A. Project Summary: Saturday Academy, in concert with community partners, will expand STEM/STEAM opportunities for nontraditional STEM learners. The goal is to provide a program of education so that children connect, engage, get inspired and have a progressive set of experiences that help them to be successful at in their K-12 education, prepared for college, and know the STEM careers that follow education. The program will be implemented through a partnership with iUrban(1), Bienestar (2) and Girls Inc. NW(3). The goal is to alleviate some of the barriers to augmentative STEM education for students by providing it through programs they already associate with. The community partners have contacts with the students and their families and Saturday Academy will follow their lead with a progressive program, tailored for each organization's students, to keep students in the STEM pipeline and prepare them for a STEM career. The program includes STEM/STEAM classes, preparation with the "soft skills" for a STEM careers, and an opportunity for an 8 week summer internship in a STEM organization.

B. Project Rationale: The program proposed is tailored to serve three groups of youth who have traditionally been underserved STEM learners: African American adolescent boys, Hispanic youth and girls from low income families. Of the two thirds of Oregon students who graduate, less than half meet the benchmarks for college readiness in Algebra and Biology (4,5). Only half of African American high school youth in Portland Public Schools graduate within four years (4), and only 35% meet or exceed benchmarks in math, and 21% in Science (5). 40% of Hispanic youth in Hillsboro do not graduate high school within four years (6). The educational attainment of children from low income immigrant families, is even worse. Only 29% meet or exceed benchmarks in Math, and only 23% in Science (7). These students are most in need augmentation of their STEM education, in additional to that provided in school, if we hope to close this gap, let alone meet Oregon's 40-40-20 education attainment goals (8).

The girls in Girl Inc. are from underserved minority and low income families. However, the goal of providing STEM programming for them goes beyond the issue of the achievement gap and STEM literacy. Women make up fewer than 18% of the engineering and technology workforce, and those statistics mirror the numbers of college engineering majors (9). An analysis of Saturday Academy's own enrollments show that girls participate in math and life science STEM opportunities at high rates (40-55% are girls), but are unlikely to sign up for computer science or engineering classes (12-15%). Thus, an additional goal of providing STEM programming for all of the participants, but particularly the girls, will be to introduce them to the real-world and cross disciplinary problems that can solved through computers, software design and engineering. Most children form their career identities and aspirations by middle school, however most youth, but girls in particular, have rarely met a STEM professional (10). Thus, career aspirations in STEM fields that drive educational attainment are absent. The program proposed will address this gap through the use of community professionals as the STEM instructors and the problems posed in every class requiring real-world STEM solutions.

The Portland Metropolitan Area is rich in STEM career opportunities. Portland is home to many Universities with rich research programs (OHSU, Univ. Portland, Portland State etc), hospitals and biomedical research organizations (OHSU, Kaiser, Providence, Legacy, Veterans Admin. Med. Ctr), government agencies (Bonneville Power, Port of Portland), and of course, the "Silicon Forest" of software and technology companies (Intel, Mentor Graphics, Tektronics, IBM etc) including a fast growing technology start-up industry (Elemental, Puppet Labs, Jive Software etc) and start up incubators and accelerators (PIE, OTRADI, Portland Seed Fund, PSU Business Accelerator, Oregon Tech. Business Ctr). Saturday Academy has partnerships with over 100 of these organizations state-wide that provide mentors for the Apprenticeships in Science and Engineering (ASE) summer high school internship program (see below). Similarly,

Saturday Academy utilizes approximately 200 community professionals annually as instructors in our classes, camps and afterschool program; many from these organizations.

The content of Saturday Academy's classes directly address state standards (see example below), and the hands-on and inquiry based aspects of our classes address the three dimensions of the Next Generation Science Standard (NGSS): Students learn the practice of science that leads to discovery including questioning, trial and error and scientific controls. The STEM classes are cross-cutting as they integrate multiple areas of science in order to solve a problem.

