(a) NEED FOR PROJECT. Tech Together: Ka Ulu Ana Project

E lawe I ke aʻo malama, a e ʻoi mau ka naʻauao.
He who takes his teachings and applies them increases his knowledge. Mary Kawena Pukui

(i) The magnitude or severity of the problem to be addressed by the proposed project. Native Hawaiians (NHs) are under-represented in employment opportunities in STEM fields typically because they are educationally disadvantaged, [1]especially in STEM. Low school performance among Native Hawaiian children is frequently linked to weaknesses in public education as well as their cultural traditions of learning through hands-on instruction by cultural mentors as opposed to the traditional western model in Hawaiian public schools focusing on classroom instruction on abstract concepts. The Partners in Development Foundation (PIDF) "Tech Together: Ka Ulu Ana Project" will address these issues by providing instruction through innovative hands-on projects, focused on renewable and non-renewable energy in a strong cultural context, combined with professional development of teachers in STEM and exposure to UH faculty and student mentors of Hawaiian descent. This approach has been empirically documented to generate interest and enthusiasm about STEM education and career opportunities among Native Hawaiian at-risk children and youth **(Priority 1)** (and low-performing students in general), in response to the weaknesses in the educational services, infrastructure, and the lack of opportunities for Native Hawaiians who are underemployed in STEM careers **(Priority 2)**.

Although STEM fields are one of the growth areas for job opportunities targeted by the State, only one percent of Native Hawaiians are entering professional STEM occupations.[2] STEM education is undermined for Native Hawaiians as the result of a generally under-performing school system in which there are documented weaknesses in STEM education among teachers, in addition to these special learning approach challenges for Native Hawaiians**.**

[1] Office of Hawaiian Affairs, 2006 Data Book on Economic Development
[2] Congressional Research Service, The U.S. Science and Technology Workforce, June 2009

Native Hawaiian (NH) children are significantly disadvantaged in STEM education compared to global, national and State of Hawai‘i standards. In 2007, the Global Report Card which standardizes achievement scores for 25 developed nations showed that when compared to Canadian students, for example, the average student from the State of Hawai‘i ranked only at the Canadian 20th percentile in math and the 28th percentile in reading.[3] Native Hawaiian scores are below national norms in the U.S. for all grade levels,[4] with graduation rates less than half of all other recognized ethnic groups.[5] The Native Hawaiian Educational Assessment Update reports that Native Hawaiians are among the lowest in standardized test scores in the State of Hawai‘i. The Hawai‘i Statewide Assessment for sixth grade students (targeted in this proposal) shows that when comparing percentages of Hawaiians to non-Hawaiians testing proficient; the respective percentages are 58% versus 70% in reading, 44% versus 58% in math and 20% versus 35% in science.

(ii) The extent to which specific gaps or weaknesses in services, infrastructure, or opportunities have been identified and will be addressed by the proposed project, including the nature and magnitude of those gaps or weaknesses. **Weaknesses in Services.** This project will provide the services outlined in Section b below to effectively remediate the impacts of the weaknesses and gaps in these areas for 2,375 sixth grade Native Hawaiian students and 50 teachers at 30 schools as well as 7,125 family members to stimulate interest and achievement in STEM. The U.S. Department of Education 2010-2011 Race to the Top Hawai‘i Report identified Native Hawaiians at the lowest level of overall proficiency on Hawai‘i’s English Language Arts (ELA) Assessment scores against all other nationalities.[6] “Title I” districts have 40% or more

[3] *Smart Business Hawaii*, “Hawai‘i educational test scores rank poorly when compared globally,” October 2011
[4] U.S. Government Accountability Office’s Report to Congressional Requesters, March 2008
[5] U.S. Census Bureau 2000 and Census 2000 Special Report: “We the People: Pacific Islanders in the United States.
[6] U.S. Department of Education, Race to the Top Hawai‘i Report, 2010-2011

students at or below the poverty level.[7] These districts have the greatest incidence of students failing or being at risk of failing to meet the State's academic achievement standards.[8] In highly populated Native Hawaiian regions, most of the elementary schools are classified as Title I schools. Ninety-one percent of Title I elementary schools have 40% or more Hawaiians students, although Native Hawaiians comprise less than 28% of the overall student population.[9] Native Hawaiians as a whole are one and one-half times more likely to qualify for subsidized meals compared to their non-Hawaiian counterparts[10] (59% qualified to receive meal subsidies),[11] and Hawai'i State Assessment mathematics scores, for example, are associated with participation in subsidized school meals.[12] Moreover, the poverty level is correlated with academic achievements, and these at-risk students have higher absences, juvenile arrests, and lower graduation rates. Native Hawaiians are found in poverty at twice the rate (12.5%) as the statewide average (6.8%),[13] and 24% of the school-age population have juvenile records[14], compared to 36% for Native Hawaiians. [15] Only 36% of Native Hawaiians have high school diplomas compared to 84% of all ethnic groups nationally, and only 15.2% have bachelor's degree compared to 27% of all others[16] **(Priority 1).**

Native Hawaiians represent the largest population in the state with special needs, 16% compared to only 11% of non-Hawaiians,[17] including special education programs provided to students with learning disabilities, mild mental retardation, emotional impairment, and other

[7] National Center for Education Statistics: Fast Facts-U.S. Department of Education
[8] U.S. Department of Education- Improving Basic Programs Operated by Local Educational Agencies (Title1, Part A)
[9] Hawai'i State Department of Education, No Child Left Behind, Parents 2011
[10] Hawai'i Department of Education Update 2010, Kamehameha Schools Research & Evaluation
[11] Hawai'i Department of Education Update 2010, Kamehameha Schools Research & Evaluation
[12] Hawai'i Department of Education Update 2010, Kamehameha Schools Research & Evaluation
[13] Post-High Update 2010, Kamehameha Schools Research & Evaluation
[14] The Disparate Treatment of Native Hawaiians in the Criminal Justice System, Office of Hawaiian Affairs, Justice Policy Institute, University of Hawai'i & Georgetown University September 2010
[15] Office of Hawaiian Affairs, 2006 Data Book on Education
[16] U.S. Census Bureau 2000 and Census 2000 Special Report: "We the People; Pacific Islanders in the United States"
[17] Hawai'i Department of Education Update 2010, Kamehameha Schools Research & Evaluation

disabilities.[18] Native Hawaiians in secondary school are more likely to be excessively absent and thus, more likely to be retained in their grade levels. Native Hawaiian students have the highest rates of drug and alcohol use in the State and are victimized by child abuse and neglect.[19]

