu High</p> <p>Windward District 18. Castle High 19. Kahuku H/I 20. Kailua High 21. Kalaheo High 22. Olomana School</p>	<p>H/E 30. Pahoehoe H/I 31. Waiakea High</p> <p>Maui District 32. Baldwin High 33. Kekaulike High 34. Lahainaluna High 35. Maui High 36. Molokai High</p> <p>Kauai District 37. Kapaa High 38. Kauai High 39. Waimea High</p>	<p>9. Washington Mid*</p> <p>Central District 10. Aiea Inter 11. Aliamanu Mid 12. Moanalua Mid 13. Wahiawa Mid* 14. Waialua H/I 15. Wheeler Mid*</p> <p>Leeward District 16. Ewa Makai Mid 17. Highlands Inter* 18. Ilima Inter 19. Nanakuli H/I 20. Waianae Inter* 21. Waipahu Inter*</p>	<p>23. Kalaniana'ole E/I 24. Keaau Mid 25. Kealahou Inter 26. Kohala Mid 27. Konawaena Mid 28. Laupahoehoe H/E 29. Paauilo E/I 30. Pahoehoe H/I 31. Waiakea Inter 32. Waikoloa E/M</p> <p>Maui District 38. Iao Inter 39. Kalama Inter* 40. Lahaina Inter 41. Lanai H/E 42. Lokelani Inter 43. Maui-Waena Inter 44. Molokai Mid</p> <p>Kauai District 45. Kamakahahei Mid 46. Kapaa Mid 47. Waimea Canyon Mid</p>
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*Denotes 4 – 9 teachers are not highly qualified in science at the school.

Charter High Schools with Non-HQ Teachers	Charter Middle Schools with Non-HQ Teachers
<ol style="list-style-type: none"> 1. Education Laboratory of Hawaii PCS 2. Kanu O Ka'aina PCS 3. Kanuikapono PCS 4. Kawaikini PCS 5. Ke Kula O Samuel M. Kamakau A Laboratory PCS 6. Kihei Public Charter School PCS 7. Kula Aupuni Niihau A Kahelelani Aloha New Century PCS 8. Myron B. Thompson Academy PCS 	<ol style="list-style-type: none"> 1. Hawaii Technology Academy PCS 2. Ke Ana La'ahana PCS 3. Ke Kula Niihau O Kekaha PCS 4. Waimea Middle PCS

Table 3 displays the number of HQ and NHQ teachers teaching Biology, Chemistry and Physics

Table 3 – Number of HQ and Non-HQ Teachers Teaching Biology, Chemistry, and Physics

Courses in 2010	HQ Teachers	Non-HQ Teachers
Biology 1	137	27
Biology 2	2	0
Chemistry	87	5
Physics	43	2
AP Biology	26	1
AP Chemistry	12	0
AP Physics	8	1
Total Number of Teachers in Biology, Chemistry, Physics	315	36

Table 4 depicts the course-taking patterns of the class of 2009 and 2010.

Table 4 - Statewide Science Course Frequency Counts for top 10 courses (out of 33) and *Advanced Placement (AP) Biology, *AP Chemistry, and *AP Physics

Course Title	Class of 2009 Enrollment		Class of 2010 Enrollment		2009 & 2010 Total Enrollment	
1. Biology 1	9845	86.0%	10062	92.3%	19906	89.1%
2. Physical Science	6369	55.6%	7556	69.3%	13925	62.3%
3. Chemistry	6462	56.4%	6342	58.2%	12804	57.3%
4. Marine Science	2568	22.4%	2395	22.0%	4962	22.2%
5. Physics	1977	17.3%	2378	21.8%	4355	19.5%
6. Human Physiology	1916	16.7%	1810	16.6%	3726	16.7%
7. Physics Basic	2180	19.0%	1494	13.7%	3674	16.4%
8. Chemistry Basic	1699	14.8%	1753	16.1%	3452	15.4%
9. Earth System	1029	9.0%	931	8.5%	1960	8.8%
10. Environmental Science	474	4.1%	571	5.2%	1044	4.7%
*AP Biology	450	3.9%	403	3.7%	853	3.8%
*AP Chemistry	243	2.1%	187	1.7%	430	1.9%
*AP Physics	133	1.2%	129	1.2%	261	1.2%

Class of 2009 = 11448; Class of 2010 = 10898; Total of 2009 + 2010 = 22346

Analysis of Data in Tables 1-4:

Professional development and PRAXIS preparation in-service sessions are needed to increase the number of HQ teachers on all islands.

- Total number of secondary science teachers in 2010 is 887.
- At the high school level, there are a total of 483 science teachers. Of this total, 378 (78.3%) are highly qualified teachers and 105 (21.7%) are not highly qualified.
- At the middle school level, there are a total of 404 science teachers. Of this total, 255 (63.1%) are highly qualified teachers and 149 (36.9%) are not highly qualified.
- The non-highly qualified science teachers are located in 39 high schools and 47 middle schools statewide. Four high schools (Kalani, Kapolei, Mililani, and Nanakuli High) have four to nine teachers who are not highly qualified to teach science at their schools. Ten middle schools (Highlands, Kaimuki, Kalama, King, Stevenson, Wahiawa, Waianae, Waipahu, Washington, and Wheeler Intermediate/Middle) have four to nine teachers who are not highly qualified to teach science at their schools.

Based on course taking patterns, the HSA 10th grade science assessment addressing Biology standards and the number of Biology teachers currently available, professional development is needed to support the number of HQ and highly effective teachers required to teach Biology.

- Biology 1 is the most frequently selected course by students. The number of students enrolled in Biology increased by 217 students (6.3 %) from 2009 to 2010.
- Biology 1 is taught by 137 highly qualified teachers and 27 non-highly qualified teachers.

There is a need to increase the number of students enrolling in AP science and Science Technology Engineering and Mathematics (STEM) courses as the College and Career Ready (CCR) diploma will have a STEM designation. Likewise, there is a need to increase the number of teachers who are able to teach AP courses.

- The number of students enrolled in AP Biology decreased from 450 (3.9%) in 2009 to 403 (3.7%) in 2010. The number of students enrolled in AP Chemistry decreased from 243 (2.1%) in 2009 to 187 (1.7%) in 2010. The

number of students enrolled in AP Physics remained the same 133 (1.2%) in 2009 and 129 (1.2%) in 2010. Issue:

- AP Biology, AP Chemistry, and AP Physics courses did not rank in the top 10 courses enrolled by students. In 2010 out of 33 courses, AP Biology ranked 13, AP Chemistry ranked 18, and AP Physics ranked 21.

There is a need to provide on-time professional development for teachers in the field already teaching science courses who are not highly qualified in the specific science content area such as Elementary Science, Biology, Chemistry or Physics based on HSA science results.

- As students progress toward graduation, they perform less well in the HSA science test. In the 2010 HSA overall science test results, 10% of grade 4 students exceeded as compared to 5.2% of grade 6 students and 4.9% of grade 10 students. In the same overall results, 33% of grade 4 students scored below as compared to 35.7% of grade 6 and 45.1% in grade 10.
- In the Life Science section of the HSA test, only 14.4% of grade 10 students are meeting proficiency.
- More than half (53.5%) of the grade 10 students are scoring below proficiency in the Life Science section of the HSA test.
- In 2010, there were 378 HQ high school science teachers from a total of 483 science teachers.
- At the middle school level 255 science teachers are HQ from a total of 404 science teachers.
- At the elementary level, certification is not based on specific content area expertise; teachers are credentialed with an Elementary certification. In addition, emphasis is on English Language Arts and Mathematics.

Potential solutions to prepare teachers to become HQ in science:

1. Increase course offerings for professional development. Teachers may become highly qualified by:
 - Successfully completing 30+ course credits
 - Successfully completing 100+ HOURSSE points
 - Successfully completing the PRAXIS
2. Collaborate with pre-service Institutes of Higher Education (IHE) to provide rigorous science preparation for elementary teacher certification.
3. Develop on-line courses:

- PRAXIS preparation in Biology, Chemistry, and Physics for high school science teachers; and General Science for middle school science teachers. Teachers will take the online prep session which would feature prep tests in their field with resource links for topics/areas that teachers need further review before re-taking the prep test.
- Hybrid online content courses for secondary science teachers to become highly qualified. Teachers would participate in online course sessions as well as face-to-face meetings. Teachers will need at least 30 credits to receive a degree from a post-secondary institution.
- PDE3 courses for teachers to receive at least 100 HOUSSE points to become highly qualified. Teachers will attend courses at their school, complex, or island.

4. Provide Peer-Mentoring or Coaches:

- Teachers participate in a peer-mentoring program through which identified master high school teachers or post-secondary faculty/post doctorate students would mentor non-highly qualified science teachers to prepare for the PRAXIS or assist with course work.

Proposed Budget and Narrative:

Potential STEM Initiatives

STEM Initiative	Description	Cost
Online PRAXIS Prep	Create and administer online PRAXIS prep to prepare science teachers to be highly qualified and be in compliance with No Child Left Behind. IHE will develop 4 preparation programs Biology, Chemistry, and Physics for high school and General Science for middle school. PRAXIS prep is a self-directed program for teachers to complete as necessary.	Estimated budget = \$300,000 2 courses ready in 9 months; 4 courses ready in 18 months. Course completion will vary by teachers.
STEM Mentorship and PDE3 Courses	HIDOE in collaboration with school complexes, post-secondary institution, and field experts, will develop a mentorship program and necessary PDE3 courses to support secondary teachers who are teaching science courses out of their field of specialization.	Estimated budget = \$750,000 Mentorship program (15 complexes x 3 science areas x \$10,000 = \$450,000) Development of PDE3

STEM Initiative	Description	Cost
		Development of PDE3 courses for AP Biology, AP Chemistry, and AP Physics (\$100,000 per course x 3 courses = \$300,000)
Challenger Center Hawaii	Challenger Center Hawaii (CCHI) is a hands-on learning center that utilizes space exploration as a theme to teach STEM in relation to HCPS III and the General Learner Outcomes. Students work in cooperative teams to solve real-life problems during a spaceflight simulation. The program promotes scientific literacy through an interdisciplinary and inquiry based approach for students in grades 6 – 8. CCHI has funding for this year from Governor’s office and is seeking funding for next year.	Annual Operating Cost = \$244,882 (3 Teachers + 1 E.A. = \$200,232 and Licensing fees, supplies, equipment = \$44,650)
Aiea Intermediate STEM Signature School	Expand STEM learning time for students through <ul style="list-style-type: none"> • Afterschool clubs/project classes • Saturday projects • STEM Summer Academy Integrate STEM educational components in all curricular areas, such as the hydroponics Initiative, Solar & alternative Energy Initiative, and Electric Car & Alternative Transportation Initiative. Aiea Intermediate received funding this year directly from Governor’s office and is seeking funding for next year.	Estimated Budget = \$250,000 (Personnel costs = \$177,318 and Equipment costs = \$132,682)
EPICS High Program	EPICS high (High Schools Improving Lives with Engineering Projects in Community Service Learning) is an engineering-centered, multi-disciplinary set of courses that uses service learning to teach design. The program was	Estimated Budget = \$470,000 42 high schools x \$10,000 each + \$50,000 state

STEM Initiative	Description	Cost
	founded at Purdue University in 1995. In this program, teams of high school students collaborate with post-secondary institutions to develop multi-disciplinary projects that address engineering and technology-based needs of their community and educational organizations. Two high schools (Pearl City and Waipahu) are piloting the program. Project teachers agree that this program should be continued and conducted statewide.	coordination = \$470,000
Solar Sprint Project (part of the Sun Power for Schools Project)	Hawaiian Electric Company, Maui Electric Company, and Hawaii Lighting and Electric Company in collaboration with HIDOE provided grades 6 & 8 students with an opportunity to demonstrate standards for quality product and performance and an understanding of selected science and career and technical education standards by conducting the Solar Sprint Exhibition. Students designed and created mini-solar cars to travel along a guided wire to meet performance standards. Solar cars also carried a load of 12 ounces to exceed standards. Students inspected peers' solar cars to validate the criteria of quality product. Evidence pages reflected understanding of selected content standards. Project ended due to austerity. Continuation and expansion of project statewide is requested.	Estimated Budget = \$395,000 69 inter/middle schools x \$5,000 + \$50,000 state coordination = \$395,000
STEM P.D. Utilizing Discovery Education Digital Media Resources	Professional development for grades K-8 teachers and complex/state staff on STEM concepts and skills using the Discovery Education Digital Media Resources. Subscription to Discovery Education digital media resources until March 2013.	Estimated Budget = \$680,000 \$2500/session x 42 complexes = \$105,000 4 sessions per complex = \$441,000 + \$150,000 subs

STEM Initiative	Description	Cost
		/stipends + \$89,000 logistics = \$680,000
Space Exploration and Astronomy	UH-Manoa, UH-Hilo, Institute for Astronomy, Hawaiian Academy of Sciences, Windward Community College, and Imiloa are interested in providing support in the understanding of Earth-Space Systems Science through STEM projects, such as Journey to the Universe, Journey to the Moon, Space Explorations, and Mars Student Imaging Project.	Estimated budget = \$1,000,000 Grades 4-12 \$100,000 per grade level + \$100,00 state coordination
Marine and Aquatic Explorations	UH-Manoa, Hanauma Bay Nature Conservancy, NOAA Pacific Center, National Humpback Whale Sanctuary, Hawaiian Academy of Sciences, Department of Land and Natural Resources, and Polynesian Voyaging Society are interested in providing support in understanding the science standards through the study of the marine and aquatic environments through such projects as CMORE project, Sea Perch, Project Ho'olokahi (high school voyaging project).	Estimated budget = \$1,000,000? Grades 4 – 12. \$100,000 per grade level + \$100,00 state coordination

Total: \$ 5,089,882

The Department of Education will need to collaborate, partner and coordinate the activities of Science Fair, Science Olympiad, Science Bowl, HiEST academies, Robotics, Botbal and other science education-related activities sponsored by other organizations. Currently, these activities receive funds from the Governor's Office and run independent of the Department. As such, capacity to sustain the instructional links to science education is serendipitous.

