A Study of Science Education Projects in the United States-NASA Explorer School's Initiative to Promote Interest in Science-

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- NASA Explorer School's Initiative to Promote Interest in Science-

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Abstract: Over the past 25 years, many reports have pointed out the necessity of reformation and improvement in science, technology, engineering and mathematics (STEM) education in the United States. STEM education is essential to maintain competitiveness in the highly technological and knowledge-based society of today. NASA Explorer Schools (NES) is a program that promotes and supports STEM education. NES is a three-year program that has NASA and school educators and administrator teams work as partners to promote and support STEM education. It was launched in 2003. The program is for classroom grades 4-9. During the three-year program, school teams will create and improve action plans, persist professional development, and involve the students and their families. Studying NES may help indicate how to reform Japan's STEM education system, which is also facing the same issue as the United States.

Background

Over the past 25 years, many reports have pointed out the necessity of reformation and improvement in science, technology, engineering and mathematics (STEM) education in the United States. STEM education is essential to maintain competitiveness in the highly technological and knowledge-based society of today. This issue endangers the future American workforce in the fields of science and engineering. A similar phenomenon is happening in Japan, called "Rika-Banare".

Japan has been facing the problem of "Rika-Banare" (decline of interest in science) for the past three decades. Highly developed countries in science and technology tend to face the problem that science literacy declines. This is because, in highly developed countries, outcomes of science and technology becomes a "Black-box" and difficult to understand the mechanism behind the phenomenon. According to

results of Trends of International Mathematics and Science Study 2003 reported by the International Association for the Evaluation of Educational Achievement(IEA), Japan's results are not significantly low. The critical problem is that more and more students are losing interest in science.

The Ministry of Education and Science of Japan acknowledges this tendency as a significant problem for the society and show great concern. If NASA's attempts to promote interest for science are successful, Japan can learn from the scheme.

NASA's involvement in STEM education

NASA's Office of Education distributes educational material to all levels. Their website provides resources and information to the public, educators and students. Teaching material can be downloaded by educators from their website or given hard copies by attending NASA related programs and workshops for free. The teaching material counts 1460 at the present moment, and clearly shows that the American society has great needs for science education and NASA takes it seriously.[1] The teaching materials are categorized into five levels.

1) K-4

2) 5-8

2) 9-12

4) Higher education

5) Informal education

Each category is divided into twenty sub categories, to match the educator's needs. All educational material is based on NASA's Strategic Plan and has three major educational goals to achieve.

1) Strengthen NASA and the nation's future workforce,

2) Attract and retain students in STEM disciplines,

3) Engage Americans in NASA's mission.

NASA Explorer Schools(NES) is one of NASA's attempt to stop the declining interest in science. This paper focuses on NES.

NASA Explorer Schools

NASA Explorer Schools (NES) is a program that promotes and supports STEM education. NES is a three-year program that has NASA and school educators and administrator teams work as partners to

[1] NASA Office of Education: http://education.nasa.gov/home/index.html, June. 2008

promote and support STEM education. The program targets classroom grades 4-9. During the three-year program, school teams will create and improve action plans, persist professional development, and involve the students and their families. Students and teachers are given opportunities to engage with NASA's rich resources and contents.

The program objectives are as follows:

1) Increase student interest and participation in mathematics, science, technology and geography.

2) Increase student knowledge about careers in mathematics, science, engineering and technology.

3) Increase student ability to apply mathematics, science, technology, and geography concepts and skills in meaningful ways.

4) Increase the active participation and professional growth of educators in science.

5) Increase the academic assistance for and technology use by educators in schools with high populations of under-served students.

6) Increase family involvement in children's learning.

Based on these objectives, NES implements many elements over the three-year period. They provide and focus on student opportunities, special professional development opportunities, family engagement and inspiring hope for students and entire school communities.

Students have opportunities to engage and relate with NASA and learn STEM disciplines through unique methods. Many activities help students see the relevance and involvement of their everyday life with science and mathematics. For example, students can design an experiment, and actually have their teachers' carry out the experiment on NASA's gravity reduced aircraft.

A variety of special professional development opportunities are also provided to the educators and administrators throughout the program. For example, each summer a professional development workshop is held for teachers and administrators to visit one of the nine NASA field centers or the Jet Propulsion Laboratory. It is a one-week training program to learn how to effectively implement NASA content into their schools and classes. NASA covers all expenses. NES educators are also offered scholarships to attend STEM related workshops and conferences.

Family engagement is also considered an important element. Strategies, resources and materials are provided to the families to support their children's science and mathematics studies. NES also helps plan local family events. There have been events such as Family Rocket Workshop, Family NASA Nights, Star Parties, etc.

Inspiring hope is significant for motivating all teachers and students. NES allows schools to access NASA's abundant resources, which normally can only be seen on the newspapers. This unique interaction and experience helps NASA and the schools associate and have students relate to real world science.

The NES program is evaluated by credible sources, and continues to implement improvements based on the evaluations.

Observation and Conclusion

NES is endeavoring to the increase of interest in science and stopping the “Rika-Banare” in the United States. The following elements of NES are playing an important part. Student opportunities, special professional development opportunities, family engagement and inspiring hope. Each are essential to the program.

The element of the promoting and supporting of teacher’s professional development is important. It seems that NES is committed to take the initiative for this role. NES focuses on the enhancement of teacher’s interest and motivation towards science. Where as in Japan, emphasis is put on the developing of teaching skills. The author believes that teachers that attain strong motivation in the STEM disciplines can teach the subject more passionately and positively in the classrooms.

The summer professional development workshop is one example of how to maintain teachers’ interest in science at a high level. Experiencing NASA’s gravity reduced aircraft is a rare experience that helps teachers to have high motivation, and the motivation can be conveyed to students when the teachers return to their schools. It is clear that NES puts emphasis and effort on motivation of teachers.

NES’s promotes the program to effect the entire school. Normally, once the school is chosen as an Explorer School, collaboration among all grades is conducted. The entire school shares the opportunities of science, technology and math during the program. This creates group dynamics among the students. This group dynamics helps produce students with high levels of interest for science. Students interact with each other and a chemical reaction occurs among them, and interest for science grows among students autonomously. It is similar to the effect of peer discussion groups.

Another important element is taking initiative in the involvement of students’ family and community. Recently schools in Japan also recognize the importance of family engagement to help parents understand school activities. But it seems it has not grown as mature as seen in NES. NES’s scheme is designed to promote family’s understanding of what their sons and daughters are doing in school. This understanding help create family support to encourage students’ motivation to seek STEM knowledge and interest.

Finally, NES promotes “Inspiring hope”. In the field of education, there is always the “KAP gap”. Students often encounter the gap between knowledge and practice. This gap is inevitable but hope can help overcome the gap and help find a way to connect knowledge and future practice.

Many facilities and organizations such as museums and planetariums provide various programs to help STEM education, but a three-year program like NES is unique. NES is a complex program with many

unique elements. Implementing the elements of student opportunities, special professional development opportunities, family engagement and inspiring hope is important for preparing an effective learning environment for the teachers, students and families.

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