Class Description	State Standard
Engineering Quirky Machines – Ever hear of Rube Goldberg who over-engineered a contraption to perform a simple task? Students gain hands-on engineering experience as they work in a small team to design and build quirky contraptions out of everyday materials to solve simple problems. Along the way, they learn about the physics of energy conservation, inertia, forces, and electric circuits.	**Mathematics** 2.MD Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes. (grade 2) 3.MP.1 Make sense of problems; persevere in solving them. (grade 3) **Science** 2-LS2-2 The shape and stability of structure of natural/designed objects are related to the function(s). (grade 2) 3 – 5 ETS1-1 Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (grade 3) **The Arts** AR.03.CP.02 Explore aspects of the creative process and the effect of different choices on one's work. (grade 3)

Finally, the content of the classes meet the four disciplines outlined in the NGSS (e.g. life sciences, engineering etc) and provide tools to solve real-world problems within each class.

C. Project Plan: Objectives and Outcomes: The main objectives are that students:

- receive augmentative STEM/STEAM (the integration of arts and STEM) educational opportunities and to enable students to follow up with additional STEM opportunities.

- see STEM as the means to solutions to real-world problems.

- learn about STEM careers, see being a scientist or engineer as a potential career, and understand the role STEM plays in all 21st century careers.

The outcomes are that students increase in STEM knowledge and engagement but the ultimate goal is that they follow up an initial experience with additional STEM opportunities.   It is the "multiple STEM touches" including in- and out-of-school opportunities that will help bridge the achievement gap while also providing an avenue to meet the 40-40-20 Oregon Education goal.

Ample evidence suggests that persistence and success in STEM fields requires adequate preparation, understanding the real-world significance of the learning, a mentor or role model, and knowledge of the careers that follow education (11). This program includes all of these features: Preparation requires sustained as opposed to one-time demonstrations. We propose multi-week classes, an 8 week internship, and opportunities to continue STEM learning through additional classes, afterschool or internships programs. All of the opportunities include hands-on activities that solve real-world problems and are taught or mentored by community professionals so that children see adults as a conduit to learning and the STEM careers that follow education.

Activities: Children from each partner organization will have a "package" of STEM opportunities that fit the age, interests and structure of the partnering organization and their students. We hold our programs throughout the Portland Metropolitan Area and have an Operations Team that organizes and delivers the materials and mobile computer, robotics and microscope labs wherever we hold our classes. Thus we can flexibly implement STEM opportunities within the framework of our partners.

iUrban provides at least two one-day Tech Summits each year in Portland for 14-16 year old young men; mostly African American youth. They have approximately 150 who attend on the University of Portland Campus (UP) and about 60% of these teens follow through with a subsequent half day tour of a technology company. The goal is that students meet STEM career professionals of color and gain confidence through public speaking and leadership workshops. With iUrban, Saturday Academy will recruit young men in small cohorts of pairs or triplets of

friends to enroll in a Saturday Academy STEM or STEAM class of their choosing so they may carry the iUrban Tech experience beyond the summit. Research shows that identity is formed and reinforced within one's cohort. Therefore, encouraging STEM education as something one does with friends will utilize this best practice. In addition, Saturday Academy will provide an "ASE-It" class for iUrban teens at UP. This class teaches students some of the "soft skills" of a STEM career including interviewing, essay writing, communication, and working in teams. The goal is that students who take the ASE-It class will have more competitive applications for Saturday Academy's internship program (see below).

Bienestar holds afterschool homework clubs at their housing units, but they do not have expertise or materials to provide STEM education. Therefore, Saturday Academy will provide nine STEM/STEAM classes for elementary and middle school students throughout the school year, taught by community professionals at three of the housing units: 12 students/class, one-day a week, for 10 weeks (1.5 hr/day)/class. In addition, Bienestar will recruit and provide transportation to students in the summer to attend STEM/STEAM classes at Saturday Academy's summer satellite programs at Glencoe High or Saturday Academy Beaverton.