UNIVERSITY OF HAWAI‘I SYSTEM REPORT



REPORT TO THE 2011 LEGISLATURE

REPORT BY THE UNIVERSITY OF HAWAI‘I AT MĀNOA
ON THE ECONOMIC VALUE OF EXPANDING
WORKFORCE DEVELOPMENT CAPACITY
AND STEM INITIATIVES

HOUSE CONCURRENT RESOLUTION 297
S.D.1 C.D.1 (2010)

November 2010



**FOSTERING INSPIRATION and RELEVANCE THROUGH SCIENCE and
TECHNOLOGY – PRE-ACADEMY (ACT 111):**

H.C.R. NO. 297 S.D.1, C.D. 1

Legislative Report FY 2009 – 2010

ON STEM INITIATIVES

Continued Funding per Memorandum of Agreement
between
The Governor of the State of Hawai'i
and
The University of Hawai'i
regarding
American Recovery and Reinvestment Act (ARRA)
State Fiscal Stabilization Fund (SFSF), Government Services – Part B

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PRE-ACADEMY (ACT 111)

The Fostering Inspiration and Relevance through Science and Technology (FIRST) Pre-Academy was established through Act 111 of the 2007 Legislature for *Innovation in Education*, and is administered by the University of Hawai'i College of Engineering. Its mission is to provide additional resources and expertise to stimulate the interest and achievement of students in science, technology, engineering, and mathematics (STEM) skills and to address the State of Hawai'i's growing pipeline shortage of qualified individuals in STEM related professions.

FUNDING FROM THE STATE OF HAWAII: ARRA – SFSF Part B

The American Recovery and Reinvestment Act (ARRA) State Fiscal Stabilization Fund (SFSF), Government Services – Part B, for the Fostering Inspiration and Relevance through Science and Technology (FIRST) Pre-Academies authorizes State funding for elementary and secondary education and public institutions of higher education, and to meet and make progress on the Assurances contained in Hawai'i State's SFSF application to the federal government as pertaining to education.

A Memorandum of Agreement (MOA) between the Governor of the State of Hawai'i and the University of Hawai'i established the allocation of \$3,063,000 of Part B SFSF funding for the budget period 07/01/09 to 06/30/11 for the purpose of paying expenses associated with the FIRST Pre-Academies as established pursuant to Act 111 of 2007, and to expand the FIRST Pre-Academies to every public middle school by school year 2012.

HCR 297

House Concurrent Resolution No. 297 of House of Representatives of the Twenty-fifth Legislature of the State of Hawai'i (2010), requests that a report on the economic value of expanded workforce development capacity be provided by the Department of Business, Economic Development, and Tourism (DBEDT). An update on STEM initiatives in Hawai'i schools shall include Research Experiences for Teachers – Middle School, Project EAST, Hi-EST, FIRST academies, and other robotics.

The following report, provided by the University of Hawai'i College of Engineering, presents the status of our ongoing STEM initiatives and activities.

Our goal is to attract an increasing number of the State's K-12 students to the University of Hawai'i's STEM and related programs and lead them to better employment options in our economy's increasingly technology driven industries. As of June 30, 2010, FIRST Pre-Academy programs have exceeded projected goals, affirming our belief that these initiatives successfully address urgent STEM needs in our community.

EXECUTIVE SUMMARY

An important tenet of the *Innovation in Education* initiative is to improve education and career opportunities for underserved segments of the Hawai'i population by nurturing adaptability and learning skills, and increasing awareness of niche opportunities in the growing market for individuals with technology training, beginning with students of middle school age or younger.

The FIRST Pre-Academy represents the College of Engineering and University of Hawai'i System's commitment to develop Hawai'i's future high technology workforce through intervention in middle school education at the teacher level. Its programs heighten the technical knowledge and research-based skills of middle school educators across a broad spectrum of science, technology, engineering and mathematics disciplines, thus boosting student interest and achievement in STEM subjects and their associated careers from early in the pre-college process. By integrating traditional classroom education with hands-on field experiences, Pre-Academy teachers can provide students with a deeper understanding of STEM and its relevance to the real world in which they live and will someday work.

The success of the FIRST Pre-Academy is strongly supported by its multilateral teacher-driven approach. Teachers are held accountable for meeting standardized curriculum benchmarks and obtain best results when they can integrate STEM content and technology into their own lessons. University and industry mentors respond to specific teacher needs and help design and implement curriculum tailored to individual programs: 1) in special focus workshops; 2) in the classroom, 3) with online technology and technical counsel, and 4) with science kits.

During FY 2010, the FIRST Pre-Academy held more than twenty professional development workshops and teacher-training sessions on a wide range of STEM-related themes including data collection and analysis, robotics, sustainability, 3D modeling and fabrication, and topics in microbial oceanography. Such special focus events expose teachers to state-of-the-art technologies, research areas and applications via direct interaction with industry professionals and university researchers. Powerful teacher-mentor relationships are enabled, and provide the backbone for new and relevant curriculum. The workshop series was supplemented with in-service campus visits, and online support via a public internet portal.

In support of teacher-driven curriculum, FIRST Pre-Academy is working to establish an ongoing base of STEM mentors from academia and industry. Included are university faculty and students from the College of Engineering, the Center for Microbial Oceanography Research and Education (C-MORE) and other relevant departments in the University of Hawai'i system, as well as industry and community professionals interested in *pro bono* support of middle school level STEM education.

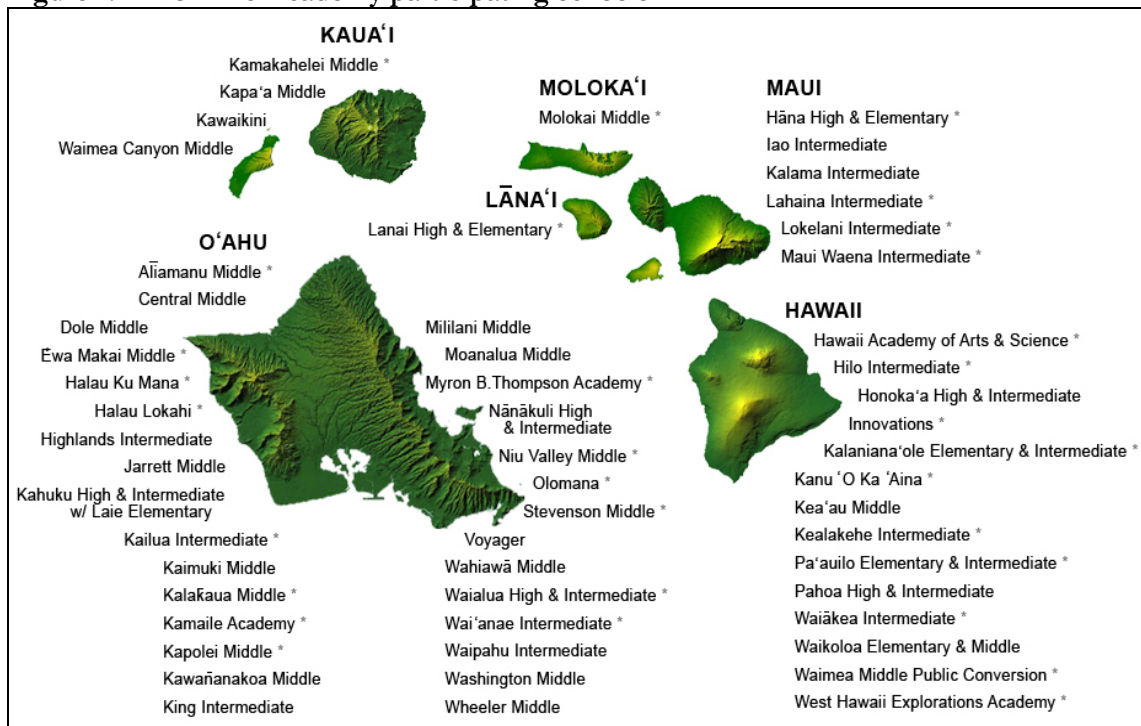
FY 2010 Priority Areas

FIRST Pre-Academy identified the following priorities for FY 2010:

- Support middle school teachers who will: (a) provide students with problem-based, applied learning experiences in STEM pursuant to Act 111 of 2007, and (b) motivate and engage students in STEM.
- Provide technical support to Pre-Academy teachers in the development and implementation of complementary and enhanced problem-based, applied learning projects and curriculum in STEM, which address benchmarked standards.
- Expand the program to all interested public non-charter and public charter middle schools within the State of Hawai'i.
- Establish partnerships with other relevant programs within the University of Hawai'i system, Hawai'i Department of Education and appropriate public and private agencies to provide expanded and continuous support for teacher-driven development of problem-based and applied learning experiences in STEM.
- Provide an online web portal and data system to document program outcomes, problem-based and applied learning curriculum, disseminate materials, articulate and collaborate on projects, and facilitate teacher support.

Statewide Participation

Figure 1. FIRST Pre-Academy participating schools



By the close of FY 2010, FIRST Pre-Academy achieved 70% participation statewide, including 56 public middle schools on six islands: O'ahu (30), Hawai'i (14), Maui (6), Kaua'i (4), Moloka'i (1), and Lanai (1). This benchmark far exceeded the projected target of 40

schools by the end of June 2010. Figure 1 displays a map of current FIRST Pre-Academy schools; new schools are listed in boldface font.

FIRST Pre-Academy currently represents 45 of 54 public non-charter middle schools (80%) and 11 of 26 public charter middle schools (42%) statewide. At the end of FY 2010 participants numbered 174 teachers and 4,460 students*. These figures are itemized by school, district and type of participation in Appendix A.

*Note: These tallies should be considered minimums; double counting was avoided by using the largest number of students involved in a single activity at each school.

Program Tracks

During FY 2010, FIRST Pre-Academy further developed three existing program strands which address key STEM research and training areas. As described in the sections below, these include:

- Research Experiences for Teachers – Engineering, Technology & Mathematics
- Research Experiences for Teachers – Science: Microbial Oceanography
- Applied Learning: Creative Media & Technology

An update on overall FIRST Pre-Academy management and these three program tracks is presented in the following sections.

PRE-ACADEMY ADMINISTRATION AND COORDINATION

Planning, coordination and oversight for the Pre-Academy were performed by the Office of the Dean, College of Engineering and administrative and fiscal support provided by the Office of the Vice-President for Research. It was uncertain at the outset of FY 2010 if program funds would be available; however Pre-Academy programs continued at various levels of implementation. SFSF Part B funds in the amount of \$1,032,500 became available in March 2010.

The College of Engineering maintained an interface between the university and public and private stakeholders, and supplied additional support such as project management, development, and reporting.

STEM INTERCOMMUNITY PORTAL

The STEM Intercommunity Portal (SIP) is a website which intends to enhance the FIRST Pre-Academy program by improving information exchange, outreach and interaction among STEM community members, and to facilitate technical and logistical support for Pre-Academy teacher and student participants. The SIP addresses unique needs of STEM stakeholder groups (teachers, industry/academia, and students) that together contribute the problem-based and applied learning activities essential to the Pre-Academy program. Participants have uninterrupted access to an online forum where they can process and archive ideas for innovative STEM projects and curriculum. The SIP is being developed in collaboration with Referentia Systems, Inc., a Honolulu-based firm.

2010 SIP Highlights

1. Generate Interest and Membership among Teachers & other STEM Stakeholders
2. Enhance Interaction among STEM Stakeholders via
 - a. Real-time dissemination of curriculum materials, resource/technical content, and STEM opportunities
 - b. New collaboration tools including messaging
3. Facilitate Technical Support for Pre-Academy Participants
4. Enable and Promote Autonomous Participation of SIP Members

2009-2010 Implementation

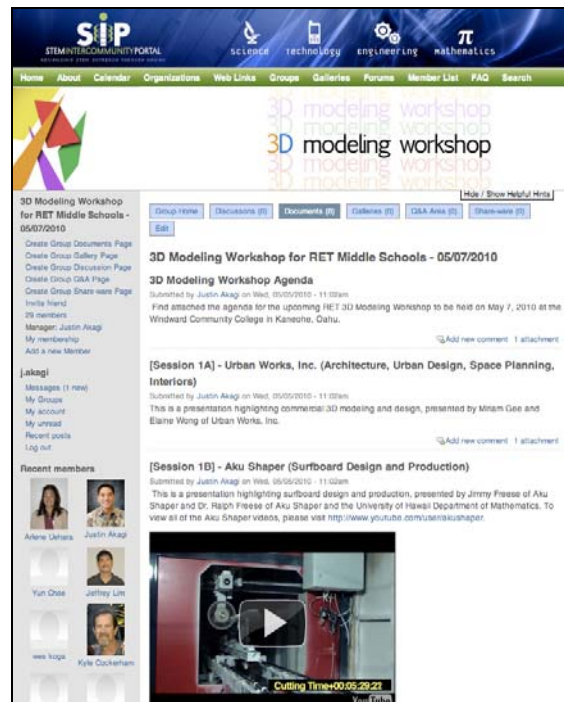
1. Generate Teacher Interest and Membership – In FY 2010 the SIP successfully attracted significant new membership. New discussion groups were formed and traffic increased as members implemented new online resources such as document, curriculum and photo sharing. A messaging tool allows direct collaboration among invited participants.

2. Enhanced Interaction among STEM Stakeholders - A landing page, www.sip-hawaii.org/pre-academy presents key information about the FIRST Pre-Academy and invites site visitors to register as members. Highlights include a brief overview of the FIRST Pre-Academy initiative, featured discussion groups, upcoming and recent events, and currently participating middle schools. A tag cloud provides links to related topics on other pages. Content administrators can post announcements and related material from workshops, invite teachers to participate in person or online in future activities, and provide links to archived content from past workshops. After a workshop takes place, teachers can post images, videos and documents and create groups for online collaboration.