Weaknesses in Infrastructure. As Hawai‘i’s renewable and nonrenewable market booms, education on these industries is critical to spur the interest of potential careers in these areas. Hawai‘i’s elementary school teachers have a lack of experience in science.[20] Only 86.3% of Hawai‘i’s public school teachers are fully licensed by the State.[21] Hawaiian/part-Hawaiian students are the largest ethnic group in public schools (27.7%), but only 9% of teachers are Hawaiian.[22] The State Department of Education Highly Qualified Teacher State Plan of 2007 documents that 41% of Title I non-highly qualified teachers did not meet the highly qualified teacher standards mandated through No Child Left Behind (NCLB) for faculty.

The NCLB Act in 2002 required the Hawai‘i Department of Education (DOE) to create the Adequate Yearly Progress (AYP) program to monitor achievements of schools in meeting Hawai‘i Content and Performance Standards that require schools to meet multiple performance targets specified in the Hawai‘i’s NCLB plan. The AYP documented that 54% of all Native Hawaiian students are in schools that are designated for corrective action, planning for restructuring, or restructuring, having missed one or more of the performance targets for at least four years.[23] The focus on reading and math scores has lessened instruction in other subjects;[24] thus, schools need support services that can address this gap in areas such as science.

Weaknesses in Opportunities. Both current Hawai‘i Governor Neil Abercrombie and the previous Governor Linda Lingle have targeted STEM areas for economic growth and created

[18] Congressional Record Proceedings and Debates of the 106th Congress Second Session May 2000
[19] Congressional Record Proceedings and Debates of the 106th Congress Second Session May 2000
[20] Improving Elementary School Science Teaching by Cross-Level Mentoring, Journal of Science Teacher Education, Kluwer Academic Publishers, 1999
[21] State of Hawai‘i Data Book, 2007
[22] State of Hawai‘i Data Book, 2007
[23] Hawai‘i Department of Education Update 2010, Kamehameha Schools Research & Evaluation Division
[24] Center on Education Policy, March 2006

plans for economic development that also recognized and promoted STEM educational resources to support people of the State to enter those occupations. The State of Hawai‘i economic development plan includes five areas, three of which are STEM related: life sciences/ biotechnology, information technology, and diversified agriculture.[25] Hawai‘i’s Sustainability 2050 Plan includes improving the workforce in sustainability-related industries such as renewable energy, innovation and science-based industries, and environmental technologies and ranks those industries at the 66th percentile among the highest paying fields in the State. Unfortunately, 24.7% of Native Hawaiians are working in manual labor positions compared to 18.7% of the state population[26] and only 25% are employed in professional and managerial staff positions in science and engineering, compared to 34% of the U.S. population.[27]

(b) Quality of Project Design.

“As a Science teacher at Blanche Pope Elementary School in Waimanalo, I appreciate the programs that the Partners in Development staff have introduced to our schools and the resources presented to reinforce the value of education in the areas of mathematics, sciences, engineering, and technology. I will personally assure Partners in Development my sincere support and commitment on behalf of Blanche Pope Elementary to participate in Tech Together programs.”
Kazzandra K. Pokini, Science Teacher Grades 4-6, Blanche Pope Elementary School

(i) The extent to which the design of the proposed project is appropriate to, and will successfully address, the needs of the target population or other identified needs. In the middle school years, there are considerable developmental changes. Sixth grade students are at the beginning of transition and are at an appropriate age to be introduced to new concepts, potential careers or future studies in physical sciences. PIDF has built a culturally-appropriate model laced with Hawaiian language that incorporates hands-on experiential learning, cooperative group-oriented projects and cooperative and integrated subjects as well as exploratory methods for sixth grade students and their teachers **(Priority 3)**. The STEM curriculum introduces science concepts utilizing technology, engineering and math to fuse the knowledge learned through hands-on

[25] Department of Business, Economic Development and Tourism, DBEDT, 2008
[26] Post-High Update 2011; Kamehameha Schools Research & Evaluation, June 2011
[27] Office of Hawaiian Affairs, 2006 Data Book on Economic Development

projects with Hawaiian culture and language, so it is relatable to these students and where they live. Ka Ulu Ana encourages healthy relationships by requiring a mentor as a daily support to the student as he or she completes homework and projects. This component includes the family in the learning cycle ending with the culmination event of ‘Ohana (Family) Night. The model has been successfully utilized under “Ke Ao Nei: A Program to Teach Hands-On Energy Technology to Native Hawaiian Families (Grant S362A090020).” Details on the success of that program are included below in Section b.ii.

Culture-Based Education (CBE) methods concentrate on “place-based, project-based, and hands-on learning.”[28] This optimal learning style improves the academic functioning of Native Hawaiians over Western methods of teaching. Through a dramatic study of Native Hawaiian students from Kamehameha’s Early Education Program, the cultural norms (in communication, interpersonal behavior, and learning styles) used showed significant improvements in academic and social skills, including reading ability, attention span, quality and quantity of participation, and language art skills.[29] Teachers must learn the ways in which students’ cultures impact their learning styles and study students’ cultural backgrounds because “matching the contextual conditions for learning to the cultural experiences of the learner increases task engagement and hence increases task performance,”[30] including frequent use of the Hawaiian Language with specific Hawaiian vocabulary for each module (**Priority 3)**. The Native Hawaiian Education Council recognizes the efficacy of this approach, and national research on students shows hands-on content is an important element for encouraging careers in STEM **(Priority 2)**.[31]

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[28] Hawaiian Cultural Influences in Education (HCIE): Culture-Based Education among Hawai‘i teachers, May 2009

[29] Kamehameha Early Education Program (Smith, G. Pritchy, Common Sense about Uncommon Knowledge: The Knowledge Bases for Diversity. The American Association of Colleges for Teacher Education, 1988, p.19

[30] Farr, Steven, Teaching as Leadership: The Highly Effective Teacher’s Guide to Closing the Achievement Gap, January 2010

[31] Native Hawaiian Education Council Needs Assessment Report 2011

Ka Ulu Ana will deliver STEM education by using up-to-date information on the trends in STEM education and evaluation framework. The goal is to teach and motivate students, engage families and mentors in supporting students, and enable teachers through in-service training to gain knowledge, skills, and confidence to continue teaching STEM-related courses. The project design is guided by three approaches evolved from previous efforts by the applicant and research in effective teaching and learning processes as well as evaluation results and lessons learned from the Ke Ao Nei program which verified the efficacy of the following approach.

