4-H Science

(which includes: Science, Technology, Engineering, and Applied Math)

Situation

There is a concern that the United States is not preparing a well-trained and highly prepared workforce to work in the fields of science, technology, engineering , and mathematics (STEM). Several studies and databases have highlighted the plight from elementary students to the university level students.

According to the recently released *Nation's Report Card* for science (National Assessment of Educational Progress, 2009, http://nces.ed.gov/nationsreportcard/), American students are still struggling with science proficiency. At grade 4, 34% of students are considered proficient in science (proficient represents solid academic performance and the demonstrated competency over challenging subject matter), 30% of 8th graders are considered proficient, and only 21% of 12th graders are considered proficient. In fact, 60% of 12th graders performed at a basic level (denoting only partial mastery of fundamental knowledge and skills). The 2009 NAEP data also shows us that 4th grade students in Georgia are performing at a lower level than the national average, our 8th graders are performing on par with the national average, and a comparison of Georgia 12th graders against the national average is not available.

Information allowing for the comparison of U.S. students and other international students is available from Trends in International Mathematics and Science Study (TIMSS - http://nces.ed.gov/timss/). In the most recent study of 2007, 4th grade students scored lower in science than those in 4 other countries (all in Asia) and 8th grade the students scored lower in science than those in 9 other countries (all in Asia or Europe).

The Program for International Student Assessment (PISA, http://www.pisa.oecd.org) also implements an assessment that measures the competency of 15 year old students around the world (this would be an average of the end of compulsory education). The 2009 PISA results indicate that U.S. high school students scored behind those in 22 other countries.

National Science Board (http://www.nsf.gov/statistics/seind10/) released the *Science and Engineering Indicators of 2010* report which states that of the first university degrees awarded in science and engineering in 2006, only 11% were earned in the United States. This is compared with 21% in China and 19% in the European Union. Additionally, of the degrees earned around the world in 2002, the average international percentage of STEM first university degrees is 26.4% while the U.S. percentage of STEM first university STEM degrees earned is only 16.8%.

In response, 4-H has set about to engage one million new scientists in STEM programming by the year 2013 to contribute to global competitiveness and prepare the next generation of scientists, engineers, and technology leaders.

4-H Science Programs

These existing 4-H opportunities are a natural fit for 4-H Science programming because of their content, duration, and delivery methods:

- AgriScience Curriculum

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- National Youth Science Day/National Science Experiment
- Project Achievement (depending on project)
- Georgia 4-H Environmental Education Program
- Junior Master Gardener
- Garden Earth Naturalist

Many of the following could be 4-H Science Programs if care was given to accomplish items on the attached 4-H Science checklist:

- Judging Contests: Dairy, Forestry, Horse, Land, Livestock, Poultry, Wildlife, & Hippology
- Beef School
- Horse School
- Rivers Alive
- School/Community Gardens
- Day camps
- GPS/GIS work
- Robotics/rocketry
- Appropriate classes at 4-H summer camp
- UGA programs (Young Scholars, Camps, Science Fair, etc.)

Outcomes

The recently released study entitled *Evaluating the 4-H Science Initiative: The 2010 Youth, Engagement, Attitudes and Knowledge Survey Results* concludes that:

> "Taken altogether, the evaluation findings reported indicate that 4-H is indeed implementing its rich and abundant variety of science, engineering and technology programs/activities to 4-H youth successfully. By providing engaging out-of-school programming, 4-H Science programs have the potential to bolster participants' interest in pursuing education and careers in the STEM fields."

To be more specific, when 4-H Science respondents were compared with a national sample:

- 76% of 4th grade 4-H respondents agreed with the statement "I like science" compared with 64% from the national sample
- 74% of 8th grade 4-H respondents agreed with the statement "I like science" compared with 50% from the national sample
- 86% of 12th grade 4-H respondents agreed with the statement "I like science" compared with 31% from the national sample

Additionally, the following information is provided in the report:

- Over 80% of respondents intend to finish college or continue to get more education after college
- 50% of respondents want to pursue a science career
- 71% of 4-H Science participants said science is one of their favorite subjects
- 68% do science-related activities that are not for school work
- 59% would like to have a job related to science when they graduate from school

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4-H Science Checklist

A "SET Ready" 4-H experience is a program that is framed in SET concepts, based on SET standards and intentionally targets the development of SET abilities and the outcome articulated by the 4-H SET Logic Model. Additionally, it integrates the Essential Elements and engages participants in experiential and inquiry based learning. In addition to the following criterion below, it also recommended that SET programs offer a sustained learning experience which offers youth the opportunity to be engaged in programs with relevant frequency and duration. Utilize the following checklist to self assess the program you deliver.