Figure 2. SIP Screenshots



FIRST Pre-Academy landing page

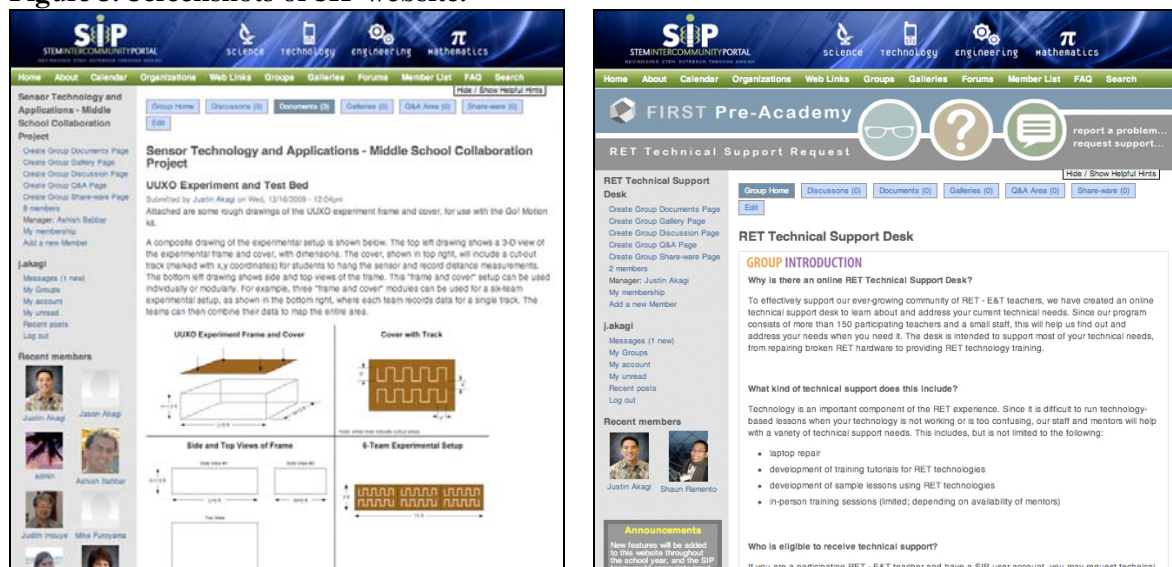


Sample teacher workshop group

The SIP fosters organic interaction by disseminating teacher needs, concerns, STEM curriculum and activities through a conveniently accessible website. By virtue of its public nature, the SIP also affords the benefit of showcasing the FIRST Pre-Academy program to future participants among teachers, researchers and stakeholders from government and industry. SIP resources are available any time and place that internet access is available.

3. Facilitate Ongoing Support for Pre-Academy Participants - An important SIP function is to facilitate technical and logistical support for Pre-Academy teacher participants. FIRST teacher participation effectively doubled from FY 2009 to FY 2010 while support staff remained essentially the same. Online support became key to economize personnel, resources and time. New support features were developed and tested in FY 2010.

Figure 3. Screenshots of SIP website.



Technical support for lesson development

Community resources for RET – E&T teachers

The FIRST Pre-Academy pairs RET teachers and schools with mentors from academia and industry who can guide them through research and technical challenges. Mililani Middle School was the first to utilize the SIP for curriculum development and collaboration with university mentors. Figure 3 shows user-created focus groups, such as the *Sensor Technology and Applications – Middle School Collaboration Project*. Teachers can interact with each other and their technical mentors online even when real-time communication is not feasible.

During FY 2010, the demand for technologies to support hands-on STEM activities greatly increased. In order to meet the growing need for equipment to perform short-term classroom and field experiments, technology tools were pooled and housed as community resources for participating teachers. The SIP enabled teachers to monitor availability of resources and reserve them via an online system.

4. Enable and Promote Autonomous Participation of SIP Members – New online tools such as messaging, that permit instantaneous dissemination of curriculum materials, STEM opportunities, and technical content immediately resulted in more spontaneous use of the SIP as a networking resource. Participant activity will be closely monitored and encouraged in FY 2011.

Forward Planning and Implementation

Major SIP initiatives launched during FY 2010 will be further refined in FY 2011. Real-time service support has become logistically challenging due to the rapidly increasing number of Pre-Academy participants, and teachers will depend increasingly on the SIP to communicate with each other, program staff and mentors. As a preemptive measure, program staff is investing time and effort now to help teachers make full use of SIP capabilities and tools such as file sharing, online collaboration and messaging.

Interaction among STEM stakeholders will be greatly enhanced through refinement of the FIRST Pre-Academy landing page. Plans are to render the SIP more intuitive by improving site design and navigability, and to integrate website capabilities that directly support online collaboration and user communication.

RESEARCH EXPERIENCE FOR TEACHERS (RET) – MIDDLE SCHOOLS ENGINEERING, TECHNOLOGY AND MATHEMATICS

The Research Experiences for Teachers – Engineering Technology and Mathematics (RET – ET&M) program track intends to assist public and public charter middle school teachers by enhancing their knowledge of current technology and research across a broad range of STEM disciplines. Participating teachers receive technical support from academic and industry mentors, and hardware/software technology support to explore and develop new curriculum and activities. ET&M technical and technology support is specifically targeted to promote teacher ideas for hands-on, STEM-related lessons and activities. Collaboration among teachers and between teachers and mentors is strongly encouraged, as such interactions help stimulate professional interest and generate new curriculum ideas.

FY2010 Highlights

- RET – ET&M hardware/software and technical support helped teachers develop and implement more than 150 STEM-related lessons, projects and hands-on activities.
- Participation increased from 26 schools, 62 teachers and 3,470 students to 40 schools, 158 teachers and 4,224 students.
- A technology-focused workshop series facilitated interaction for teachers from 27 middle schools statewide with university researchers and industry professionals.
- Educational 3D modeling software and a fabrication tool were introduced and made available to improve understanding of basic geometry and engineering concepts.

Program Planning, Coordination and Implementation

The RET – ET&M program track was coordinated by the Office of the Dean, College of Engineering (CoE).

Technical mentors, including CoE students and volunteer research engineers provided additional support for teachers during FY 2010.

Major Initiatives

1. Technology-Specific Teacher Workshops
2. Teacher-Developed Curriculum & Activities
3. Ongoing Technical Support

FY 2010 Implementation

1. Technology-Specific Teacher Workshops

Four technology-specific ET &M workshops were held in FY 2010. Each half-day session focused on a particular area of teacher interest and enabled participants to share implemented STEM curriculum and best practices with their mentors and peers. Close attention was given to the impact of these activities on student engagement and achievement relative to mandated benchmark standards.

Speakers from academe and industry presented state-of-the-art technology and STEM research relevant to the workshop topics. These lay-friendly demonstrations provided an excellent complement to the teacher-teacher interactions and were enthusiastically received. Participants could learn directly from university researchers and industry professionals how middle school curriculum applies to cutting-edge research and real-world applications.

Following are brief summaries of the four technology-specific teacher workshops.

I. September 2009, PDA Workshop – Manoa Innovation Center

A Research Corporation of the University of Hawai'i systems engineer and several middle school teachers presented on wireless technology and applications and demonstrated the PDA and its various data collection applications, including real-world uses in aerospace, medicine, entertainment and education. Teachers led hands-on PDA training, and shared interactive classroom and field activities using PDAs. Shared activities included: lava toe and vesicle measurement, water chemistry testing, rainforest field guides, and social science surveys. 12 teachers from 10 O'ahu and Maui middle schools attended in person or via videoconference.

II. December 2009, Robotics Workshop – Manoa Innovation Center

Invitees from UH Manoa Department of Mechanical Engineering, The Queen's Medical Center and Spectrum Photonics presented ongoing medical robotics research, and demonstrated a medical robotics application used at a local hospital, and other robotics based real-world engineering applications. Teachers shared relevant classroom and extra-curricular activities such as a week-long robotics experience culminating in a field trip to the UH College of Engineering, and a sequence of year-long courses in structures, simple machines and robotics. 24 teachers from 10 O'ahu, Maui, Kaua'i and Hawai'i middle schools attended this workshop in person or via videoconference.

III. February 2010, Sustainability Workshop – Honolulu Community College

UH speakers from Pacific Bioscience Research Center, Water Resource Research Center and Sea Grant College Program presented on sustainability science, material flow analysis, climate change, renewable energy, and biochar carbon sequestration. They highlighted the environmental impact of increasing demand for natural resources, and introduced current research to improve global sustainability through conservation and renewable resources. Teachers shared implemented hands-on activities and lessons on sustainability and

renewable energy. 35 teachers from 17 O‘ahu, Maui, Kaua‘i and Hawai‘i middle schools attended this workshop in person or via videoconference.

IV. May 2010, 3D Modeling Workshop – Windward Community College

Speakers from Urban Works, Aku Shaper, Rapid Technology and UH Department of Mathematics presented digital modeling and fabrication tools, and 3D printing and rapid prototyping applications. The presentations showcased technology used to design and create 3D architectural renderings of building plans, how Aku Shaper integrates math principles into surfboard design and manufacturing, and the capabilities of digital prototyping tools used to produce 3D models such as human skulls, body armor, and gear assemblies.

Teachers shared self-developed mathematics lessons using educational 3D modeling and fabrication tools. 50 teachers from 23 middle schools on O‘ahu, Maui, Kaua‘i and Hawai‘i attended this workshop in person or via videoconference.



The FY 2010 workshop series was attended by teachers from 27 middle schools statewide., Steadily increasing registration numbers indicate that the workshops resonated strongly with participating RET – E&T teachers. Attendees shared STEM-related curriculum and implementation methods. As example, after the 3D modeling workshop, teachers from a dozen schools began planning hands-on lessons to teach geometry concepts using the FabLab ModelMaker software and 3D modeling tool. Academic and industry professionals introduced cutting-edge research and real-world applications that apply to classroom topics. Teachers were excited by math equations used in surfboard design and rapid prototyping technology used to produce body armor for Hollywood blockbuster movies, as students easily relate with such tangible applications. Several teachers attended a follow-up site tour of the Rapid Technology facilities to learn more about the digital 3D prototyping process.

2. Teacher-Developed Curriculum & Activities

During FY 2010, RET – E&T teachers developed and implemented many hands-on activities to complement the traditional STEM classroom curriculum. FIRST Pre-Academy strongly supported this work with expertise and technology (hardware) matched to specific lesson ideas. This approach encouraged teachers to innovate, and provided them with the technical support necessary to implement new lessons and activities in their classrooms.

A selection of Pre-Academy supported lessons and activities presented in the teacher workshop series stimulated interaction and collaboration among RET – E&T teachers and

led to the development or adaptation of many additional activities. This initiative proved effective in generating teacher collaboration and innovative STEM-related curriculum.

The FIRST Pre-Academy was instrumental in helping teachers identify and address existing curriculum areas that could be complemented with hands-on lessons and projects. Each teacher was allowed the leeway to integrate activities that would most effectively serve students in their unique classrooms and/or teaching environments.

A majority of the implemented hands-on activities fall within two topic areas covered at the teacher workshops:

Environmental Studies – Water Quality

Teachers implemented a variety of hands-on experiments using digital water quality sensors to measure pH, temperature, turbidity, dissolved oxygen, nitrate content and phosphate content in local streams, ponds, watersheds and rainfall. These technologies helped students collect, store and transmit data from remote locations while on environmental study field trips, and allowed them to analyze their data to gain a basic understanding of factors that affect water quality. Nine schools implemented water quality activities, including: Dole, Honokaa, Iao, Kawanakoa, King, Mililani, Pahoia, Waikoloa, and Washington.

Mathematics – 3D Modeling

Teachers developed hands-on lessons about three-dimensional geometric shapes, surface areas and volumes, and digital modeling using the educational FabLab ModelMaker 3D modeling software. Students could tactilely experience 2D nets and digital models by constructing three-dimensional models from paper. Twelve schools stated their intention to use the digital modeling software during the 2010-11 school year, including: Central, Ewa Makai, Innovations, Kapaa, Keaau, Lahaina, Lokelani, Maui Waena, Moanalua, Waimea Canyon, Waipahu, and Wheeler. Hawaii is the first state in the nation to use this software statewide in its public middle schools.

Although sustainability and 3D modeling were the topic areas of highest interest, teachers also implemented hands-on lessons and projects in a variety of other areas, including:

- **Physics**
Investigations: force, motion, electricity, magnetism, electromagnetic, waves, wireless theory, thermal transfer, periodicity
- **Life Science**
Investigations: photosynthesis, diffusion, cell theory, E. Coli, oxygen and carbon dioxide concentration
- **Earth/Space Science**
Investigations: GIS technology, sea level rise, global warming, reef studies, GPS technology, global climate variation, ocean floor mapping, UVA/UVB radiation
- **Engineering**
Design Projects: bridge building, roller coaster design, solar car design, Newton's Laws of Motion, simple machines, robotics, solar oven design
Investigations: Unexploded Ordnance (UXO) mapping

FIRST Pre-Academy staff and volunteers supported more than 150 RET – ET&M activities in FY 2010. The number and variety of new lessons, projects and activities demonstrate the buy-in of middle school teachers for technical and technology support to stimulate professional and student interest and greater STEM-related achievement.

3. Ongoing Technical Support

Ongoing technical support was provided to RET – E&T teachers based on articulated needs. Since teacher interest is the driving factor behind lesson development, a teacher facilitator acted as an interface between participating teachers and technical support personnel, and coordinated technical support for teachers. Program staff, engineering students and volunteers offered a combination of informal technology training sessions, collaborative lesson development, training tutorials, and sample lessons.

Technology Training Sessions and School Visitation

Program staff and volunteers provided in-service training as needed for teachers and students to perform hands-on lessons and activities using RET – E&T technologies. Several training sessions are described below:

- Iao Intermediate: Program staff taught teachers how to run water quality experiments (pH, temperature, dissolved oxygen and turbidity) using two differing sensor configurations: 1) PDA, Vernier LabPro and Vernier sensors, and 2) Apple iPod Touch, Pasco AirLink and Pasco sensors. This session provided teachers with the training needed to lead a 300-student stream water observation field trip at Kahakuloa on Maui.
- Dole Middle: An RCUH engineer volunteered to demonstrate and supervise water quality experiments (pH, temperature, dissolved oxygen and turbidity). This session provided in-field training to 80 students and their teachers on a water quality excursion to Kokua Kalihi Valley.
- Mililani Middle: Program staff showed how to use the FabLab ModelMaker tool to manipulate 3D shapes, learn basic geometry concepts (vocabulary, sides, faces, surface area, volume), and construct 3D models. This session provided hands-on training for a dozen students and teachers on STEM Night at Mililani Middle School.

Collaborative Online Curriculum Development

Program staff worked with Mililani Middle to introduce a collaborative online curriculum development concept using the SIP website as an interface. Staff mentors helped the Mililani teacher develop a new lesson and experiment on sensor technology for underwater unexploded ordnance (UXO) mapping. As a pilot, this concept was deemed successful in enabling mentors to interact with teachers across the island and when schedule conflicts prevented regular face-to-face meetings. Additional online collaboration using the SIP will be supported during FY 2011, as described in the section on RET – E&T *Forward Planning and Implementation*.

Undergraduate Student Mentors

CoE undergraduate students were selected as mentors based on their interest in supporting a program that engages students and motivates them to pursue careers in STEM-related fields. Among the mentors are graduates of Hawaii high schools who feel that teacher and mentor

support made the difference that inspired them to pursue higher education and careers in STEM.