The **first approach** is to stimulate students' interest in STEM by providing a program centered on kinetic activities. Experiential education through repeated exercises of manipulating the hands-on projects is highly effective for at-risk Native Hawaiian students. Each student will be required to build five hands-on projects in class and complete three hands-on homework projects with the identified mentor at home in the course of the 10 modules during the two-week course. Student projects will be displayed and presented by students at an 'Ohana (Family) Night following each course and at an annual public 3R's Fair, both with a science fair format.

The **second approach** is to incorporate families and enthusiastic leaders within the Native Hawaiian community. Family involvement positively impacts educational outcomes in both indigenous and non-indigenous families.[32] Family involvement helps children get ready to enter school, promotes their school success, and prepares youth for college.[33] The project will implement this approach through support by mentors at home, at 'Ohana (Family) Night, and the annual 3R's Fair. Substantial effort will be made to secure Hawaiian STEM scientists and college science students to speak at career day (module 10), 'Ohana Night, and/or the annual 3R's Fair.

The **third approach** is to augment and strengthen science baseline content through

[32] Impact of Family Involvement on Education, Kamehameha Schools Research & Evaluation Oct. 2009
[33] Harvard Family Research Project, Harvard Graduate School of Education 2006

teacher professional development (in-service training, field trip activities, workshops, and participation in hands-on projects) for PIDF's staff as well as the teachers served. The professional development program will increase teachers' interest and knowledge in physical science, natural science and structural engineering, while the project's provision of teacher kits will support the replication of the project. These three approaches are outlined below with the three corresponding overall goals divided into measureable objectives, the methods for achieving them as well as the targets for process indicators and outcome measures discussed in Section e.

Table 1: Project Goals, Objectives and Outcomes

Goal 1	Objectives	Methods	Process Indicators	Outcome Measures
Goal 1: To enable a minimum of **2,375 sixth grade** students in three years in **30 different schools** to increase their base line knowledge in key STEM areas (by at least 40%) and favorable attitudes toward STEM study and careers	**Objective A:** To significantly (alpha <.05) increase performance of students' math and science scores from class base-line scores to a class average of 40%, an achievable/realistic goal based on experience in current grants.	**Method 1:** Twenty hours of classroom instruction will be delivered to students in each school in STEM subject areas that focus on renewable energy and its related technologies. Supported by STEM professionals and college students as guest speakers.	95% of students will complete the full course of STEM classroom instruction, including completion of **five hands-on project kits**.	Pre-post Knowledge Surveys will verify statistically significant increases (alpha <.05) of at least 40% in the knowledge gained in STEM classes.
	Objective B: To stimulate statistically significant (alpha <.05) increases in students' interest in the study and career options in STEM areas.	**Method 2:** Students: will each complete homework assignments and create three hands-on projects as homework with support from identified mentor(s).	90% of students will be able to complete all, including building **three hands-on homework project kits** using STEM concepts from classroom instruction and homework materials.	Pre-post assessments will verify statistically significant increases (alpha <.05) in the number of STEM fields and career areas in which students express interest on the Student Interest Assessment and the Attitudes Toward STEM and STEM Careers instrument.

Goal 2	Objectives	Methods	Process Indicator	Outcome Measures
Goal 2: To increase involvement for **7,125 familymembers/ mentors** of sixth grade students in developing at-home learning environments/activities that encourages community interest in learning and building science projects to propel student to success.	**Objective A:** To significantly (alpha <.05) increase family interactions that focus on student learning and family/community commitment to increase student success in educational accomplishments.	**Method 2:** from Goal 1 above to increase student knowledge will also support Goal 2 to involve family and others as mentors .	75% of families and/or mentors will engage with the students on **three hands-on homework project kits** and provide feedback on activities.	Frequency and quality of mentoring actions reported by students on the Student Family Assessment will verify both 75% participation by families and statistically significant (alpha <.05) increases in participation and enthusiasm through the sequence of the 10 modules.

	Objective B: To conduct 'Ohana Night's after 100% of each STEM course consisting of 10 modules to empower the students with relative science skills and knowledge and provide families/mentors an opportunity to show enthusiasm and support.	**Method 3:** At 'Ohana Night students, families, mentors, and teachers engage in an evening which highlights each student's success in a "science fair" style event with awards, student presentations including questions and answers, and learning games	90% of students will publically showcase their projects and be able to explain to families/mentors and community which STEM elements their project encompasses. All students will receive a certificate of completion and enthusiastic appreciation from their families and mentors who attend.	The outcomes are simply the process indicators. The percentage of students displaying their work will determine whether the process indicator of 90% is met, and family and mentor attendance will be an indicator of the degree of support that each student was able to engender.
	Objective C: To conduct the Annual 3Rs Fair in public setting with 75% attendance by students with family members.	**Method 4:** Student projects will be displayed and presented in a public setting (e.g. Mall) to encourage students and showcase their achievements.	Family members of 40% of students will attend the 3Rs Fair with their children.	Self-report by students at the 3Rs Fair will verify the percentage of family members who attended to assess the process indicator.
Goal 3	**Objectives**	**Methods**	**Process Indicator**	**Outcome Measures**
Goal 3: To engage a minimum of **50 sixth grade teachers** in professional development over three years to increase the number of teachers qualified to teach energy technology.	**Objective A:** To increase by 45 the number of qualified teachers that are committed and feel confident in their abilities to effectively teach STEM topics, so that students can continue in this learning track after the grant.	**Method 5:** In-service training will include: (1) introduction of the curriculum to be presented to students, (2) full participation by teachers as trainees during the 20 hours of classroom instruction, including completion of all hands-on projects with students, and (3) completion of field trip activities and additional workshops on new topics in Year 2 and Year 3.	(1) 90% of teachers will complete in-service energy technology training. (2) 98% of teachers will build each hands-on project during the first year and gain confidence and capability in teaching the same units in years 2 and 3. (3) 50% of teachers will participate in field trip activities and/or attend	The percentage of teachers completing in-services, hands-on projects, field trips, and workshops will determine the achievement of those process indicators. Teachers will demonstrate statistically significant (alpha <.05) increases on pre-post Teacher Interest Assessment, Knowledge Surveys and on the Teacher Competence and Commitment Survey.
	Objective B: To encourage teachers to pursue specialization in STEM areas enabling them to successfully continue teaching these subjects after this three-year program is over. 99% participation in in-service training resulting in a significant (alpha<.05) increase in interest, knowledge, competence and confidence in teaching STEM.	**Method 6:** Teachers will be provided with copies of all teaching materials from this program as well as a complete set of all project kits when the program is over in order to have the resources to continue teaching these subjects in their classes.	99% of teachers will successfully complete this professional development program and be qualified to continue teaching this course in their classes.	Teachers will demonstrate statistically significant (alpha <.05) increases on pre-post Teacher's Interest Assessment, Knowledge Surveys and the Teacher Competence and Commitment Survey.