Saturday Academy will provide 10 STEM classes, to Girl's Inc Girls Groups. However, the classes will be focused on engineering, computer science and technology to engage girls in STEM fields and careers exploration with low rates of participation by women. The girls will progress from there to Saturday Academy open enrollment classes and camps in the summer, supported by tuition assistance.

The ultimate experience to tie students to STEM careers is an internship. The ASE program pairs students with mentors in STEM organizations in the summer for an 8 week, full time internship. The students also have a series of workshops (essay writing, interview skills), a mid-summer conference day of STEM workshops at OSU and an end of summer Symposium at

UP where they present their work to family and community members. Approximately 140 students will apprentice state-wide in summer 2014. The program maintains a goal that half of the participants are young women, and 40% are underserved minority, low income, first generation college bound youth and/or English is not spoken at home.   This proposal will support at least 10 internships specifically for underserved students, with preparation and recruitment through iUrban, Bienestar and Girls Inc partners.

D. Evaluation Plan: Engagement will be assessed through written evaluations in which students and instructors rate each of the experiences through questionnaires with Likert-type scales (see

From the student in STEM/ STEAM Classes: "I see myself as a scientist, engineer"; "I want to learn more about engineering."

examples below). Knowledge is assessed in the classroom through the student outputs. Evaluations are reviewed by the instructors and the program directors and shared with the coordinator at the partnering organizations for program improvement goals. The ultimate metric will be whether the students sign up for additional STEM classes or apply for an internship. The timeframe of this proposal (15 months) limits the ability show participation in follow up opportunities beyond those provided here. However, Saturday Academy and the partner organizations will follow students and use direct contact, social media and email as well as flyers and catalogs to invite students to "follow up on their curiosity" in Saturday Academy programs or those of others (e.g Girls App Camp; Girls Gather for Computer Science, MESA)

E. Sustainability Plan: Our sustainability goal is that students continue to take advantage of STEM/STEAM opportunities in the community. Saturday Academy has a partial earned income model that enables it to support low income children with tuition assistance or full vouchers in our classes. Therefore, this program will establish partnerships that improve access for children who are at risk for poor STEM achievement and provides a pathway for them to continue augmentative learning to bridge the achievement gap.

Bibliography:

1). iUrban: http://iurbanteen.org/

2). Bienestar: http://www.bienestar-or.org/

3). Girls Inc.NW: (http://girlsincnworegon.org/)

4). Oregon Department of Education : (2011-2012 cohort)

http://www.ode.state.or.us/wma/data/schoolanddistrict/students/docs/summarycohortgrad1112.p

df

5). National Assessment of Education Progress (NAEP), Oregon data and achievement gap.

http://nces.ed.gov/nationsreportcard/pdf/stt2011/2012451OR8.pdf

http://www.ode.state.or.us/initiatives/naep/2011-naep-achievement-gaps.pdf

6). Hillsboro School district 2012-2013 Report:

http://www.hsd.k12.or.us/Portals/0/District/AYP/2012-2013/2012-

13%20Hillsboro%20HS%20Report%20Card.pdf

7). Great Portland Pulse: http://www.portlandpulse.org/student_achievement

8). From Goal to Reality: 40-40-20 Leadership Symposium report OUS

2011http://www.oregon.gov/gov/oeib/docs/nnousreport.pdf

9). Ashcraft, C., Eger, E, Friend, M.Girls in IT: The Facts, National Center for Women &

Information Technology NCWIT's K-12 Alliance, 2012.

10). Modi, K. Report from Girl Scout Research Institute 2012

www.girlscouts.org/research/publications/stem/generation_stem_what_girls_say.asp

11). Drew, C. Why Science Majors Change their Minds

http://www.nytimes.com/2011/11/06/education/edlife/why-science-majors-change-their-mind-

its-just-so-darn-hard.html?pagewanted=all&_r=0