Training Tutorials and Sample Lessons

During the summer school break, program staff and four undergraduate students developed tutorials and sample lessons on 3D modeling and water quality testing, the highest-interest topics from FY 2010: 1) A printable tutorial for the FabLab ModelMaker software includes a short overview of its capabilities, and describes step-by-step how to fabricate 3D models using the software and an accompanying tool. 2) Undergraduate student mentors helped a teacher from Jarrett Middle School develop a set of video water quality tutorials. The videos provide detailed instructions for experiments using digital water quality sensors, and several sample lessons on water quality and related sustainability topics.

These materials were created to improve technical support in topic areas that will become challenging to service through one-on-one training, due to high teacher demand and limited mentor availability. Teachers can access the tutorials via a discussion group on the SIP site.

Industry-Based Support

During FY 2010, industry partnership support was explored. This initiative encourages active *pro bono* involvement from local industry through workshop presentation, financial, and technical support. Since an overarching goal of this program is to engage students in STEM-related education and teach them about possible career opportunities, industry participation provides an important component to the FIRST Pre-Academy program.

As example, industry representatives supported the May 2010 teacher workshop on 3D modeling by showing samples of digital modeling and fabrication tools used in local enterprise. The presentations highlighted current industry applications and technologies, and emphasized the importance of STEM-related curriculum to these real-world applications. After the workshop, Rapid Technology hosted several teachers at their facility to share more about 3D printing technology and its applications, and offered to provide continued assistance to middle schools in the area of 3D modeling and prototyping.

Workshop presenters provided an important contribution to teacher workshops, however the new industry partnership concept seeks more substantial commitment. New partners are asked to volunteer the following:

- Technical and real world support and experiences (mentorship)
- Participate in workshop(s)
- Financial support for requests such as mini grants
- Encourage other business to join the program

New Horizons Computer Learning Centers of Hawaii was the first company to embrace the industry partnership concept. In addition to providing technical support, New Horizons made the initial donation to support mini-grants for RET – ET&M programs, introduced additional funding opportunities from business associations, and offered to promote the concept to other companies.

Evaluation

Throughout the FY 2010 workshop series, attendees completed surveys to evaluate the effectiveness of the workshop format, presentations and training sessions. Results showed

that more than 90% of the attendees felt the workshop format was effective and provided them with useful information on the various STEM topics. More than 80% of respondents plan to implement ideas from the workshop in their classrooms.

Based on year-end survey responses from Pre-Academy schools, all participating teachers (100%) feel that the hardware and software technology resources provided by the program have positively impacted student learning. Nearly all survey responses indicate that STEM content provided via workshops and mentor support positively impacted student learning.

FY 2011 evaluation will incorporate both process and product/outcome components:

- 1) Process evaluation will include pre- and post- assessment of resources, implementation, participation, number and kind of mentoring activities, and response to teacher needs.
- 2) Product/outcome evaluation will be conducted externally by the Institute for the Integration of Technology into Teaching & Learning (IITTL), led by Director Gerald Knezek. This component will consider pretest/baseline data and pre-post development trends in teacher participants. Data will be compared across Hawai'i DOE and to the same instruments in other U.S. programs. In addition, studies will infer: a) indications of teacher comfort level with technology; b) changes in the course of the school year; c) changes as a result of participation over time (first, second, third year), and d) components of the program most likely to yield successful outcomes in the future, with special regard to student interest and engagement in STEM careers.

Forward Planning and Implementation

Extension of FY 2010 Initiatives

Based on successes demonstrated in FY 2010, RET – ET&M initiatives will be further developed during FY 2011. Forward planning will address teacher needs for hardware/software and technical support as follows:

Technology-Focused Teacher Workshops - Technology-focused teacher workshops will continue during FY 2011. Each workshop will focus on a specific topic or technology. Academic and industry guests will share state-of-the-art technology and STEM research. Teachers will learn from their peers, and directly from university researchers and industry professionals how middle school curriculum applies to cutting-edge research and real-world applications.

Teacher-Developed Curriculum & Activities - FIRST Pre-Academy will continue to support teacher development and implementation of STEM-related curriculum and activities. The two highest-interest topic areas from FY 2010 (water quality, 3D modeling and fabrication) will be well supported in the upcoming year: 1) Additional sets of water quality sensors and kits will be made available as a shared community resource for participating Pre-Academy schools, and tutorials and sample lessons will be available to interested teachers via the SIP; 2) FabLab ModelMaker software licenses, fabrication tools and tutorials will be available to interested teachers at all public and public charter middle schools throughout Hawai'i.

At the end of FY 2010, program staff compiled a comprehensive list of teacher interests for new curriculum and activities. The list spans a variety of STEM themes, including: physics, renewable energy, energy conservation, GIS mapping, ocean science, and environmental science. Some of these topics may be covered in the FY 2011 teacher workshops.

Ongoing Technical Support - Hardware/software and technical support needs will be addressed on a case-by-case basis to accommodate curriculum plans in each school. Based on teacher stated interests and needs, program staff, undergraduate students and volunteers will provide ongoing technical support via collaborative online lesson development, training tutorials, sample lessons, and technology training sessions using the process described below:

Identify Teacher Needs for Technology and Technical Support - Program staff will contact teachers: to discuss specific curriculum plans and assess material and technical support needs; schedule hardware/software availability and/or coordinate technical support with mentors.

Collaborative Online Curriculum Development - Use the SIP to establish mentor support for teacher needs using online messaging and collaboration capability to interact with teachers. The online system will allow teachers to interact with technical mentors whose availability is limited. The online collaboration process was tested successfully during FY 2010.

Training Tutorials and Sample Lessons - Program staff will continue to develop training tutorials and sample lessons for high-interest topic areas such as 3D modeling and water quality testing, in order to mitigate technical needs where demand is high and material and mentor support are limited. Tutorials and sample lessons will be available via the SIP.

Technology Training Sessions and School Visitation - University student technical mentors will provide in-service training for hands-on lessons and activities using RET – E&T technologies in order to provide instruction as well as direct access to information about higher education and careers in STEM-related fields.

Industry-Based Support

The RET – ET&M program track will continue expanding the industry connection concept to recruit *pro bono* support from local STEM industry. Based on teacher interests for 2011, local companies from various industry sectors will be invited to present at teacher workshops and provide technical and financial support.

According to a 2008 report by the Hawaii Science & Technology Institute 1,964 science and technology companies and organizations employed 31,106 workers in 2007. A wide range of industry sectors includes: Agricultural Biotechnologies, Astronomy, Biotechnology/Life Sciences, Defense/Aerospace, Digital Media, Engineering/Professional Services, Environmental, Information and Communications Technology, Ocean Sciences, and Renewable Energy.

RET – Middle Schools ET&M seeks industry support in areas of high teacher interest:

- Sensors: Environmental Science, Natural resource management, Air & Water Quality, Visible & infrared light, Geological science, Global warming, Sustainability, Energy savings, Wind Energy, Motion Detectors
- Sustainability & Renewable Energy: Energy conservation, Weather & weathering, Frog building analysis, Wind energy.e
- 3D Modeling: Design contest, Urban planning, Conservation, School building design models, Energy efficient building design.

- GPS/GIS: Ancient civilizations, How technology is used by scientists
- Electromagnetics and Underwater Photography

Industry partners will be asked to make technical, workshop presentation and financial commitments as established in FY 2010:

- Provide technical support and real world experiences
- Participate in workshops
- Provide financial support for requests such as mini grants
- Encourage other business to join the program

Partnerships between industry and education create mutual benefit for both sides, and support a legacy for future growth.

RET – MIDDLE SCHOOLS

SCIENCE: OCEANOGRAPHY

The RET – Science: Oceanography program track assists public and public charter middle school teachers by creating and sharing self-contained, hands-on lessons that introduce students to oceanography and enhance teacher knowledge of current research and educational material through a combination of research experiences and training workshops, and providing extra-curricular educational outreach activities for middle school students and teachers. A key area of focus for this program track is microbial oceanography, because of the critically important roles of microbes in climate change, ocean acidification and the marine food web.

Educational staff and researchers at the Center for Microbial Oceanography: Research and Education (C-MORE), a National Science Foundation sponsored Science and Technology Center, have created seven types of science kits for teachers to borrow and implement in their classrooms. The kits include lessons and activities about marine science topics, such as: nautical knots & careers, marine debris, marine mystery, plankton, ocean acidification, random sampling, and the ocean conveyor belt. C-MORE science kits are aligned with Hawaii Content and Performance (HCPS III) Standards and national Ocean Literacy Principles. Teachers new to the program are encouraged to attend regular training workshops and presentations to learn how to use the various kits in their classroom.

This program track also provides opportunities to learn about microbial oceanography and research outside of the classroom environment. During FY 2010, selected teachers participated in a research cruise aboard a tall ship to gain first-hand experience in oceanographic research and techniques. Program staff held various outreach events to stimulate student interest in STEM, and to develop literacy in microbial oceanography.

Highlights

- By the end of FY 2010, 25 middle schools participated in this program track, an increase of 15 schools from the beginning of the year.

- During this official pilot year, six different science kits were borrowed at least 66 times by middle school teachers to teach hands-on lessons on microbial oceanography topics.
- A seventh science kit, entitled Ocean Conveyor Belt, was developed to expand the collection of teaching resources.
- The science kits are currently being used in a teacher-training course organized by the Hawai'i DOE.
- A research cruise aboard a tall ship was held to provide teachers from 13 middle schools with a first-hand introduction to oceanographic research and techniques.
- A detailed evaluation plan based on pre- and post- surveys for the science kits was developed in consultation with professional evaluators.

Program Planning and Coordination

The RET – Science: Oceanography program track was coordinated by the Center for Microbial Oceanography: Research and Education (C-MORE). During FY 2010, primary support personnel included four part-time positions: Research/Academic Program Coordinator, Northwestern Hawaiian Islands Outreach Specialist, and two Educational Assistants.

Major Initiatives

1. C-MORE Science Kits
2. STORI Research Cruise and Workshop for Teachers
3. Outreach Events

FY 2010 Implementation

1. C-MORE Science Kits

Background - During FY 2009, C-MORE educational staff created and tested science kits covering six topics: nautical knots & careers, marine debris, marine mystery, plankton, ocean acidification, and random sampling. The kits provided complete lesson plans and materials for hands-on science activities in a self-contained format, including background information and supplies necessary for teachers to implement a lesson on a particular topic in microbial oceanography. Ten sets of science kits were produced and field-tested in elementary, middle and high school science classrooms throughout the state and other educational venues.

Statewide Usage of C-MORE Science Kits - In FY 2010, the field-tested science kits were distributed statewide to eleven public schools and other educational venues that were selected as science kit hosts. Host sites on O'ahu, Maui, Kaua'i and Hawai'i were chosen to facilitate easy access to the kits. Since any interested teacher in Hawaii was allowed to borrow these kits free of charge, hosts were fully trained in the use of the kits and served as lending librarians and local experts who could provide training support for teachers in their local area. In total, 66 middle school teachers and an estimated 2,800 students used the science kits in FY 2010. Table 1 provides details on kit usage during the official pilot year, including the number of teachers that used each kit.

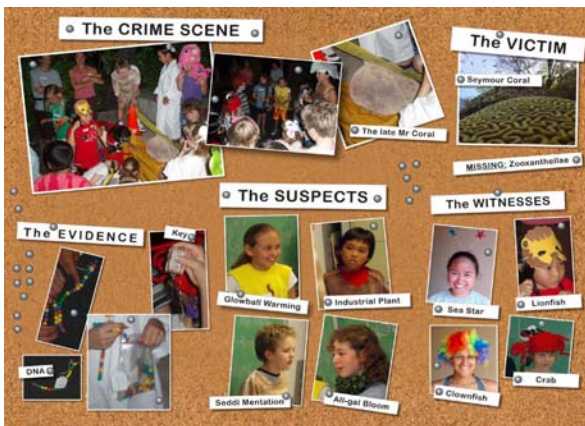
Table 1. Usage of C-MORE science kits during official pilot year (FY 2010)

C-MORE Science Kit	Minimum* number of teachers who borrowed each kit	Minimum* number of middle school teachers who borrowed each kit
Nautical Knots & Careers	9	5
Marine Debris	28	16
Marine Mystery	22	10
Plankton	34	16
Ocean Acidification	37	14
Random Sampling	12	5
Total	142	66

*Note: Only teachers who reserved kits through C-MORE’s online reservation system are included in this table. Other teachers may have borrowed the kits from local area hosts without officially reserving them; the numbers above should be considered minimums.

New Science Kit on Ocean Conveyor Belt - During FY 2010, C-MORE expanded its array of science kits by developing a new kit focused on the Ocean Conveyor Belt. Like its predecessors, this C-MORE science kit is hands-on and aligned with Hawaii Content and Performance Standards (HCPS III) and national Ocean Literacy Principles. The Ocean Conveyor Belt kit uses hands-on and computer based experiments to engage students in exploring ocean circulation, nutrient cycling, and variations in the chemical, biological, and physical properties of seawater. Four lessons use experimenting, creating models, downloading data from online scientific databases and using Excel to graph, analyze and interpret the data. During FY 2011, an extension to this kit will be developed to include a Fluorescence-Temperature-Depth instrument specially designed and created in-house with the assistance of an undergraduate engineering intern.

In December 2009 a professional development workshop was held at UH Manoa to train 25 teachers in the use of this kit. Eight of the 25 teachers were middle school teachers. Valuable teacher feedback led to significant improvements in the kit.



Teacher-training Workshops for Science Kits - In order to improve teacher confidence and increase kit usage, fifteen teacher-training sessions were held. The two different formats for these training events were formal teacher-training workshops, and informal presentations for small

groups of teachers. Table 2 provides details on each event, including the number of teachers that attended. A total of 104 teachers from 20 middle schools attended science kit workshops or presentations.

Table 2. Workshops and Presentations on C-MORE Science Kits

Event Date	School / Group	Number of Teachers	Middle School Teachers
9/2009	Waianae Intermediate	5	5
9/2009	Stevenson / Math Science Partnership	15	7
10/2009	South East Oahu	4	1
10/2009	Hawaii Science Teachers Association	13	3
10/2009	Waikiki Aquarium	124	60
10/2009	Kailua Intermediate	1	1
11/2009	Kamehameha Middle	4	4
12/2009	UH Institute for Teaching Excellence	16	-
12/2009	Stevenson / Math Science Partnership	20	9
12/2009	UH Manoa – Ocean Conveyor Belt	25	8
2/2010	Chaminade U/ pre-service teachers	15	-
2/2010	UH College of Ed/ pre-service teachers	17	6
2/2010	Kamakau Public Charter School	11	7
3/2010	Kaiser High School	2	0
4/2010	Waianae High School	9	0
	Total	267	104

Ongoing Technical Support

In addition to the group teacher-training workshops, technical support was provided by “local expert” kit hosts and an online discussion forum. Training support was provided at the following venues: University of Hawai‘i at Mānoa, Stevenson Middle, Mililani Middle, Waialua High & Intermediate, Laie Elementary, King Intermediate, Castle High, Kapolei Middle, Innovations, Mokuapapapa Discovery Center, Kauai High, and Kalama Intermediate.