The areas of instruction for Goal 1 are renewable and non-renewable energy;

sustainability and strategic habitat conservation; landscape conservation cooperatives; energy technology's impact on the ecosystems; explorations in structural pre-engineering; and the correlation between Hawaiian culture and energy needs. In Year 1, Ka Ulu Ana will develop culturally related curriculum interwoven with Hawaiian language in the first four months of the grant while servicing 15 schools in the following six months of the first year**,** 20 schools in Year 2, and 30 schools in Year 3. A minimum of 2,375 Students and 7,125 family members/mentors will be served over the three-years to reach 1,500 in Year 1, 4,000 in Year 2 and 4,000 in Year 3. For goal 3, the number of teachers served will be 14 teachers in Year 1, 32 in Year 2, and 50 in Year 3. Numbers served from year to year include some repeat participants.

The methodology in Table 1 is specific to the following seven methodologies.

Method 1: Classroom lessons. The teaching sessions will include 10 modules (10 days which includes 20 hours of instruction) centered on renewable and nonrenewable energy technology and its related physical science and math concepts. A team of a lead trainer and an assistant trainer will present relevant curriculum; five hands-on projects (e.g. a hydroponic system, bio dome, candle nut adornment, solar car, solar oven and water heater); and academic games to reinforce lessons. STEM scientists and graduate students from the University of Hawai'i Molecular Bioscience and Bioengineering (MBBE), the Hawaiian Islands Science group and other sources will meet with students, teachers and families (on either the Module 10 career day, 'Ohana Night and/or the annual 3R's Fair) to share their background, interests and goals and demonstrate hands-on projects and how they apply to the Hawaiian community.

Method 2: Homework assisted by designated mentor. Students will take home a series of handouts, worksheets, three hands-on project kit sets and materials to reference and to continue learning after the course is completed. Identification of a family member or a mentor is requested

on the first day of instruction to help with setting up a home work space, assignments, and hands-on projects, praising student achievements and discussing and explaining lessons.

Method 3: Family integration/'Ohana (Family) Night. Hawaiian students identify with the 'Ohana (family) unit as their main reference to all things in their daily life, including incredible respect for the *kūpuna* (elder) family members. The curriculum and activities will strive to connect STEM to 'Ohana and other traditional Hawaiian values. 'Ohana Night is the culminating event of the course resulting in the student's increased knowledge, showcasing the student projects, educating the parents and mentors and showcasing the parent/mentor's knowledge. The evening heightens to a celebration of success through a multi-media presentation, games and other activities, which possibly could include presentations by STEM professionals and students.

Method 4: Community Fair & Workshops. The Annual 3R's Fair will be held in a public place, ideally a Mall, where student projects can be showcased, interactive hands-on projects displayed, Ka Ulu Ana curriculum discussed and students exposed to interest and support from the public at large. The event itself will be similar in many ways to the 'Ohana Nights employing a science fair format with displays and presentations by students as well as collaborating professionals in STEM careers. Due to logistics and space limitations, the fair would include approximately ten area schools that would showcase about five students from each school and highlight the overall learning through media presentations, student displays and interactive demonstrations. All school staff, students and parents will be invited to participate in the Fair. Community workshops will include extending Ka Ulu Ana to at-risk youth in homeless shelters and/or safe house facilities as the primary teaching schedule permits, with adjustments of the sixth grade curriculum for higher grade level students.

Method 5: Teacher In-Service Training, Activities, and Workshops. Prior to classroom instruction, the lead trainer and assistant trainer will conduct a one to two hour preparatory meeting with the teacher(s) to review classroom curriculum and hands on projects, to evaluate the Hawai‘i Content and Performance Standards (HCPS) III benchmarks and to discuss logistics to ensure a smooth transition into the 10 day module. Teacher observation during classroom instruction along with their hands-on participation in building of the projects plus monitoring by the training team will reinforce teacher knowledge to enable future replication of the program. The annual field trip activity provides an opportunity to visit an educational science exhibit coordinated with Ka Ulu Ana's staff to allow the teachers to explore and gain knowledge through community resources. The annual science workshop will provide several special speakers from STEM fields to educate on new discoveries and demonstrate current STEM science projects (Years 2 and 3) as explained in detail in the budget narrative.

