

1 Introduction

The low achievement in science and mathematics by K-12 students is currently of serious concern to both educators and parents. Not only are there too many students with insufficient skills or knowledge in those areas, but teachers also have limited knowledge in their field or a lack of training to sustain and/or improve their skills.

As reported in *Rural Systemic Initiatives in Science, Mathematics, and Technology Education (RSI)* [1], national tests in science and mathematics achievement indicate a performance gap across regions of the nation. This gap has been attributed to a variety of factors, but is strongly linked with the level of poverty of students and the regions in which they reside. The lack of access to appropriate science and mathematics courses/outside activities in schools severely limits their educational career choices and their ability to be competitive in an increasingly technical workplace. Data show those students in extreme rural or disadvantaged urban areas receive the least exposure to science and mathematics courses.

In 1994, the RSI program was initiated by the National Science Foundation (NSF) to improve K-12 science, mathematics, and technology (SMT) education in *rural, economically disadvantaged regions of the United States*. The overarching goal of the RSI is to significantly improve and stimulate SMT education by implementing system-wide reform focusing on student achievement and a sustainable educational infrastructure. The First Annual Rural Systemic Initiative (RSI) Key Indicator Data Workshop was held in Colorado on June 2002 [2]. Although focusing on school districts in where 30% or more students live in poverty, this program is currently providing amazing results. In the case of Virginia [3], after five years, 94% of catalyst schools are showing improvements in mathematics, science, or both on state assessments.

As stated in the *Raising Standards and Achievement in Urban Schools: Case Stories from CPMSAs in Hamilton/Chattanooga and Newport News Public Schools* report from [4]: *By the early 1990's it was clear that urban schools needed to provide challenging standards-based curricula and instruction. Teachers needed more extensive preparation, and on-going professional development and pedagogy for teaching mathematics and science. Policies needed to be strengthened and implemented to ensure that all students were receiving a rigorous education based on the belief that all children can learn. Systemic educational reform was recognized as a necessary strategy to achieve and sustain these improvements.* A recent study from a sample of 160 urban schools throughout the nation (which included 28 cities) [4] shows improvements in student achievement over the project periods [5]. In this study, average high school student enrollment in gate-keeping and higher-level mathematics courses increased over 41%, and average science enrollments increased in 33%. By 1997-98, algebra I or higher in 8th grade enrollment rates in the school sample were equal to or higher than the national average. Out of the 80 teachers selected for that study, 80-90% were actively involved in professional development.

In summary, it is well established that pre-college mathematics and science education are a local, state, and national concerns. The prevailing achievement gap between majority and minority and/or disadvantaged students demands immediate action. As stated in the *No Child Left Behind Act of 2001* [6], *among the underlying causes for the poor performance of U.S. students in the areas of mathematics and science, three problems must be addressed: too many teachers teaching out-of-field; too few students taking advanced course work; and too few schools offering a challenging curriculum and textbooks.*

The twofold measurable objectives are consequently: (i) raising test scores, lowering gaps between majority and disadvantaged students and developing student interest in mathematics and science; and (ii) improving the pedagogy skills and knowledge of the teachers in these areas so that by 2005-2006, all students will be taught by highly qualified teachers [6].

Two recent surveys focusing on urban schools were conducted nationwide: one on the *Classroom Practices in Mathematics and Science (CPMS)* and the other on the *Comprehensive Partnerships for Mathematics and Science Achievement (CPMSA) Program* [7]. While the former focuses on the teachers' involvement in science and mathematics, the latter focuses on the students' perspective. The results of under-represented minority students and teacher professional development are summarized in Tables 4 and 5 of Appendix C.

The CPMSA focuses on under-represented students in mathematics and science. Although this sample does not include every state, it is sufficiently spread throughout the nation to be a good representation of the actual study. The overall goal of improvement of student involvement was achieved with an increase in mathematics (science) of 43.6% (38.29%) and 56.27% (20.28%) for Cohort93 and Cohort94 ¹, respectively (as shown on Fig. 4 of Appendix C). This indicates the need for similar programs. Among teachers, while 75% were involved in professional development activities in 1998-1999 (mostly were middle school teachers) as low as 63% maintained their participation in high school.

The proposed **K-12 Instructional Development in Science (KIDS)** program will focus on mathematics, physics, chemistry, biology and space and environmental sciences, and will be implemented in selected local high, middle and elementary schools ².

Institutions of higher education (Hampton University [8], Norfolk State University [9], North Carolina A&T University [10], Jackson State University [11], and Fisk University [12]) will provide faculty, staff, undergraduate students and graduate students from their School of Science (i.e, Biology, Chemistry, Mathematics and Physics Departments in addition to the Science Center at Hampton University) to carry out the proposed activities. Faculty members will serve as research project advisors and ensure that the defined goals/objectives are achieved; college students will provide tutoring assistance and science shows.

Selected schools within the Isle of Wight, Norfolk, Greensboro, Jackson, and Nashville school districts will provide the essential ingredients for the program: math and science teachers, who will define guidelines for student research projects. Students will benefit from the program and prove its success. The particular case of Hampton University and the Isle of Wight County School Division [14] will serve as a based model for the *KIDS* program (see Appendix A).