An online discussion forum was created to facilitate technical support and promote interaction between teachers and university researchers. This forum allows sharing among teachers using C-MORE science kits, suggested improvements and fixes, and technical questions to C-MORE scientists and educators. Additional information and resources not contained in the kits are also provided in the online discussion forum. The science kit forum is accessible on both the C-MORE web site (<http://cmore.soest.hawaii.edu/education.htm>) and the STEM Intercommunity Portal (<http://www.sip-hawaii.org>).

2. STORI Research Cruise and Workshop for Teachers

In May 2010, the RET – Science: Oceanography program track held a research cruise aboard a tall ship for teachers from 13 middle schools to learn about oceanographic research and techniques directly from university researchers and scientists, and perform oceanography research on an actual research vessel. A follow-up workshop was held in August 2010.

Although Hawai'i's future depends heavily on the oceans, the ocean is still a poorly understood environment. The *School Teachers: Oceanographic Research Introduction (STORI)* research cruise and workshop provided teachers with an introduction to oceanographic research and techniques that researchers use to unravel the mysteries of the deep, and an opportunity to investigate O'ahu's coastal waters.

In preparation for the cruise, the selected teachers completed an online learning module designed to familiarize them with the ship, sailing terms, and research equipment. While on board the tall ship SSV Robert Seamans, they learned how to conduct a plankton tow and deploy a Conductivity-Temperature-Depth (CTD) instrument with a carousel for water sample collection. They analyzed plankton using onboard microscopes, recorded a depth profile using the CTD in real time, and performed oxygen titrations to learn about the geochemistry of the ocean.

In total, 24 K-12 teachers and 8 C-MORE/SOEST scientists and educators participated. 15 of the 24 were middle school teachers representing 13 middle schools statewide. Participating middle schools included: Chiefess Kamakahalei Middle, Hawaii Academy of Arts & Science, Kailua Intermediate, Kalama Intermediate, Kapolei Middle, Lanai High and Intermediate, Waialua High and Intermediate, Waikoloa Middle, Waimea Middle and Waipahu Intermediate.

To directly impact student learning, teachers were required to prepare a presentation highlighting one aspect of the research cruise and share it with other participants and their students. In August 2010, participants followed up by sharing presentations and lesson ideas, and learned about other teacher resources related to the RET – Science: Oceanography track. Motivated teachers were encouraged to apply for further support through C-MORE's Grants for Education in Microbial Science (GEMS).

3. Outreach Events

A variety of outreach events held during FY 2010 were designed to increase literacy in microbial oceanography and stimulate student career interest in oceanography and related STEM fields. Some of these events are listed in Table 3, below.

Table 3. C-MORE Outreach Events

Outreach Event	Date	Estimated Number of Participants	Middle School Participation
Boys and Girls Club, Honolulu	6/2010	40	Yes
Boys and Girls Club, Kailua	6/2010	75	No
Imiloa Family Science Night	5/2010	100	No
Mililani Middle STEM Night	4/2010	75	Yes
Oceanography Merit Badge	4/2010	50	Yes
Hawaiian Ocean Expo	2/2010	400	Yes

Evaluation

During FY 2010, program staff worked with a professional evaluation team to develop and field-test various evaluation instruments. After developing the evaluation model, two instruments were selected: one for students and one for teachers. Students will answer a

series of content questions prior to using the science kit (“pre-survey”) and answer these same questions at the conclusion of the lesson (“post-survey1”). Two weeks later, they will answer the questions again (“post-survey2”) to assess retention. Teachers will be asked to complete a survey at <http://www.surveymonkey.com/s/CMORE-kit-evaluation> to describe their usage of the science kits and any feedback on science kit content. Human subjects approval from the Institutional Research Board (IRB) has been secured to use these evaluation instruments. Data collection will be conducted during FY 2011.

Forward Planning and Implementation

RET – Science: Oceanography initiatives will be further developed during FY 2011 by building on previous activities, and launching two new initiatives.

Extension of FY 2010 Initiatives

C-MORE Science Kits: Teacher-Training Workshops - During FY2011, at least one teacher-training workshop will be held on each of the following islands: O‘ahu, Maui, Kaua‘i and Hawai‘i. These workshops will train teachers in the use of the newly revised science kits, and be publicized to both in-service and pre-service teachers.

C-MORE Science Kits: Evaluation - During FY 2009 and FY 2010, seven C-MORE science kits covering a variety of ocean science topics were developed, field-tested, refined and distributed. Six of these kits have been fully updated and evaluation instruments in the form of student pre- and post- surveys and teacher evaluations have been created. During FY 2011, in consultation with a professional evaluation team from UH's Social Science Research Institute, a formal evaluation of these kits will be conducted. Three C-MORE education office staff will go into classrooms to teach lessons and administer surveys. As a corollary to this evaluation, teachers will be exposed to these kits, which will likely increase kit usage.

Outreach Events: Career Nights in Oceanography - Feedback received on the *Nautical Knots and Maritime Careers* kit, which introduces students to marine science careers, suggests it needs to include diverse career profiles that are more relevant to Hawai‘i students. During FY 2011, we plan to recreate this kit, and offer at least three career nights where students can perform hands-on science and learn more about marine science careers.

New Initiatives

Research Cruises for Teachers and Students - During FY 2011, C-MORE will offer ten day-cruises to introduce students and teachers to hands-on deck sampling and analysis. Oahu tours will use the Honu Kai and conduct sampling near Coconut Island, followed by laboratory analysis in their new education center. C-MORE is currently investigating facilities on other islands, as this program is intended for implementation statewide.

Virtual Oceanographic Field Trips - SEA-IT-LIVE, a C-MORE initiative currently under development, will bring students on virtual oceanographic field trips. SEA-IT-LIVE will use high-quality video to share the excitement of scientific research conducted by any team of scientists anywhere, any time. During FY 2011, video will be collected on several research cruises, including the C-MORE Fall 2010 cruise, which departs off the coast of Chile.

RET MIDDLE SCHOOLS

APPLIED LEARNING: CREATIVE MEDIA

The Applied Learning – Creative Media program track provides assistance to public middle schools by enhancing the technological knowledge and professional training of creative media teachers and students. Teachers and students receive technical support from peer, academic and industry mentors, as well as hardware/software technology support to implement and improve creative media programs at their respective schools. A key philosophy of this program track is peer mentorship. In this spirit, a core group of students is trained on a regular basis by Searider Productions staff and students; these students, in turn, provide technical training and mentorship at participating middle schools in their local districts.

Highlights

- During FY 2010, nine digital media workshops provided students and teachers from five middle schools with hands-on skills training in digital media production.
- Students at Waianae High, Chiefess Kamakahēlei Middle and Maui High were trained as mentors; these students provided creative media mentorship to students at middle schools in their local areas.
- Digital media training sites were set up to improve mentorship infrastructure at the following schools on O‘ahu, Kaua‘i and Maui: Waianae High, Waianae Intermediate, Chiefess Kamakahēlei Middle, Maui High, Lokelani Intermediate, Maui Waena Intermediate and Waimea Canyon.
- Digital media training curriculum was standardized so teachers and peer mentors could lead training sessions at their respective schools and other middle schools in their local areas.
- Creative media programs were established at Olomana and Stevenson Middle.

Program Planning and Coordination

The Applied Learning – Creative Media program track was coordinated by Searider Productions and the UH Academy for Creative Media.

Major Initiatives

1. Improvement and Expansion of Training Sites
2. Skills and Mentorship Training Workshops
3. New Creative Media Programs

FY 2010 Implementation

1. Improvement and Expansion of Training Sites

Infrastructure Improvement and Expansion - Existing digital media training sites on O‘ahu, Kaua‘i and Maui at Waianae High, Waianae Intermediate, Chiefess Kamakahēlei Middle, and Maui High were upgraded. Hardware and software, such as video cameras, microphones, and computers, were purchased and distributed to support advanced training and production

activities for the digital media programs at these schools. The improvements enabled students to create commercial-quality video projects for public access television and state and national competitions. To ensure consistency at the training workshops, all sites received the same equipment and digital editing software.

New Maui and Kaua'i training sites were established at Lokelani Intermediate, Maui Waena Intermediate and Waimea Canyon Middle. Equipment was provided to help beginning digital media students create basic video projects, and is similar to the equipment used in media training workshops at the advanced training sites.

Standardized Curriculum - Digital media training curriculum was standardized so teachers and student mentors could consistently apply techniques and lessons at their local training sites. Topics include: basic photography, composition, audio, storytelling, story structure, sequencing, and interviewing.

The training curriculum was aligned to meet state and national learning outcomes and standards, including the State of Hawai'i Department of Education's General Learner Outcomes (GLOs). Evidence of GLOs is demonstrated at the training workshops through observable student behaviors. The six GLOs addressed by this curriculum are:

- **Self-directed Learner** - Able to be responsible for one's own learning
- **Community Contributor** - Understands that it is essential for human beings to work together
- **Complex Thinker** - Able to demonstrate critical thinking and problem solving
- **Quality Producer** - Able to recognize and produce quality performance and quality products
- **Effective Communicator** - Able to communicate effectively
- **Effective and Ethical User of Technology** - Able to use a variety of technologies effectively and ethically

Student instruction and learning in the workshops meets several Hawai'i Content and Performance Standards (HCPS) III benchmarks in Language Arts and Career & Technical Education:

- **Language Arts – Standard 4: Writing: Conventions and Skills**
Students learn research skills, how to write interesting leads, organize information, include appropriate facts and details, provide closure to their reports, and how to storyboard their projects. This standard helps students learn to use the writing process and conventions of language and research to elicit meaning and communicate effectively for a variety of purposes and audiences.
- **Language Arts – Standard 6: Oral Communication: Conventions and Skills**
Students taking the role of reporters and anchors follow the oral communication standard. Students are evaluated on pronunciation, grammar, and use of nonverbal language to engage audience, volume, pitch, pacing, and eye contact. With this standard, students apply knowledge of verbal and nonverbal language to communicate effectively in various situations for a variety of purposes.
- **Career and Technical Education Standard 1: Technological Design**

Students assess their own videos as well as other student videos and try to modify their work based on the suggestions of other students or professionals. With this standard, students not only apply technology to create a video package, they also obtain feedback from other students and professionals to improve their projects.

The standardized digital media training curriculum addresses the six National Educational Technology Standards:

1. **Creativity and Innovation** - Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.
2. **Communication and Collaboration** - Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
3. **Research and Information Fluency** - Students apply digital tools to gather, evaluate, and use information.
4. **Critical Thinking, Problem Solving, and Decision Making** - Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
5. **Digital Citizenship** - Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
6. **Technology Operations and Concepts** - Students demonstrate a sound understanding of technology concepts, systems, and operations.

2. Skills and Mentorship Training Workshops

Nine digital media training workshops were held at Waianae High, Chiefess Kamakahahei Middle and Maui High to prepare students for higher education, employment and entrepreneurship in digital media industries. Students gained technical skills in aspects of digital media production, including: composition, story structure, photography and video editing. Training sessions incorporated important native Hawaiian values, artistic and technical skills, and teamwork through various hands-on, applied learning experiences.

Middle and high school students who attended these workshops were also trained as peer mentors so that they could use the standardized training curriculum to mentor students at their own and other participating middle schools in the area of digital media production.

August 2009 – News Production Workshop - Students learned news production skills such as basic photography, composition and story structure. By the end of the workshop, students were expected to produce a 2-minute feature video. Attendees included 55 students from Waianae High, Maui High, Chiefess Kamakahahei Middle, and Waianae Intermediate.

September 2009 – Video Production Workshop - Students learned video production skills such as basic photography, composition and story structure. By the end of the workshop, students were expected to produce a 30-second public service announcement. Attendees included 35 students from Waianae Intermediate, Wai‘anae Elementary and Leihoku Elementary.

October 2009 – Final Cut Pro Workshop - Students learned to edit videos using Final Cut Pro software. This workshop involved 10 students from Leihoku Elementary, and 5 Waianae Intermediate student mentors.

February 2010 – News Production Workshop - 38 students from Maui High, Chiefess Kamakahahelei Middle and Waianae Intermediate, and 10 Waianae High student mentors attended a two-day workshop on news production. By the end of the workshop, students were expected to produce a 2-minute news feature video.

March 2010 – Composition Workshop - 33 students from Maui High, Maui Waena Intermediate and Lokelani Intermediate, and 4 Waianae High student mentors were given lessons on basic photography, composition, audio, story structure/sequencing and interviewing. By the end of the workshop, they were expected to create their own two-minute video incorporating composition, sequencing of shots, story structure (beginning, middle and end), natural sound and music selection.

April 2010 – Hiki No Program Workshop - 10 students from Maui Waena Intermediate, and 5 Maui High student mentors attended a workshop for assistance with a 90-second video about their school/community for the upcoming PBS Hawaii Hiki No Program.

April 2010 – Composition Workshop - 24 students from Kauai High, Waimea High, Kapaa High, Chiefess Kamakahahelei Middle and Waimea Canyon Middle, and 4 Wai'anae High student mentors were given lessons on basic photography, composition, audio, story structure/sequencing and interviewing. By the end of the workshop, students were expected to create a 30-second public service announcement incorporating composition, sequencing of shots, story structure (beginning, middle and end), natural sound and music selection.

May 2010 – Hiki No Program Workshop - 10 students from Maui Waena Intermediate, and 5 Maui High student mentors received assistance with their 90-second video about their school/community for the upcoming PBS Hawaii Hiki No Program.

June 2010 – Digital Media Camp - 87 students from Waianae High, Waianae Intermediate, Maui High, Maui Waena Intermediate, Lihikai Elementary, Moanalua High and Chiefess Kamakahahelei Middle, and 6 college mentors were trained in basic video production skills such as basic photography, composition, audio, story structure/sequencing and interviewing. Advanced students worked one-on-one with guest speaker Les Rose, an Emmy Award winning photojournalist for CBS News bureau in Los Angeles to learn interviewing techniques, story development, writing copy, script structure, shot composition and camera techniques. By the end of the workshop, beginning students were expected to create their own 60-second video demonstrating composition, story structure and sequencing. Advanced students created a two-minute news feature about a person living in Wai'anae. Many of these feature stories will be aired by PBS Hawaii on the Hiki No program. The completed projects will be used as models and examples at future training sessions and camps.