Method 6: Provision of teaching materials. Teachers will be provided with copies of all teaching materials from this program as well as a complete set of all project kits when the program is over in order to have the resources to continue teaching these subjects in their classes. The quality of the project design addresses Authorized Activities (F), (Gii) and (L). *(ii) The extent to which the design of the proposed project reflects up-to-date knowledge from research and effective practice.* Tech Together, ‘Ike Ea, and Ke Ao Nei, three PIDF STEM projects previously funded by the USDOE, were very successful forerunners. In Tech Together, significant gains from pre-tests to post-tests scores averaged 21% in 2007 and 29% in 2008. In ‘Ike Ea's first year, the gain was 37%. The current Ke Ao Nei program boasts the knowledge gained at 79% over the two and a half years of programming. Average teacher evaluations of PIDF's previous program's curriculum were 71% "excellent" and 29% "very good" (with no scores in the "poor" and good" categories). Grade level assessments were 57% "above grade

level" and 43% "at grade level." There were no scores in the "below grade level" category. In 2009, the Social Science Research Institute presented Tech Together data findings at the Annual Hawai'i Pacific Evaluators Association Conference that recognized *Tech Together's project as exhibiting the highest achievement in knowledge gained of any project that they have ever evaluated.*

Currently, Ke Ao Nei continues the tradition of excellence in the knowledge gained area as well as validating that the teaching methods, culturally relevant curriculum and hands-on projects are the components that create successful outcomes. Ka Ulu Ana will apply the teaching methodologies that achieved these results with a significantly upgraded curriculum. Ka Ulu Ana has evolved from a series of programs undertaken by PIDF and University of Hawai'i to successfully support and guide Native Hawaiian students into STEM careers. Twenty-four school principals committed to Tech Together programs and all have expressed their appreciation and commitment to Ka Ulu Ana. To date, 24 schools have committed verbally and twelve committed in writing.

"The integration of cultural values and practices with a clear focus on the need to introduce sustainable skills and pursuit of careers previously not considered is an important and innovative approach to creating a promising future for our Native Hawaiian children. You are commended for your efforts and we look forward to participating and contributing to the long-term success of this educational endeavor."
Alvin N. Parker, Principal, Ka Waihona o ka Na'auao Public Charter School

In Tech Together, 'Ike Ea, and Ke Ao Nei, the use of STEM Native Hawaiian college students was successful in generating interest among family members and students in pursuing STEM subjects. Ka Ulu Ana's experiential curriculum will use these role models intertwined with CBE "where the grounding of instruction and student learning in the values, norms, knowledge, beliefs, practices, experiences, and language are the foundation of a culture."[34] The

[34] Hawaiian Cultural Influences in Education (HCIE): 'Ohana and Community Integration in Culture-Based Education, Kamehameha Schools Research & Evaluation, June 2008

experiential education approach is based on National Science Foundation research, textbook manufacturers, and other institutions in the development and testing of STEM education.[35]

Existing research also documents that early parental involvement in a child's education promotes positive long-term effects.[36] Parent support is essential to developing a child's confidence, self-esteem and values. Parent-child relationships and interactions are considered a key predictor of learner success and of particular importance to low-income and ethnic minority learners.[37] In Ka Ulu Ana, parent involvement is incorporated within the curriculum encouraging learning opportunities for students and parents, including 'Ohana Night and the annual 3R's Fair.

Ka Ulu Ana consults the most recent data available compiled by the Hawaiian Vocational Education Program, Alu Like, Inc., Kamehameha Schools' Ka Huaka'i Native Hawaiian Educational Assessment, and the Hawai'i DOE to identify target schools with high percentages of Native Hawaiians. The Ka Ulu Ana design is also based on current input from cultural consultants, organizations, and members of the Native Hawaiian community.***(iii) The extent to which the design of the proposed project will be coordinated with similar or related efforts, and with other appropriate community, State, and Federal resources.*** A comprehensive approach to weaving students, teachers, schools, communities, students' families and university resources together is crucial to a successful outcome. PIDF collaborates with appropriate partners to maximize effectiveness of its programs. PIDF has developed a unique statewide network of Native Hawaiian educational agencies and organizations supporting this project, including the UH MBBE Department, Hawaiian Islands Science representatives and other Hawaiian scientists and professors. These resources will provide community outreach and direct contact with Native Hawaiian communities on Kaua'i, O'ahu, Maui, Moloka'i, and the Island of

[35] *Research on FOSS and other hands-on science programs,"*A Growing Bibliography", Updated: July 2001.
[36] Impact of Family Involvement on Education, Kamehameha Schools Research and Evaluation Division, 2009
[37] Educational Impact Measures, Kamehameha Schools Research & Evaluation January 2011

Hawai‘i. PIDF will ensure close cooperation between the project and increasing numbers of public, private, charter schools, other educational institutions and seek to partner with other agencies and organizations with similar goals nationally. *(See Appendix 1)*

The evaluation of the project itself will become part of a new collaborative effort. As explained below under Section e, PIDF and partnering agencies and foundations are adopting an Integrated Evaluation Model (IEM) to ensure standards of quality and integrity across programs. The IEM will embody specific overall evaluation strategies, and when appropriate, include some common measures across projects with similar populations.

The collaborative effort with the UH MBBE Department will support the educational objectives in the curriculum through educational workshops for professional development for PIDF’s staff as well as the school’s teachers that we serve. This Department will also review hands on projects and identify areas of improvement to maintain industry standards. MBBE faculty will also serve as speakers to the career module of the ten day program and the ‘Ohana Night where they will speak and demonstrate applicable science projects to encourage STEM career fields so students and parents observe the relevance of science in their daily lives. Corporate support includes, for example, the Honolulu Poi Company Foods (HPCF) commitment to donate seedlings for a hydroponics hands-on project that each student will create and take home.

The successful collaboration with schools, principals, teachers, parents and students are a testament to our success and we are therefore committed to expanding the successful model by including an additional team (YR1 2 Teams and YR2 & YR3 to 3 Teams) to reach two more neighbor islands of Kaua‘i and Maui while also increasing capacity on O‘ahu, Moloka‘i, and the Island of Hawai‘i as well as conduct workshops for the homeless and safe house residents. The

Annual 3R's Fair will develop and engage an extensive community partnership involving many businesses and organizations to work cohesively to accomplish this task.

"I am very familiar with the outstanding success of your work in the schools in our communities. My colleagues have all commented on the amazing interest that parents have shown in the enrichment work you have done in the STEM areas. This project works to motivate our young children, Hawaii's future leaders, to develop confidence and demonstrate academic achievement in areas they previously believed impossible."
Wendy Matsuzaki, Acting Principal, He'eia Elementary School

(c) Adequacy of Resources. *(i) The extent to which the costs are reasonable in relation to the number of persons to be served and to the anticipated results and benefits.* The detailed description of the proposed three year budget for Tech Together: Ka Ulu Ana is included in this application. This budget is adequate based on the experience of Tech Together's years of operating and refining its budgetary needs through related projects, including (Tech Together (S362A0600072), 'Ike Ea (S362A070021) and Ke Ao Nei (S362A090020). The financial management of the grant is administered by the Project Manager and overseen by PIDF personnel with decades of experience in managing public and private grants.

