Work-In-Progress: SUNRISE: Schools, University 'N' (and) Resources In the Sciences and Engineering-A NSF/GMU GK-12 Fellows Project

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Abstract - **This WIP documents the development, implementation efforts, and preliminary results of SUNRISE a unique graduate Fellowship program at George Mason University (GMU) that targets graduate students working in the grade 4-6 school environment. SUNRISE is a new GK-12 project aimed at partnering STEM (Science, Technology, Engineering, and Mathematics) graduate students (Fellows) with elementary and middle school teachers from three different school divisions in Northern Virginia. The expected outcomes and an evaluation plan are also presented. Sponsored by the National Science Foundation (NSF), the project serves as one source of evidence that demonstrates the importance and the process of building partnerships among university's engineering and education departments, and the K-12 education system.**

Index Terms – Elementary and middle school, Evaluation plan, Graduate fellows, Information technology.

INTRODUCTION

"Recent reports of the performance of America's children and youth from both the Third International Mathematics and Science Study (TIMMS) [1-2] and the National Assessment of Educational Progress [3] echo a dismal message of lackluster performance" [4]. For example, TIMMS [2] report quotes "the available data suggest that the performance of U.S. fourth-graders in both mathematics and science was lower in 2003 than in 1995 relative to the 14 other countries that also participated in both studies". According to the National Commission on Mathematics and Science Teaching for the 21st Century, the learning shortfalls are due in part to a shortage of qualified science and math teachers [5]. Furthermore, under the No Child Left Behind (NCLB) act of 2002, policy makers have relegated science to the backburner by directing majority of the resources to reading and mathematics-the first areas to be assessed and reported with adequate yearly progress (AYP) [6-7]. Science is slated for testing only in 2007-2008, and only a few school divisions have started monitoring their competency in science. In the State of Virginia, only 48% of school divisions met the AYP requirement for 2004-05 and 45% in 2006-07 [8].

A National Research Council panel [9] recently issued a report that urges increased cooperation between universities and K-12 schools in teacher education and professional development for teachers of science and mathematics. The NSF Graduate Fellows in K-12 Education (GK-12) program offers a unique opportunity to address this need.

SUNRISE PROJECT

The conceptual focus of the SUNRISE project is to improve outcomes for elementary and middle school students in STEM subjects as identified and driven by the science needs at the schools in the participating school divisions. The objective of this project is to build a unique model of collaboration among elementary and middle schools, school division administration, and GMU to foster systemic efforts in implementing Information Technology (IT) rich STEM content-knowledge into grades 4-6 education by graduate Fellows, with the potential to enhance the delivery of science instruction and provide long term professional development for teachers. This is achieved by constructing a framework that provides training, exchange of information, and integration of scientific research from diverse disciplines with teaching to make science exciting for students. A unique feature of SUNRISE that makes this project different from other GK-12 projects in the nation is that the project is housed in the School of Information Technology and Engineering and is focused on infusing IT rich STEM curricular concepts into K-12 education. Sample IT rich STEM topics include infrared imaging, global positioning systems, oceanography, computer models of weather, acoustics and how sound is used for temperature measurements and navigation in animals. Every effort is made to show computer models and graphics to illustrate the science and engineering concepts. The project's IT theme serves multiple purposes such as motivating teachers to use more technology in the classroom, improving perception of concepts via simulation and graphics, and exciting student's interest in STEM.

IMPLEMENTATION

The implementation started with the recruitment of Fellows and Teachers in 2007. The program supports 8 Fellows from STEM disciplines who are paired one-on-one with 8

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teachers, one pair per school. The schools chosen were those with high percentage of minorities from low socio-economic backgrounds. Fellows come from engineering, physics, mathematics, and biochemistry. 50% of the Fellows are women graduate students. The fellows were given a two month long training program by the project co-PI from the College of Education and Human Development. The training included an understanding of the Virginia State Science Standards of Learning (SOL) [10], preparing and delivering of sample lessons, and discussing general topics on pedagogy particular to elementary school teaching. The Fellows worked out a schedule with the teacher at the Fellow-Teacher meeting just before school reopening in September 2007. The Fellows began their visits to classroom, identified the science needs with the teacher and began contributing to the enrichment of the lessons and discussing the science behind the lessons. The Fellows were introduced to the children as Scientist, Researcher, or an Engineer. Thus, a strong foundation was laid for a long-lasting partnership between the school and the university.

ONGOING ACTIVITIES

One of the key activities of the Fellows is the enrichment of existing curriculum and leading the discussion of the science behind the experiments. The Fellow and the teacher plan the activities a week ahead so that there is sufficient time to enrich and test the lesson before they are presented to the classroom. Another activity consists of bringing lessons from their engineering and science research, and graduate education into K-12 environment. These new lessons are tied to the SOL and the IT theme is emphasized where applicable. Fellows also act as guest lecturers in other science classes who are not participating directly in the SUNRISE project. The Fellows help with field trips, judge science projects, and answer general science questions that are dropped in a question box.

PROJECT EVALUATION AND EXPECTED OUTCOMES

A two-pronged evaluation design is employed to assess the success of the project in meeting its goals and objectives, focusing respectively on: a) *formative evaluation* of training and implementation processes during the first year, with the goal of making refinements and adjustments to procedures in subsequent years of the project; and b) *summative evaluation* of the impact of the project on: i) the University's higher education program and in the development of teaching Fellows; ii) K-12 institutions served in enhancing student performance; and iii) the long-term professional growth of participating Fellows and teachers, beginning in the second year of implementation. The anticipated outcomes of the project, as given in the NSF Request For Proposals, were used as the guiding framework to formulate the specific goals and objectives of SUNRISE against which project outcomes are continuously being evaluated. The evaluation focuses on the benefit of the project to the Fellows' education and development of professional skills, the teachers' growth in content knowledge, the K-12 students' problem solving expertise and attitude toward science, and cultural changes that this project has on the schools and the university. The evaluation also considers the role played by the Fellows' research advisors in the program, and the long-term effects of participation for teachers and Fellows.

The expected outcomes are improved science content knowledge for teachers and K-12 students, improved communication and pedagogical skills for graduate students, and an institutional culture change that transforms K-12 and graduate education. The societal benefit is the sustained growth in quantity and quality of the nation's STEM workforce brought about by this unique school division-university partnership.

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