3. New Creative Media Programs

The Applied Learning – Creative Media program track built on the proven success of the Searider Productions model for engaging Hawai'i's youth through digital media. In FY 2010 ACM established new creative media programs at middle schools and supported additional schools that demonstrated a strong need to enhance their existing programs. Consideration was given to schools servicing some of our most challenging or at risk student populations.

Lokelani Intermediate, Maui Waena Intermediate, Waimea Canyon Middle, Olomana, Stevenson Middle, and Waialua Middle and High were selected to receive hardware and software technology support, and digital media training opportunities. Prior to FIRST Pre-Academy support, two of the five schools (Olomana and Stevenson Middle) had extremely

limited media equipment for video production or animation, and few of the schools participated in benchmark programs such as Olelo's Youth Xchange.

In FY 2010, Olomana and Stevenson Middle received start-up resources to establish new creative media programs; Waialua received funds to enhance its existing Creative Media department. The resources were used to buy hardware and software, including HD cameras and computers, to train students in broadcast journalism, computer animation, visual effects, production of public service announcements (PSAs) and music videos, including composing original music on computer software. Students and faculty from Waialua, and from Baldwin High School (Maui) attended the October, 2010 Waianae Seariders Production "Boot Camp". Teachers and students in these programs will receive training and technical support from Searider Productions mentors and staff in FY 2011.

Evaluation

Teacher and student participants unanimously (100%) found the Applied Learning – Creative Media program track worthy of recommendation to others. Initiatives implemented throughout FY 2010 generated positive teacher and student impact in areas such as student engagement, student achievement, and professional development for teachers. Students commented that they found the workshops extremely helpful because they became better communicators and learned good work ethic and digital media skills. Teachers found the workshop content pertinent to [middle school] standards and class objectives, personally and professionally enriching and inspirational. All participants found instructors and student trainers to be knowledgeable and able to engage student interest. Students 'become teachers', gain confidence, and are respected as experts in the classroom.

Forward Planning and Implementation

Skills and Mentorship Training Workshops: In FY 2011, program staff plans to expand the statewide impact of digital media training workshops through collaboration with PBS Hawaii's *Hiki No* multimedia educational initiative. *Hiki No* middle schools will be invited to attend future RET – Creative Media training workshops. *Hiki No*, which means "can do" in Hawaiian, will be the first statewide student news network in America. Currently, approximately 60 middle and high schools are interested in participating. In future workshops students will produce 90-second to two-minute videos about their schools or communities for broadcast on PBS Hawaii. This collaboration will help students develop professional quality videos that meet the broadcast standards of PBS Hawaii.

Additional planning includes training workshops to provide students with hands-on skills training in digital media production and mentorship training. The training will take place throughout the school year and summer of FY 2011, and will continue thereafter.

Based on the success of a week-long training at Waianae High in June 2010, another week-long workshop is planned for October 2010. Students from at least ten Oahu middle schools will learn basic video production including: photography, composition, audio, story structure, sequencing, and interviewing. By the end of the workshop, beginning students are expected to create a 60-second video demonstrating composition, story structure and sequencing skills. Advanced students will be expected to produce a two-minute news feature.

In FY 2011, four two-day workshops at schools on Hawaii, Maui and Kauai are planned at Hilo High, Maui High, Baldwin High and Chiefess Kamakahalei Middle. Current Applied Learning – Creative Media participants and non-participating middle schools will be invited.

In June 2011, Waianae High will host a second week-long workshop for new in-training student mentors from Chiefess Kamakahalei Middle, Maui High, Hilo High and Waianae Intermediate. Students will receive in-depth training to prepare them as mentors at their respective schools and other participating middle schools in their local districts. Students and faculty from Baldwin High (Maui), Olomana, Waialua, Stevenson Middle and 5 additional schools on different islands will also attend.

Improvement and Expansion of Training Sites: In FY 2011, with the new addition of Hilo High, mentor training sites will have been established on all major islands in the state, including O‘ahu, Kaua‘i, Maui and Hawai‘i. Hilo High media teacher Byron Kapali has agreed to host future digital media workshops at his school, and to help expand this program track in Hilo by inviting other local middle school teachers and students to scheduled events.

Professional Development Training: The Applied Learning – Creative Media program track will expand its technical support base by working with the new UH West O‘ahu campus to add creative media instruction to their teacher education degree programs. Program staff will work directly with DOE Acting Superintendent Kathy Matayoshi and DOE Acting Deputy Superintendent Ronn K. Nozoe to enhance professional development of existing faculty in the DOE through Searider Productions program and facilities, and with UH West O‘ahu Chancellor Gene Awakuni, UH West O‘ahu Vice Chancellor for Academic Affairs Linda Randall and Chris Lee, Founder and Director of the Academy for Creative Media to develop curriculum for creative media instruction degrees at UH West O‘ahu.

ROBOTICS

funding from Temporary Assistance for Needy Families (TANF) Block Grant

A TANF Block Grant in support of Scholastic Robotics Program Implementation provided \$88,000 for the period July 1, 2009 – June 30, 2010 by agreement between the University of Hawai‘i at Mānoa College of Engineering (CoE) and the Department of Business, Economic Development, and Tourism (DBEDT). The account was established March 9, 2010, thus considerably shortening the true performance period to March 9, 2010-June 30, 2010.

It was decided to focus attention of three Hawai‘i DOE Complex Areas: A) East O‘ahu Region; B) West Hawai‘i Island Region, and C) Windward O‘ahu Region. The existing funding structure was redesigned to provide broader impact across the K-12 educational spectrum. Dr. Song K. Choi, Assistant Dean of CoE, coordinated efforts to establish contact at the elementary, middle and high school levels with complex area teachers, mentors and representatives, to recruit volunteer and fundraising assistance, and to procure and distribute educational robotics kits for students to use in state and national robotics programs and competitions. VEX, Underwater SeaPerch, Lego Mindstorm and Letry were chosen as the robotics kits that would enable the most students to participate at the least expense, and ensure the greatest continuity between grade levels. In FY 2010 more than 1400 (K-12) students benefitted from robotics activities in the State of Hawai‘i. The abbreviated performance period resulted in some carry-over kits which will be used in FY 2011.

CONCLUSION

The Fostering Inspiration and Relevance through Science and Technology (FIRST) Pre-Academy, established through Act 111 of the 2007 Legislature for *Innovation in Education*, and administered by the University of Hawai'i System and University of Hawai'i College of Engineering, is entering its fourth year of program implementation and is well on track to achieve its goal of statewide participation of all interested schools by 2012.

In FY 2010, funding from the American recovery and Reinvestment Act (ARRA) State Fiscal Stabilization fund (SFSF), Government Services – Part B, enabled expansion of existing initiatives as well as dissemination to new and underserved areas of the State.

We anticipate that with continued funding, academic and industry support, the FIRST Pre-Academies will exert considerable positive impact with regard to STEM subjects and their associated careers, by attracting an increasing number of the State's K-12 students to higher level studies in STEM and related programs and leading them to better employment options in our economy's increasingly technology driven industries.

Appendix A: FIRST Pre-Academy -- Program Participation

FIRST PRE-ACADEMY ALL PROGRAM TRACKS July 1, 2009 - June 30, 2010	District	Start Year	Participating Students**	Participating Teachers**	RET - E&T	RET - Science: Oceanography	Applied Learning - Creative Media
All Schools							
Aliamanu Middle	Central	2010	0*	1	Y		
Central Middle	Honolulu	2009	240	2	Y		
Chiefess Kamakahelei Middle	Kauai	2010	20	1		Y	Y
Dole Middle	Honolulu	2005	250	20	Y		
Ewa Makai Middle	Leeward	2010	0*	4	Y		
Halau Ku Mana	PCS	2010	1	1		Y	
Halau Lokahi	PCS	2010	1	1		Y	
Hana High & Intermediate	Maui	2010	0*	4	Y		
Hawaii Academy of Arts & Science	PCS	2010	1	1		Y	
Highlands Intermediate	Leeward	2008	220	4	Y		
Hilo Intermediate	Hawaii	2010	0*	3	Y		
Honokaa High & Intermediate	Hawaii	2006	110	3	Y		
Iao Intermediate	Maui	2008	300	9	Y		
Innovations	PCS	2010	1	2	Y	Y	
Jarrett Middle	Honolulu	2008	30	3	Y		
Kahuku High & Intermediate	Windward	2008	130	3	Y	Y	
Kailua Intermediate	Windward	2010	0*	1	Y	Y	
Kaimuki Middle	Honolulu	2008	150	2	Y		
Kalakaua Middle	Honolulu	2010	20	7	Y		
Kalama Intermediate	Maui	2008	150	4	Y	Y	
Kalaniana'ole Elementary & Intermediate	Hawaii	2010	0*	3	Y		
Kamaile Academy	PCS	2010	1	1		Y	
Kanu o ka Aina	PCS	2010	0*	4	Y		
Kapaa Middle	Kauai	2007	450	4	Y		
Kapolei Middle	Leeward	2009	0*	1		Y	
Kawaikini New Century PCS	PCS	2008	19	1	Y		
Kawanānakoā Middle	Honolulu	2008	145	3	Y		
Keaau Middle	Hawaii	2005	198	4	Y		
Kealakehe Intermediate	Hawaii	2010	1	1		Y	
King Intermediate	Windward	2008	300	6	Y	Y	
Lahaina Intermediate	Maui	2010	0*	3	Y		
Laie Elementary***	Windward	2008	75	1	Y		
Lanai High & Elementary	Maui	2009	1	1		Y	
Lokelani Intermediate	Maui	2010	0*	11	Y		Y
Maui Waena Intermediate	Maui	2010	0*	2	Y		Y
Mililani Middle	Central	2009	100	2	Y	Y	
Moanalua Middle	Central	2008	450	6	Y		
Molokai Middle	Maui	2010	0*	6	Y		
Myron B. Thompson Academy	PCS	2010	1	1		Y	
Nanakuli High & Intermediate	Leeward	2008	260	3	Y	Y	
Niu Valley Middle	Honolulu	2010	1	1		Y	
Olomana	Windward	2010	0*	1			Y

Appendix A: FIRST Pre-Academy -- Program Participation

**FIRST PRE-ACADEMY
ALL PROGRAM TRACKS
July 1, 2009 - June 30, 2010**

	District	Start Year	Participating Students**	Participating Teachers**	RET - E&T	RET - Science: Oceanography	Applied Learning - Creative Media
All Schools (Continued)							
Paauilo Elementary & Intermediate	Hawaii	2010	0*	5	Y		
Pahoa High & Intermediate	Hawaii	2008	158	2	Y		
Stevenson Middle	Honolulu	2009	1	1		Y	Y
Voyager PCS	PCS	2008	49	1	Y		
Wahiawa Middle	Central	2008	120	3	Y		
Waiakea Intermediate	Hawaii	2010	0*	3	Y		
Waialua High & Intermediate	Central	2010	1	1		Y	Y
Waianae Intermediate	Leeward	2010	15	1		Y	Y
Waikoloa Elementary & Middle	Hawaii	2008	200	1	Y	Y	
Waimea Canyon Middle	Kauai	2008	120	1	Y		Y
Waimea Middle Public Conversion	PCS	2010	1	1		Y	
Waipahu Intermediate	Leeward	2008	45	5	Y	Y	
Washington Middle	Honolulu	2008	120	4	Y	Y	
West Hawaii Explorations	PCS	2010	1	1		Y	
Wheeler Middle	Central	2008	55	4	Y		

TOTAL			4512	176	40	25	8
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	District	Start Year	Participating Students	Participating Teachers	RET - E&T	RET - Science: Oceanography	Applied Learning - Creative Media
Schools Added Since June 30, 2010							
Aiea Intermediate	Central	2011	0*	2	Y		
Connections	PCS	2011	0*	1			Y
Education Laboratory	PCS	2011	0*	1	Y		
Ke Kula Niihau O Kekaha Learning Center	PCS	2011	0*	1			Y
Kihei	PCS	2011	0*	1			Y

TOTAL NEW SCHOOLS			0*	6	2	0	3
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Notes:

* School joined FIRST Pre-Academy after start of Spring 2010 semester. Student involvement numbers are not collected during the first semester that the school participates in the program to allow teachers time to integrate activities into curriculum. This number will be updated for all continuing schools (pre-2010), and schools added

** Number of participants should be considered a minimum; to avoid double counting, the numbers represent the maximum number of participants in any single program track. Also, since the number of students impacted by C-MORE science kits was not tracked during FY 2010, it was assumed that a minimum of one student used the borrowed science kits.