The budget includes costs for personnel and fringe benefits, travel expense, equipment expense, supplies and materials, contractual fees, and other expenses, such as facility rental and liability insurance. The total number of participants this project anticipates serving is 2,375 students, 30 schools, 50 teachers and 7,125 family mentors (based on an average of three per child per program experience). The cost per participant is estimated at [redacted] based on the 3 year budget of [redacted] divided by 9550 served (students, teachers, family members).

In combination with the extensive community partnerships cited above, the budget will allow Tech Together: Ka Ulu Ana to provide a high quality hands-on renewable and nonrenewable program serving sixth grade students throughout Hawai'i with positive outcomes in the knowledge gained in STEM baseline scores with curriculum that addresses 96 of the HCPS III benchmarks. (*See Appendix 2*)

(ii) The relevance and demonstrated commitment of each partner in the proposed project to the implementation and success of the project. The administrative and training staff will ensure successful expansion to the new schools and new islands with proper administrative support with goals achieved as the result. The partnership of the UH MBBE Department will be instrumental in reviewing the hands-on projects and experiments for their relevance in the industry as well as serve as mentors, speakers for career day and a teacher workshop. Hawaiian Islands Science, Hawaiian scientists, and UH professors are secured to support this program with additional speakers for either the career day in the 10 day curriculum, ‘Ohana Night, and/or the annual 3R’s Fair. The Honolulu Poi Company Foods Ltd. will be providing seedlings for the hydroponic project for each student throughout the three years. The cooperation of the State of Hawai‘i Department of Education schools will complete the partnerships to impact sixth grade students. Twenty-four schools have made verbal commitments with twelve that have made written commitments. PIDF is also fully committed to this project, having experience administering Tech Together, ‘Ike Ea, and Ke Ao Nei in partnership with UH. The project will contract a highly experienced external evaluator, Dr. Scott Ray, who will provide the feedback and project performance reports to project staff, the advisory committee, PIDF, and USDOE assessing the implementation of the design and accomplishment of objectives and the outcomes of the project.

(iii) The extent to which the budget is adequate to support the proposed project. The budget is built on the historical costs of a similar project and is a fair representation of the costs necessary to run this project. The project will have eight management/administrative staff (4 at 100%, 4 part-time) and five training staff (2 lead trainers with 2 assistant trainers and one floater at 100% to support purchasing teaching materials, preparation for teachers and students instructional materials and to replace staff due to illness). In Year 2 and Year 3, the project will have three lead trainers and three assistant trainers with one full time floater. The first four months of Year

One will be dedicated to building an entirely new STEM curriculum with multi-media slide presentations, content for student workbooks, demonstration projects developed, hands-on classroom projects and homework assignments along with three hands-on homework projects. The Curriculum Development Specialist (CDS) assisted by PIDF's cultural team will ensure relevant science concepts along with Hawaiian culture and language interwoven throughout each module while the Recruitment Specialist solicits schools to fill the schedule of the following six months of training. The full time floater will be hired in October 2012 to support the preparation work for the upcoming six months of training in the first year. The Project Manager and Project Assistant will manage the administrative logistics of the office as well as organize the annual 3R's Fair, schedule the workshops for Year 2 and Year 3, and coordinate the special speakers for either career days, 'Ohana Night or the professional development workshops. In Year One, the funding request of [redacted] will implement the program on O'ahu and Hawai'i (Big Island). In Year Two and Three, the increase in the requested amounts ([redacted] and [redacted]) will support serving O'ahu, Hawai'i (Big Island), Moloka'i, with expansion to Maui and Kaua'i.

With the wealth of experience of Tech Together through previous projects funded by the USDOE, the proposed project of Ka Ulu Ana is committed to continue to increase performance scores in science content base areas for all sixth graders in the target schools. While designed for Native Hawaiian children, the program provides equal access to and treatment of all regardless of race, color, national origin, gender, age, or disability.

(d) Quality of the Management Plan. *(i) The adequacy of the management plan to achieve the objectives of the proposed project on time and within budget, including clearly defined responsibilities, timelines, and milestones for accomplishing project tasks.* Table 2 describes time commitments of staff, timing and frequency of program development and implementation

that will be tracked with other activities and milestones in the process evaluation to provide continuous feedback to staff, PIDF Management and other stakeholders.