To meet the needs of children, youth and the nation with high-quality science, engineering and technology programs…

☑	**Are you providing science, engineering and technology programs based on National Science Education Standards -** Science education standards are criteria to judge quality: the quality of what young people know and are able to do; the quality of the science programs that provide the opportunity for children and youth to learn science; the quality of science teaching; the quality of the system that supports science leaders and programs; and the quality of assessment practices and policies. **http://www.nap.edu/readingroom/books/nses/**
☑	**Are you providing children and youth opportunities to improve their SET Abilities?** Predict, Hypothesize, Evaluate, State a Problem, Research Problem, Test, Problem Solve Design Solutions, Measure, Collect Data, Draw/Design, Build/Construct, Use Tools, Observe, Communicate, Organize, Infer, Question, Plan Investigation, Summarize/Relate, Invent/Implement Solutions, Interpret/Analyze/Reason, Categorize/Order/Classify, Model/Graph/Use Numbers, Troubleshoot, Redesign, Optimize, Collaborate, Compare
☑	**Are you providing opportunities for youth to experience and improve in the Essential Elements of Positive Youth Development?** Do youth get a chance at **mastery** – addressing and overcoming life challenges in your programs? Do youth cultivate **independence** and an opportunity to see oneself as an active participant in the future? Do youth develop a sense of **belonging** within a positive group? Do youth learn to share a spirit of **generosity** toward others?
☑	**Are learning experiences led by trained, caring adult staff and volunteers acting as mentors, coaches, facilitators and co-learners who operate from a perspective that youth as partners and resources in their own development?**
☑	**Are activities led with an experiential approach to learning?**
☑	**Are activities using inquiry to foster the natural creativity and curiosity of youth?**
☑	**Does your program target one or more of the outcomes on the SET Logic Model and have you considered the frequency and duration necessary for youth to accomplish those outcomes?**

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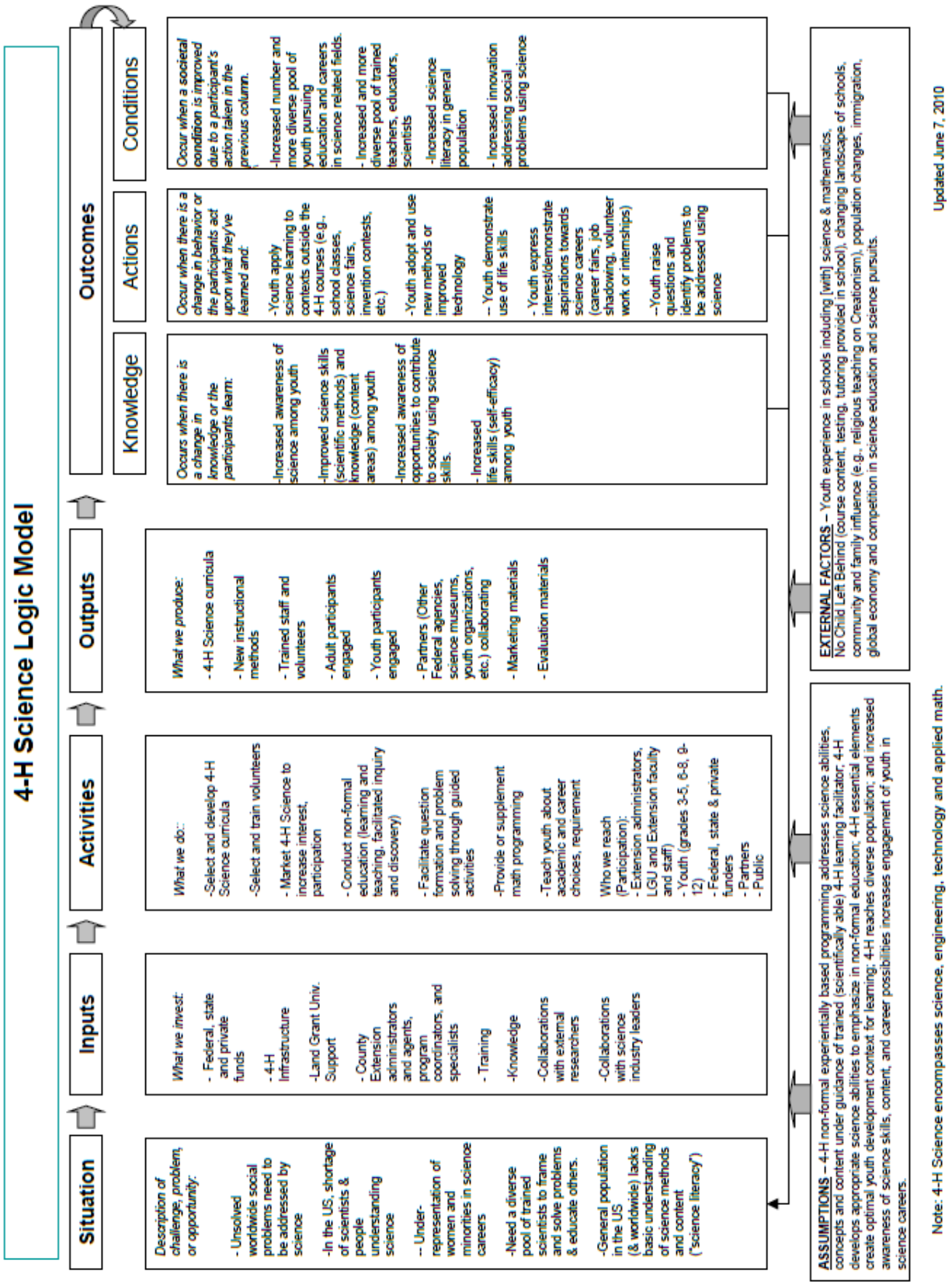

Note: 4-H Science encompasses science, engineering, technology and applied math.

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