*** Laie Elementary and Kahuku High & Intermediate participate as one team.

Appendix B: Summary of Deliverables Met During FY 2010

MOA Deliverable	FY 2010 Implementation
<p>A. While participation in the FIRST Pre-Academy is voluntary, the goal is to expand the FIRST Pre-Academy program to 40 public and public charter middle schools within the State of Hawaii by June 30, 2010 and reach 80 public and public charter middle schools by January 31, 2011.</p>	<p>FIRST Pre-Academy achieved 70% participation statewide, including 56 public and public charter middle schools on six islands: O‘ahu (30), Hawai‘i (14), Maui (6), Kaua‘i (4), Moloka‘i (1), and Lana‘i (1). This represents 45 of 54 public non-charter middle schools (80%) and 11 of 26 public charter middle schools (42%) statewide. At the end of FY 2010, participants numbered 174 teachers and 4,460 students.</p> <p>Sources:</p> <ol style="list-style-type: none"> 1. <i>Program Summary – Statewide Participation</i> 2. <i>Appendix A: FIRST Pre-Academy – Program Participation</i> 3. <i>Appendix C: RET – Engineering & Technology – Program Track Participation</i> 4. <i>Appendix D: RET – Science – Program Track Participation</i> 5. <i>Appendix E: Applied Learning – Creative Media – Program Track Participation</i>
<p>B. Provide technical support in the development and implementation of additional problem-based, applied learning projects and curriculum in STEM. Technical support includes expert mentoring through the STEM portal, classroom visits, teacher meetings, field trip support, etc. The program will also facilitate teacher to teacher collaboration and sharing.</p>	<p>Technical support was provided to FIRST Pre-Academy participants through a combination of university/industry mentoring through the SIP, classroom visits, technical training, teacher meetings, workshops, field trip support, and UH-developed tutorials and sample lessons.</p> <p>Sources:</p> <ol style="list-style-type: none"> 1. <i>SIP – Enhanced Interaction Among STEM Stakeholders</i> 2. <i>SIP – Facilitate Ongoing Support for Pre-Academy Participants</i> 3. <i>RET – E&T – Technology-Specific Teacher Workshops</i> 4. <i>RET – E&T – Teacher-Developed Curriculum & Activities</i> 5. <i>RET – E&T – Ongoing Technical Support</i> 6. <i>RET – Science – C-MORE Science Kits</i> 7. <i>RET – Science – STORI Research Cruise and Workshop for Teachers</i> 8. <i>Applied Learning – Creative Media – Skills and Mentorship Training Workshops</i>
<p>B.i. Technical support will include industry and university experts.</p>	<p>Industry and university experts provided technical support through the SIP, classroom visits, technical training, workshops, presentations, field trip support, and UH-developed curriculum aids.</p> <p>Sources:</p> <ol style="list-style-type: none"> 1. <i>SIP – Facilitate Ongoing Support for Pre-Academy Participants</i> 2. <i>RET – E&T – Technology-Specific Teacher Workshops</i> 3. <i>RET – E&T – Ongoing Technical Support</i> 4. <i>RET – Science – C-MORE Science Kits</i> 5. <i>RET – Science – STORI Research Cruise and Workshop for</i>

Appendix B: Summary of Deliverables Met During FY 2010

	<p align="center"><i>Teachers</i></p> <p align="center">6. <i>Applied Learning – Creative Media – Skills and Mentorship Training Workshops</i></p>
<p>C. Procure additional resources including hardware, software, materials and supplies required to implement the teacher driven-developed curriculum and projects. The goals of the activities are to stimulate the interest and foster achievement of students in science, technology, engineering and mathematics skills.</p>	<p>Hardware and software resources were procured to support Pre-Academy activities at participating schools.</p> <p>Sources:</p> <ol style="list-style-type: none"> 1. <i>RET – E&T – Teacher-Developed Curriculum & Activities</i> 2. <i>RET – Science – C-MORE Science Kits</i> 3. <i>Applied Learning – Creative Media – Improvement and Expansion of Training Sites</i> 4. <i>Applied Learning – Expand Existing and Establish New Creative Media Programs</i>
<p>D. Organize four mini-technical workshops per Fiscal Year. Workshop content will also be disseminated through the web portal to ensure maximum reach.</p>	<p>Twenty technical workshops were held for participating Pre-Academy teachers at intervals throughout FY 2010.</p> <p>Sources:</p> <ol style="list-style-type: none"> 1. <i>RET – E&T – Technology-Specific Teacher Workshops</i> 2. <i>RET – Science – C-MORE Science Kits</i> 3. <i>RET – Science – STORI Research Cruise and Workshop for Teachers</i> 4. <i>Applied Learning – Creative Media – Skills and Mentorship Training Workshops</i>
<p>E. Develop program evaluation measures to provide feedback on program effectiveness and impact towards the advancement of STEM in middle schools.</p>	<p>A combination of formal and informal evaluation measures were performed for the three program tracks.</p> <p>Sources:</p> <ol style="list-style-type: none"> 1. <i>RET – E&T Workshop Evaluation and Articulation Feedback</i> 2. <i>RET – Science – Evaluation</i> 3. <i>Applied Learning – Creative Media - Evaluation</i>
<p>F. Develop an industry-university support base consistent with workforce market needs. The support will include mentoring, classroom presentations, minigrants, field trip support, technical assistance, etc.</p>	<p>Industry partnership support was explored. This initiative encourages active involvement from local industry through workshop presentation, financial, and technical support. Since an overarching goal of this program is to engage students in STEM-related education and teach them about possible career opportunities, industry participation provides an important component to the FIRST Pre-Academy program.</p> <p>Industry/university support based was developed, and provided mentorship, classroom presentations, mini-grant funding, field trip support, and technical assistance for participating teachers.</p>

Appendix B: Summary of Deliverables Met During FY 2010

	<p>Sources:</p> <ol style="list-style-type: none"> 1. <i>RET – E&T – Ongoing Technical Support</i>
<p>G. Create an online Pre-Academy teacher web portal for middle school STEM educators to collaborate with other STEM educators, private industry, university, and community groups to promote innovation in STEM education. First Phase (documentation phase) to be completed by June 30, 2010. Second Phase (collaboration, sharing phase, and data mining tools) to be completed by January 31, 2011 with ongoing upgrades.</p>	<p>The STEM Intercommunity Portal was developed to enhance the FIRST Pre-Academy program by improving information exchange and interaction among STEM community members, and facilitating technical and logistical support for Pre-Academy teacher and student participants. The SIP provides uninterrupted access to an online forum where participants can share, review, research, collaborate and archive ideas for innovative STEM projects and curriculum.</p> <p>Sources:</p> <ol style="list-style-type: none"> 1. <i>SIP – General Teacher Interest and Membership</i> 2. <i>SIP – Enhanced Interaction Among STEM Stakeholders</i> 3. <i>SIP – Facilitate Ongoing Support for Pre-Academy Participants</i> 4. <i>SIP – Promote Autonomous Participation of SIP Members</i>

Appendix C: RET - Engineering & Technology -- Program Track Participation

FIRST PRE-ACADEMY RET - ENGINEERING & TECHNOLOGY July 1, 2009 - June 30, 2010	District	Start Year	Participating Students	Participating Teachers	Sep 2009 PDA Workshop	Dec 2009 Robotics Workshop	Feb 2010 Sustainability Workshop	May 2010 3D Modeling Workshop
Continuing Schools								
Central Middle	Honolulu	2009	240	2	0	0	0	1
Dole Middle	Honolulu	2005	250	20	1	4	7	9
Highlands Intermediate	Leeward	2008	220	4	1	1	1	2
Honokaa High & Intermediate	Hawaii	2006	110	3	0	0	0	1
Iao Intermediate	Maui	2008	300	9	1	5	4	2
Jarrett Middle	Honolulu	2008	30	3	3	3	3	1
Kahuku High & Intermediate*	Windward	2008	130	3	1	0	1	0
Kaimuki Middle	Honolulu	2008	150	2	0	0	0	0
Kalama Intermediate	Maui	2008	150	4	0	0	2	1
Kapaa Middle	Kauai	2007	450	4	0	1	1	0
Kawaikini New Century PCS	PCS	2008	19	1	0	0	0	1
Kawananakoa Middle	Honolulu	2008	145	3	1	1	3	1
Keaau Middle	Hawaii	2005	198	4	0	0	1	2
King Intermediate	Windward	2008	300	6	1	0	1	3
Laie Elementary*	Windward	2008	75	1	0	0	1	0
Mililani Middle	Central	2009	100	2	1	1	4	2
Moanalua Middle	Central	2008	450	6	0	6	1	3
Nanakuli Intermediate	Leeward	2008	260	3	0	0	1	1
Pahoa High & Intermediate	Hawaii	2008	158	2	0	0	0	0
Voyager PCS	PCS	2008	49	1	0	0	0	0
Wahiawa Middle	Central	2008	120	3	0	0	1	0
Waikoloa Elementary & Middle	Hawaii	2008	200	1	0	1	0	1
Waimea Canyon Middle	Kauai	2008	120	1	0	0	0	1
Waipahu Intermediate	Leeward	2008	45	5	0	0	2	3
Washington Middle	Honolulu	2008	120	4	1	1	1	1
Wheeler Middle	Central	2008	55	4	1	0	0	1
SUBTOTALS			4444	101	12	24	35	37

Note:

* Laie Elementary and Kahuku High & Intermediate participate as one team.

Appendix C: RET - Engineering & Technology -- Program Track Participation

FIRST PRE-ACADEMY RET - ENGINEERING & TECHNOLOGY July 1, 2009 - June 30, 2010	District	Start Year	Participating Students	Participating Teachers	Sep 2009 PDA Workshop	Dec 2009 Robotics Workshop	Feb 2010 Sustainability Workshop	May 2010 3D Modeling Workshop
Expansion Schools								
Aliamanu Middle	Central	2010	0**	1	0	0	0	0
Ewa Makai Middle	Leeward	2010	0**	4	0	0	0	0
Hana High & Intermediate	Maui	2010	0**	4	0	0	0	0
Hilo Intermediate	Hawaii	2010	0**	3	0	0	0	2
Innovations	PCS	2010	0**	2	0	0	0	0
Kailua Intermediate	Windward	2010	0**	1	0	0	0	0
Kalakaua Middle	Honolulu	2010	20	7	0	0	0	5
Kalaniana'ole Elementary & Intermediate	Hawaii	2010	0**	3	0	0	0	0
Kanu o ka Aina	PCS	2010	0**	4	0	0	0	0
Lahaina Intermediate	Maui	2010	0**	3	0	0	0	0
Lokelani Intermediate	Maui	2010	0**	11	0	0	0	5
Maui Waena Intermediate	Maui	2010	0**	2	0	0	0	0
Molokai Middle	Maui	2010	0**	6	0	0	0	0
Paauilo Elementary & Intermediate	Hawaii	2010	0**	5	0	0	0	0
Waiakea Intermediate	Hawaii	2010	0**	3	0	0	0	2
SUBTOTALS			20	59	0	0	0	14
TOTALS			4464	160	12	24	35	51

Schools Added Since June 30, 2010	District	Start Year	Participating Students	Participating Teachers
Aiea Intermediate	Central	2011	0**	2
Education Laboratory	PCS	2011	0**	1
TOTAL NEW SCHOOLS			0**	3

Note:

** School joined FIRST Pre-Academy after start of Spring 2010 semester. Student involvement numbers are not collected during the first semester that the school participates in the program to allow teachers time to integrate activities into curriculum. This number will be updated for all continuing schools (pre-2010), and schools added during 2010.

Appendix D: RET - Science -- Program Track Participation

FIRST PRE-ACADEMY RET - SCIENCE: OCEANOGRAPHY July 1, 2009 - June 30, 2010	District	Start Year	Attended Science Kits Workshop	Hosted / Borrowed Science Kits	STORI Research Cruise and Workshop
Active Schools					
Chiefess Kamakahalei Middle	Kauai	2010	Y		Y
Halau Ku Mana	PCS	2010		Y	
Halau Lokahi	PCS	2010		Y	
Hawaii Academy of Arts & Science	PCS	2010		Y	Y
Innovations	PCS	2009		Y	
Kahuku High & Intermediate	Windward	2010	Y	Y	
Kailua Intermediate	Windward	2010	Y		Y
Kalama Intermediate	Maui	2009	Y	Y	Y
Kamaile Academy	PCS	2010		Y	
Kapolei Middle	Leeward	2009	Y	Y	Y
Kealakehe Intermediate	Hawaii	2010	Y	Y	
King Intermediate	Windward	2009		Y	
Lanai High & Elementary	Maui	2009	Y	Y	Y
Mililani Middle	Central	2009		Y	
Myron B. Thompson Academy	PCS	2010		Y	
Nanakuli High & Intermediate	Leeward	2010		Y	
Niu Valley Middle	Honolulu	2010	Y	Y	
Stevenson Middle	Honolulu	2009	Y	Y	
Waialua High & Intermediate	Central	2010	Y	Y	Y
Waianae Intermediate	Leeward	2010	Y	Y	
Waikoloa Elementary & Middle	Hawaii	2010			Y
Waimea Middle Public Conversion	PCS	2010			Y
Waipahu Intermediate	Leeward	2010			Y
Washington Middle	Honolulu	2010		Y	
West Hawaii Explorations	PCS	2010		Y	
TOTALS			11	20	10

* Active status is denoted for schools that implemented science kits in curriculum and/or participated in research cruise/workshop.

Appendix D: RET - Science -- Program Track Participation

FIRST PRE-ACADEMY RET - SCIENCE: OCEANOGRAPHY July 1, 2009 - June 30, 2010 Non-Active Schools	District	Start Year	Attended Science Kits Workshop	Hosted / Borrowed Science Kits	STORI Research Cruise and Workshop
Hilo Intermediate	Hawaii	2010		Y	
Jarrett Middle	Honolulu	2010		Y	
Kaimuki Middle	Honolulu	2010		Y	
Ke Kula o Samuel M. Kamakau Laboratory	PCS	2010		Y	
Kanuikapono Learning Center	PCS	2010		Y	
Kapaa Middle	Kauai	2010		Y	
Waimanalo Elementary & Intermediate	Windward	2010		Y	
TOTALS			0	7	0

Appendix E: Applied Learning - Creative Media -- Program Track Participation

FIRST PRE-ACADEMY APPLIED LEARNING - CREATIVE MEDIA July 1, 2009 - June 30, 2010	District	Start Year	Participating Students	Participating Teachers	Aug 2009 Training Workshop	Sep 2009 Training Workshop	Oct 2009 Training Workshop	Feb 2010 Training Workshop	Mar 2010 Training Workshop	Apr 2010 Training Workshop (Maui)	Apr 2010 Training Workshop (Kauai)	May 2010 Training Workshop	Jun 2010 Training Workshop
Continuing Schools													
Chiefess Kamakahahei Middle	Kauai	2009	20	1	17	0	0	17	0	0	13	0	21
Waianae Intermediate	Leeward	2009	15	1	13	16	6	11	1	0	1	0	15
Waimea Canyon Middle	Kauai	2009	3	1	0	0	0	0	0	0	4	0	0
SUBTOTALS			38	3	30	16	6	28	1	0	18	0	36
Expansion Schools													
Lokelani Intermediate	Maui	2010	1	1	0	0	0	0	2	0	0	0	0
Maui Waena Intermediate	Maui	2010	10	1	0	0	0	0	2	11	0	11	8
Olomana	Windward	2010	0*	1	0	0	0	0	0	0	0	0	0
Stevenson Middle	Honolulu	2010	0*	1	0	0	0	0	0	0	0	0	0
Waialua High & Intermediate	Central	2010	0*	1	0	0	0	0	0	0	0	0	0
SUBTOTALS			11	5	0	0	0	0	4	11	0	11	8
TOTALS			49	8	30	16	6	28	5	11	18	11	44

Appendix E: Applied Learning - Creative Media -- Program Track Participation

Schools Added Since June 30, 2010	District	Start Year	Participating Students	Participating Teachers
Connections	PCS	2011	0*	1
Ke Kula Niihau O Kekaha	PCS	2011	0*	1
Kihei	PCS	2011	0*	1
TOTAL NEW SCHOOLS			0*	3

* School joined FIRST Pre-Academy after start of Spring 2010 semester. Student involvement numbers are not all collected during the first semester that the school participates in the program to allow teachers time to integrate activities into curriculum. This number will be updated for all continuing schools (pre-2010), and schools added during 2010.