Table 2: MANAGEMENT PLAN

Task	Person Responsible	Timeline	Milestone/Targets	Related Project Objective	Priorities & Auth. Activities
PROJECT ADMINISTRATION & MANAGEMENT					
Hire and provide training for 5 training staff	HR, PM	Start date 8/1/12	5 qualified training staff members confirmed by 9/15/12; all staff members will complete new hire, safety, and all PIDF necessary training. (Training staff includes 4 trainers and 1 floater).	1a, 1b, 2a, 2b, 2c, 3a, 3b	1,L
Secure Honolulu facility to accommodate program	EPD, PM	8/1/2012	Location will be confirmed and secured by 10/01/12.	1a, 1b, 2a, 2b, 2c, 3a, 3b	1,L
Recruit Schools	PM, RS	Yr 1: 8/1/12 - 6/13/13	Yr 1: 15 schools on O‘ahu & Hawaii (Big Island); Attendance documented.	1a, 1b, 2a, 2b, 2c, 3a, 3b	1,2,3,F,Gii, L
		Yr 2: 8/1/13 - 6/13/14	Yr 2: 25 schools on O‘ahu, Hawai‘i (Big Island), Maui, Kaua‘i, & Moloka‘i; Attendance documented.	1a, 1b, 2a, 2b, 2c, 3a, 3b	1,2,3,F,Gii, L
		Yr 3: 8/1/14 - 6/13/15	Yr 3: 30 schools on O‘ahu, Hawai‘i (Big Island), Maui, Kaua‘i, & Moloka‘i; Attendance documented.	1a, 1b, 2a, 2b, 2c, 3a, 3b	1,2,3,F,Gii, L
Schedule and deliver program on O‘ahu & Hawai‘i (Big Island) in Yr 1; Begin and continue program on O‘ahu, Big Island, Maui, Kaua‘i, & Moloka‘i in Yr 2 & Yr 3	RS, TS	8/1/2012	Program begins on O‘ahu & Hawai‘i (Big Island) by 1/7/13.	1a, 1b, 2a, 2b, 2c, 3a, 3b	1,2,3,F,Gii, L
		8/1/2013	Program continues on O‘ahu, Hawai‘i (Big Island), Maui, Kaua‘i, & Moloka‘i in Yr 2 & 3.		
Evaluate and modify project as needed	PM, CDS	9/1/2012	Biweekly for the first four months. Thereafter monthly evaluations. Management will work closely with training staff to ensure quality of the project.	1a, 1b, 2a, 2b, 2c, 3a, 3b	1,2,3,F,L
Report and document project status	PM	9/1/2012	Report to PIDF corporate at monthly manager's meeting and quarterly to PIDF Board of Directors.	1a, 1b, 2a, 2b, 2c, 3a, 3b	1,2,3,L
PARTNERSHIPS					
Identify and secure speaker panel, community partners, and evaluators to assist in resource materials, and hands-on curriculum, and feedback	EPD, PM, CDS, RS, TS	Start date 9/1/12	4 community partnerships from O‘ahu by 11/1/12; all staff involved in all community service activity each year; UH and Business partnerships: DMBBE, HIS, HPS, HPCF.	2c	1,2,3,F,Gii, L
CURRICULUM					
Design and implement curriculum for students and teachers	PM, CDS, TS	Start date 8/1/12-12/1/12	Curriculum will be completed and applied annually; students will increase HSA scores with science based curriculum; Student and teacher workbooks and worksheets distributed and completed.	1a, 1b	1,2,3,F, Gii, L
Implement curriculum and teachers in-service training	PM, CDS, TS	Start date 1/7/13	Curriculum will be completed and applied daily; teachers will increase knowledge and capacity in science based terminology and hands-on project skills.	1a, 1b	1,2,3,F, Gii, L

In class activities, take home and hands-on projects	CDS, TS	Start date 8/1/12	10 in class activities, 3 homework projects, 5 in class hands-on projects.	1b, 2a	1,2,3,F,L
Family (‘Ohana) Night; Student presentation with families and mentors	TS	Start date 1/7/13	90% of student and teachers will participate in family integrated event; Guest speakers and mentors are identified: DMBBE, HIS, HPS, HPCF; Student projects displayed.	2b, 2c	1,2,3,L
Incorporate Annual 3R's Fair	PM, CDS, TS	Annually beginning 2013 in May	Ka Ulu Ana curriculum and student projects will be displayed and presented in a public setting to encourage students and showcase their achievements on STEM projects; Community partnerships incorporated.	2c	1,2,3,L
PROGRAM QUALITY & STAFF PROFESSIONAL DEVELOPMENT					
Professional development workshops, conferences and activities	EPD, PM, CDS, TS	Start date 8/1/12	100 % staff participation in biannual Hawaiian culture and STEM area workshops; All staff attend PIDF organization-wide cultural in-service.	3a, 3b	1,2,3,G,L
DEVELOPMENT OF EDUCATIONAL & ASSESSMENT RESOURCES, DATA COLLECTION					
Identify, design and implement surveys to support curriculum and program	SRA, PM, CDS	Start date 8/1/12	Student and teacher Pre-Post Knowledge Surveys will be designed and implemented by 1/7/13.	1a	1,2,3,L
Develop evaluation design, data collection methods and procedures for data management	SRA, CDS, PM	Start date 8/1/12	Assessment tools used to measure: program, student, teaching staff, and curriculum with summary data reported to USDOE biannually and end of grant final report by Aug. 2015; 8 survey tools developed and modified over 3 yrs.	1a, 1b, 2a, 2b, 2c, 3a, 3b	1,2,3,L
Implement instruments and distribute evaluation procedures	SRA, CDS, PM, TS	Start date 1/7/13	Teach training staff to manage and disseminate evaluation tools.	1a, 1b, 2a, 2b, 2c, 3a, 3b	1,2,3,L
Collect and analyze teacher, student, and program data	PM, PA, SRA, CDS	Monthly, then Quarterly	Analyze data collection for program goals and objectives by 1/7/13	1a, 1b, 2a, 2b, 2c, 3a, 3b	1,2,L
Proposed Schedule Key: EPD= Executive Project Director, HR= Human Resources, PM= Project Manager, CDS= Curriculum Development Specialist, RS= Recruitment Specialist, PA= Project Assistant, TS= Training Staff, SRA= Scott Ray & Associates, HIS= Hawaiian Islands Science, HPS= Hawaiian Professors & Scientists, DMBBE= Department of Molecular Biosciences & Bioengineering, HPCF= Honolulu Poi Company Foods (See Priorities & Authorized Activities in the Program Abstract and RFP.)					

(ii) The extent to which the time commitments of the project director and principal investigator and other key project personnel are appropriate and adequate to meet the objectives of the proposed project. The management team will be responsible for continual improvement in every aspect of the operations. The management team as described in the budget narrative will contribute a percentage of time to the project, including PIDF Executive Project Director Jan Dill (5%), Project Manager W. Keikilani Lyons (100%), Project Assistant Susan Yamasaki (100%), Curriculum Development Specialist Melanie Ramsey (100%), and Recruitment Specialist Pete

Velasco (100%). (*See Resumes in Other Attachments*) The management team will meet regularly to devote the time and effort necessary to ensure objectives are being reached**.**

(iii) The adequacy of mechanisms for ensuring high-quality products and services from the proposed project. To assure achievement of Ka Ulu Ana's objectives**,** all methods or learning activities will be closely monitored and measured throughout the program. These evaluation and assessment mechanisms will ensure high-quality services, and an external evaluator will provide accurate and timely data, analysis and reporting of formative and summative process as well as outcome evaluation to help ensure continuous quality improvement and success. The management team will review quarterly evaluation reports which will summarize the overall status and progress of the project, delayed action steps, emerging issues, problems and opportunities, recommendations and lessons learned. The management team will evaluate and modify the program based on the process evaluations and administrative observations and analyses and seek regular input from PIDF management, collaborating experts, and the external evaluator. The evaluator will assist Ka Ulu Ana with recommendations to reach goals and objectives of this program. PIDF has a comprehensive infrastructure to support fiscal, personnel and other required business functions to support the project.

(d) Quality of Project Evaluation. *(i) The extent to which the methods of evaluation are appropriate to the context within which the project operates.* PIDF and partnering agencies and foundations are implementing an Integrated Evaluation Model (IEM) to ensure the integrity of PIDF and its various programs. While the model addresses a variety of Native Hawaiian educational programs with specific content and assessment tools, there is a general set of common precepts underlying the logic model of goals, strategies and intended outcomes for each individual program, and programs for similar populations even share some common evaluation measures. The PIDF IEM mandates (1) formative process evaluation, (2) summative process

evaluation and (3) outcome evaluation, of which all three use some common data.

(1) The formative process evaluation will monitor "implementation fidelity" by measuring and documenting the extent to which each program implements the planned objectives, on a timely basis, and in compliance with project plans as well as the extent to which they contribute to the overall program purpose and goals. Program objectives will be broken into the expanded sequence of "action steps" required to achieve each objective, and each action step will be cross-walked to the "person(s) responsible, deadlines and completion status." Completion status will be reviewed (beginning monthly, then quarterly and summarized annually) by assessing each action step *qualitatively* as being "in planning/not yet due, on-schedule, completed or delayed." The percentage of steps in each category will be quantified by program objective and project-wide. This continuous monitoring and reporting of progress will serve to alert administrators of problems before or as they emerge to enable early remedial actions.

(2) The summative process evaluation will provide quarterly reports of cumulative inventories of indicators of the variety of project activities such as the numbers and characteristics of students and families served and realizing various program benefits, in the context of project activities (e.g. professional development) contributing to those results. Together, formative and summative data will document the extent to which planned activities were completed and resulted in achieving the overall project goals and objectives to give staff feedback to support program improvement and replication.

(3) The outcome evaluation will measure and document systemic and programmatic outcomes with a focus on direct results for participants, including changes in student and caregiver characteristics within (pre to post) and across successive program years, using common statistical tests of the significance of those changes (e.g. t- and F-tests, chi-square). In addition to specific measures for each program, common outcome measures will be used where appropriate

for similar populations. While this project will share only measures of "Student Attitudes Toward STEM and STEM Careers" in the context of Hawaiian cultural norms and a "Program Satisfaction Instrument" with another STEM program for middle-school students in Hawaiian charter schools, this evaluation will strictly conform to the overall IEM methodology above.

Outcome analyses will use a single group pre-post-test design as diagrammed below.

Intake	Follow-up
X_{pre}	X_{post}

Appropriate combinations of measures will be combined in multiple analysis of variance (MANOVA) models for repetition computing multivariate (Hotelling's T) as well as univariate (F/t-tests) tests of significance, using the general linear model (GLM). Dosage effects will be assessed by entering attendance into the MANOVA analyses as a covariate. Results will be presented in local Hawaiian education forums and professional seminars.

Dr. Scott Ray, the external evaluator, holds a Ph.D. in Social Science Research including significant statistical coursework in educational psychology; resides in Hawai'i; has 35 years of experience, including directing large-scale Federal grants and evaluating scores of Federal grant projects, including a dozen projects targeted to Native Hawaiians *(See in Other Attachments).*

(ii) The extent to which the methods of evaluation will provide timely guidance for quality assurance. As specified above, formative and summative process analyses will be performed and the results shared with the management team and PIDF administrators monthly in the first quarter and quarterly thereafter, with annual summaries. The initial monthly reports will be abbreviated summaries designed to identify and address difficulties with the start-up of the project. Outcome analyses will be added into the quarterly reports cumulatively as sufficient data become available to support analysis and reporting, beginning with baseline data in the initial reports and incorporating analyses of changes from to pre- to post-tests as follow-up data are collected. These reports will be presented to the PIDF Board of Directors annually and to

USDOE at least annually and at any additional frequency requested. As indicated above, process evaluations will qualitatively assess and quantitatively summarize the overall status and progress of the project, delayed action steps, emerging issues, problems and opportunities, recommendations and lessons learned as well as the implications of outcome data as it is accumulated. At the end of the project, the collective results of quarterly reports will be summarized in a narrative that will *guide for replication* by identifying the history of project implementation; problems that arose; outcomes that were or were not achieved; remedial actions that were taken; and which remedial actions were successful or not.

(iii) The extent to which the methods of evaluations include the use of objective performance measures that are clearly related to the intended outcomes of the project and will produce quantitative and qualitative data to the extent possible. Both process performance indicators and outcome measures were specified in relationship to the specific program goals, measureable objectives and methods for achieving them in Table 1 on page eight. The crosswalks of program objectives to person(s) responsible, deadlines and completion status specified in the IEM above will include the process indicators from Table 1 as well as the behavioral objectives in Table 2 on page 19 and possibly other important objectives of the program that develop.

The outcome measures were also specified in Table I. All of these instruments have been developed in previous projects with similar populations. Pre and Post Knowledge Surveys on the curriculum were specified above for evaluating the knowledge outcomes for students in Goal 1 and Objective A (1.A) and 1.B (and for teachers in 3.A and 3.B). The Student Interest Assessment (collected after each module) and the Attitudes Toward STEM and STEM Careers will assess changes in those interests and attitudes (1.B). The Student Family Assessment (collected after each module) will measure student assessments of family participation and enthusiasm in mentoring STEM assignments (2.A). A self-report checklist will be used for

students to verify numbers of their mentors attending ‘Ohana nights (2.C). The Teachers Interest Assessment (pre-post) will assess interest in STEM and STEM careers among teachers (3.A and 3.B), and the Teacher’s Competence and Confidence (pre-post) will measure teacher efficacy in teaching STEM (3.A and 3.b). The project will use a Program Satisfaction instrument in common with another IEM program for middle school students. There is only a process indicator for 2.B. Finally, the specified GPRA data relevant to the Native Hawaiian students in schools served by this program (percentages meeting specified proficiency standards and graduation from high school) will be reported to USDOE as required, although these students are only a small proportion of all Native Hawaiians in these schools, and they will not have yet graduated from high school.