Appendix F: Sample Lesson Plans

Creative Media

Searider Productions

SEQUENCING PROJECT

Good To Great. Keep It Simple. Action. Reaction. Emotion. Compose. Sequence. Story.

EXPORTING VIDEO:
Place final video on server
DEADLINES ARE IMPORTANT

PLEASE LABEL
CORRECTLY

REMEMBER
GET CLOSE UP

Task - Create a video using a treatment, shot list and 10 shots.

GUIDELINES

1. PLEASE GET INTO GROUPS

2. TREATMENT

Write a treatment describing your story. There can be **no audio**. Make sure it has a Beginning, Middle, End.
3. SHOT LIST

Create your shot list and review with advisor. An example of what it should look like is on the right.
4. SHOOT
5. EDIT

6. PREMIERE
7. EVALUATE

Reflection : How does sequencing help you tell stories? Did you group work well together? Problems or praise? Did you deserve your grade? Why?

Compose - to make up, create, or line up.

Sequence - A series of shots that tell a story.

Story - Beginning. Middle. End.



Super-wide hides and reveals details. They also make for a more interesting shot.

No.	Shot	Who	Action

Create a shot list to organize your thoughts.



Get up in there. It just looks better.

Remember one shot can tell a story.

Wide. Medium. Close-Up. Extreme Close-Up.

Get close up. Details make it more interesting.

Appendix F: Sample Lesson Plans – CMORE



MARINE MYSTERY: A WATERY WHO-DUNNIT!

Grade Level: This kit is appropriate for students in grades 3–8.

Standards: This kit is aligned with state science content standards for Hawai'i, California and Oregon, as well as national Ocean Literacy Principles.

Overview: Students learn about the causes of coral reef destruction by assuming various character roles in this marine murder-mystery. As they determine who killed Seymour Coral, students learn the basics of DNA testing. Suspects include global warming, sedimentation, and other threats facing coral reefs today. This activity is designed for 15 students, but can be modified for 12–24 students. A narrated PowerPoint that provides background information on coral reefs can be shared in advance in a separate lesson. The total class time for the PowerPoint, skit, and pre- and post-surveys is about 100 minutes.

Suggestions for Curriculum Placement: This activity can be used as part of a marine, life, or environmental science unit. Two key concepts are addressed: the interdependence of coral polyps and zooxanthellae (the symbiotic algae that lives inside – and provides food for – the coral), and the decline of coral reefs worldwide.

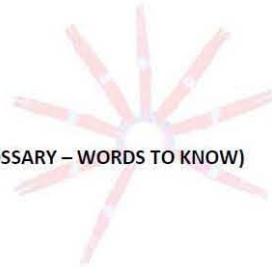
Materials: (Paper materials contained in binder are shown in **BOLD CAPS**)

Front Binder Materials

1. CD, containing Video, PowerPoint, and electronic versions of everything in binder
2. C-MORE *Key Concepts in Microbial Oceanography* brochure
3. C-MORE *Microbial Oceanography: Resources for Teachers* brochure

Marine Mystery Activity

4. Coral Reef (3 pieces)
5. Orange Cones (4)
6. Ziploc Bag with Crime Scene Tape
7. Mailboxes (4)
8. Zooxanthellae in cage
9. Teacher Packet (contains shark hat, evidence bag & clue bag)
10. Student Packets (15 different packets, each containing a different character's ID, script, costume or mask and related items)
11. Extra Costumes packet
12. **TEACHER GUIDE**
13. **POWERPOINT SCRIPT**
14. **CHARACTER LIST**
15. **TEACHER SCRIPT**
16. **TEACHER VERSION OF 3 SCRIPTS**
17. **TEACHER ANSWER KEY to MARINE MYSTERY SURVEY**
18. **HANDOUTS (MARINE MYSTERY SURVEY, ENVIRONMENTAL SUSPECTS and GLOSSARY – WORDS TO KNOW)**
19. **REWARD SIGNS (3)**
20. **SCENE SIGNS (5)**
21. **HOUSE SIGNS (4)**
22. **DNA KEYS FOR EVIDENCE AND SUSPECTS (for reference only)**



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Appendix F: Sample Lesson Plans – RET

Sprucing up Kalakaua Middle

SEEKING JUNIOR ARCHITECTS

Summer, 2010

Seeking Junior Architects



Kalakaua Middle School will be sprucing up its library with renovations for the next school year. The designers are seeking junior architects to measure, draw, and build a scaled three-dimensional model of the school campus including all major buildings to be displayed in the school library.

Phase 1

Each team will measure one type of building and make a linking cube model **representation** of it.

Building types include:

1. Administration
2. Library
3. Cafeteria
4. Two-Story Classroom Building (R, N, O, E, L)
5. Portable Classroom (P6, P7, P8, P9, P11, P12)
6. Elective Classrooms (U101, U102, K102, K101)

Phase 2

Each team will draw **building plans** to include:

1. Front view
2. Right view
3. Base outline

Each team must also draw an **isometric view** of the building.

Phase 3

In the final stage, teams will draw a **two-dimensional net** of the building using the FabLab software, cut and assemble the building, and present the completed campus model to the library.

MEASURE • DRAW • BUILD • PRESENT

Project EAST/STEMworks, February 2011:

Recap of Expenditures made by EDAH to support/expand the EAST/STEMworks program:

The monies appropriated to 3T's/EDAH by the Hawaii State Legislature provided the needed spark to continue growing and expanding the EAST program throughout the state. The \$1.1 million dollars allocated in 2007 was not actually released by Governor Lingle and available until September of 2008. Prior to the contract monies flowing, MEDB and EDAH partners utilized federal, county, and private funding to facilitate the momentum and implementation of the program. With the careful spending of the monies, and two no cost extensions, which were requested and approved – this allowed the monies to be live until December 31st, 2009. During the contracted period the monies were spent at fifteen schools throughout the state (Maui High, Baldwin High, Lahainaluna High, Kihei Charter, King Kekaulike High, Farrington High, McKinley High, Roosevelt High, Mililani High, Kauai High, Chiefess Middle, Molokai Middle, Molokai High, Kealakehe High, and Kea'au High) in the following areas...

6 New School Start Up Schools (McKinley, Mililani, Roosevelt, Farrington, Kealakehe, and Kauai High) – \$567,000

- EAST National New School Support Fees
- Professional Development for new EAST Facilitators – 3 Phase Training
- New Lab Hardware/Software Procurement – Approximately \$50,000 per school
- Summer Internships
- High Tech Industry Exposure/Events
- Hawaii STEM Conference
- Service Learning
- Diversity

9 Existing School Enhancement – \$287,000

- EAST National Support Fees
- Professional Development for existing EAST Facilitators
- Hardware/Software Upgrades
- Summer Internships
- High Tech Industry Exposure/Events
- Hawaii STEM Conference
- Service Learning
- Diversity

Software Training (Maui, Oahu, Kauai, and Hawaii County) - \$50,000

- CAD, Web Design, Photoshop, Game Design, Video, Sketch Up, Music, etc...

Travel - \$24,000

Program Deployment (MEDB, KEDB, HIEDB, Oahu EDB) - \$120,000

Professional Fees (Audit Fees, Accounting Fees) - \$44,000

***A more detailed description of the activities that took place during the contract dates have been provided to both DBEDT and the State Legislature for review.

Now that EAST was offered in a range of schools on Oahu as well as on the neighbor islands, what's your recommendations for the types of schools in which the EAST/STEMworks approach makes the most sense?

Because MEDB WIT is a non-profit organization that has a significant representation of industry leadership on its board, we have the ability to innovate and implement a very cost effective model. One of the key elements of our EAST/STEMworks program is the requirement that the program reflect the demographics of the participating school – whether it be age, gender, race/ethnicity, socioeconomic, or academic status. To date, a majority of the schools that we are currently working with are Title 1 schools. This distinction allows us to target and provide the program to girls, underrepresented, and undeserved populations who are in the most need of and would benefit the most from an experiential and dynamic STEM/Service-Learning program. We honestly feel all schools within the DOE system would benefit from a partnership with our STEMworks program -- our grassroots efforts to identify and work with teachers, augmenting their skill sets and strengths, while working with the administrators who are the leaders and champions on their campus. As the EAST/STEMworks participants become immersed in the pedagogy and methodology of our program, they then inspire others to become involved – helping to integrate STEM and Service-Learning into their classroom offerings, while building a community of creativity and innovation. The beauty of the program is whether the school is in a rural or urban environment students will engage with their own communities to make a positive impact while utilizing high tech tools.

What kind of tracking of student EAST participants and their future college choices has MEDB/WIT conducted over the last 4 years? Is this type of tracking of future college choices something that other Act 111 STEM programs can utilize and replicate? Does MEDB currently have a means of tracking job placement for EAST participants after they complete their college matriculation?

As an organization, we have been tracking students' participation progress as they move through the EAST program and their future intent for higher education on an annual basis. This has allowed us to track college intent, future area of study, level of anticipated college completion (associates, baccalaureate, masters, or doctorate), and actual program participation impact. What has been very difficult to overcome are the legal instruments in place through the DOE system, which protect student privacy and information. This has been an issue in implementing a longitudinal study of our program and its effectiveness. Through the use of a system's dynamics modeling tool,

we are currently in the initial phase of mapping the important variables in the STEM Pipeline that contribute to continued interest in STEM fields and act as a vehicle for high school success. The initial investment in creation of the model came from monies we received from a competitive grant from a private foundation. Eventually, with a further infusion of resources to complete the process, we see this tool as contributing to the construction of a longitudinal analysis of the STEM Pipeline for all Statewide STEM program partners and the DOE.

We do know anecdotally our program is very effective in creating an interest and pursuit in the STEM fields. Our graduates frequently come back to participate in our internship programs, and/or keep us updated as to their college experience and pathway. In addition, we intersect with our local graduates as they participate in our Kama`aina Come Home program. To date, approximately 275 local high school graduates are working in the High Tech Industry. Not all are former EAST students, but many are participants in our STEM pipeline programs.

What has provided the greatest degree of successful STEM career matches (e.g., from EAST – to college choices, and then to tech job placements)?

The key to MEDB/WIT's success is that we are a significantly Industry led organization working with High Tech companies for job placements. We help foster and bridge STEM job opportunities and placement with our program participants. Our successful approach to supporting the STEM Pipeline has allowed us to broker our contacts in industry to the benefit of those schools involved in STEM Programs supported by MEDB/WIT. This approach also provides us the opportunity to design meaningful outreach activities at multiple junctures as students move through the STEM Pipeline. We help facilitate the workforce pipeline that flows directly to Industry, due to our "educational fingers" being on the pulse of Industry. We believe the cornerstone of our efforts is EAST/STEMworks - a classroom experience integrated into the DOE as an institutionalized course offering that impacts both teacher effectiveness and student learning. EAST/STEMworks acts as a hub where students are able to explore other STEM programs that peak their interest and encourages their movement through the STEM Pipeline to eventually become the next generation of homegrown Hawaii STEM professionals.

Future STEMworks funding...

15 Existing STEMworks Labs – Annual requested funding \$200,000 for existing schools.

Professional Development for existing STEMworks Facilitators

STEMworks teachers will be immersed in a one week STEMworks Academy introducing the teachers to the STEMworks methodology, curriculum, in-class support, real-world exposure to Industry professionals, and high tech tool exposure. Teachers will have the opportunity to learn from STEMworks trainers and the curriculum developer. Teachers

will be provided a STEMworks kit which will provide the needed tools to successfully integrate STEMworks into their classrooms.

Hardware/Software Upgrades

Each STEMworks lab will need periodic hardware and software upgrades to keep up with the ever changing high tech environment and immerging career paths. The normal replacement time for equipment and software is approximately three years. Each school will need to be evaluated for their individual needs on an annual basis.

Summer Internships

Providing a creative and stimulating STEMworks environment for our Hawaii students is an important link to developing the next generation of Hawaii STEM professionals. Much effort will be placed on connecting the dots between the STEMworks curriculum, software tools available in the classroom, and the real world connection and actual application. Existing partnerships with Industry partners will allow our STEMworks students to work on a real world project utilizing the tools and knowledge gained while participating in the STEMworks program.

High Tech Industry Exposure/Events

A huge part of the STEMworks process and expectations for the students is their understanding of the creative STEM career opportunities in Hawaii. Part of the STEMworks methodology is creating a solid foundation for the students by creating a direct link between the classroom and the many career paths in STEM – utilizing the creativity that has been fostered while in the STEMworks program. Students will be provided a real world/hands-on tour of the creative STEM High Tech companies throughout the state.

Hawaii STEM Conference

Over 200 STEM/Service Learning students, teachers, parents, community and business leaders will gather on Maui to celebrate their work over the past year, share stories and meet other STEM/Service Learning students from different islands. For many, it is their first experience at a regional technology conference complete with breakout sessions, software competitions, a formal awards banquet, and exhibit presentations. It will be an excellent opportunity for students to get the latest software training, and compete against other teams in challenging, but fun software competitions.

<http://www.womenintech.com/HawaiiSTEMConference>

STEMworks portal

In a partnership with the University of Hawaii's College of Engineering a STEMworks portal is in the process of being created. The site will serve as a portal to the participating schools, project examples, Industry links, upcoming events/opportunities, press releases, software tutorials, curriculum, and more.

Software Training (Maui, Oahu, Kauai, and Hawaii County)

As STEMworks students become exposed and immersed in the STEMworks curriculum opportunities for training in the following areas.

*Dreamweaver * Photoshop * Scratch * SketchUp * Solidworks * Maya * Photography
*Digital Media *Game Design *SketchUp *Video *Web Design *CAD

These training sessions will be provided by Industry professionals working in the Hawaii creative STEM fields.

Service Learning

Students engaged in the STEMworks program will be immersed in Service Learning while engaging with High Tech tools. A large portion of the STEMworks curriculum is focusing on the importance of service learning, giving back to ones community, and providing an opportunity for the students to grow as young leaders.

STEMworks New School Start Up Cost – \$60,000

Professional Development for new STEMworks Facilitators

New Lab Hardware/Software Procurement – Approximately \$40,000 per school

Summer Internships

High Tech Industry Exposure/Events

Hawaii STEM Conference

Service Learning

Diversity