2 Vision, Goals and Outcomes

The *KIDS* program seeks to improve student achievement in high-quality mathematics and science for K-12 students. It will also focus on reducing achievement gaps in mathematics and science education among diverse student sub-groups. To realize this,

¹The two Cohorts listed corresponds to the sites of schools involved in this study.

²See Appendix D for a detailed list of the partners in *KIDS* .

both students and teachers need to receive high quality standards of learning. The goals of the *KIDS* program are:

1. *To significantly enhance the capacity of schools to provide a challenging curriculum for every student, and to encourage more students to participate in and succeed in advanced mathematics and science courses.*
2. *To increase and sustain the quality of K-12 teachers of mathematics and science, especially in under-served areas.*
3. *To contribute to the national capacity to engage in large-scale reform through participation in a network of researchers and practitioners, that will study and evaluate educational experimental approaches to the improvement of the quality of teachers.*
4. *To engage the learning community in the knowledge base being developed among current and future NSF Centers for Learning and Teaching and Science of Learning Centers.*

Goal 1 and Goal 2: The *KIDS* program provides science shows and tutoring sessions by the undergraduate population from the institutions of higher education. In addition, students and teachers from the school districts will participate various pre-existing programs in the nation (see section 3). These activities will not only encourage more students to participate and succeed in advanced mathematics and science courses, but also promote reducing achievement gaps in mathematics and science education among diverse student sub-groups. These activities provide the tools to increase and sustain the quality of K-12 teachers in mathematics and science. In particular, a two-weeks of research/study with advisors on the campuses of the institutions of higher education during the summer will be used to investigate implementations of new hands-on activities in classrooms for providing challenging curriculum. Also, as discussed in section 3, teachers will receive re-certification points and graduate credits from school districts which will be used to renew teaching licenses.

Goal 3: The addition of four new institutions of higher education in the second year of the funding is the first step towards the vision of implementing this program throughout the nation. The *KIDS* program, by its nature, provides a network of researchers and practitioners. Two-weeks of on-campus research and teacher specific programs will: (i) provide new hands-on experiences for teachers, (ii) provide a ground for learning newly discovered concepts in science and mathematics, and (iii) establish new experimental approaches to improve the quality of the teachers in mathematics and sciences.

Goal 4: Most of the institutions of higher education involved in the *KIDS* program have NSF funded research centers with one component dedicated to learning and teaching (COSM [15] at Hampton University, STARGE [16] at Jackson State University, for example).

The proposed *KIDS* program will be implemented in six (6) years, the first year serving as a pilot year (funding is not requested for it) as summarized in Table 1. The yearly population increase of students, teachers and schools is depicted in Fig. 1.

In the particular case of the IWCS district (which acts as a pilot to infuse the proposed activity), where the total number of schools is eight, the selection of the schools is as follows:

First year one elementary school, one middle school and one high-school

Activity	Pre Year (2002-2003)	First Year (2003-2004)	Second Year (2004-2005)	Third Year (2005-2006)	Forth Year (2006-2007)	Fifth Year (2007-2008)
Schools	2 09/02	3 09/03	11 09/04	15 09/05	20 09/06	20 09/07
Students	20 09/02	5,000 09/03	15,000 09/04	15,000 09/05	15,000 09/06	15,000 09/07
Teachers	2 09/02	250 08/03	750 08/04	750 08/05	750 08/06	750 08/07
Faculty	9 09/02	8 08/03	25 08/04	30 08/05	40 08/06	50 08/07
Projects	20 09/02	60 08/03	250 08/04	300 08/05	400 08/06	500 08/07
Meeting	04/02	04/03	04/04	04/05	04/06	04/07

Table 1: Overview of the pilot year and five years of the *KIDS* program. The first three rows list the number of schools, the population of students and teachers projected to be involved from school districts. The fourth row includes the personnel from institutions of higher education. The fifth row corresponds to the number of research projects for the dedicated *KIDS* meeting.

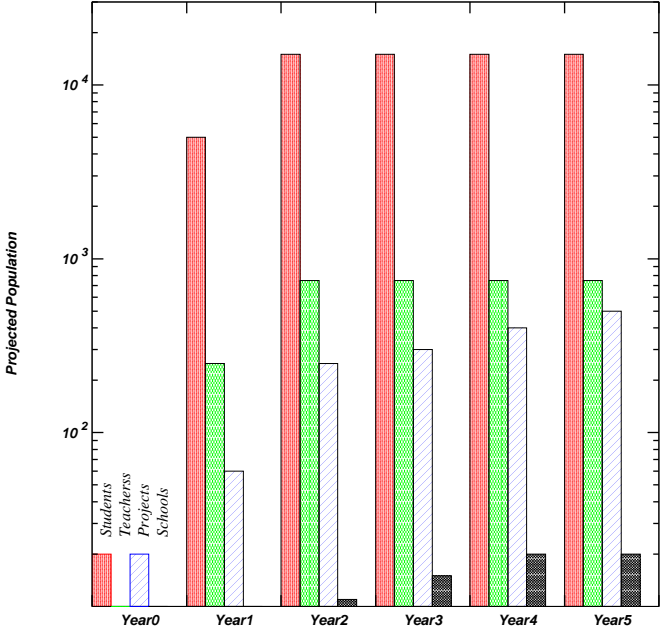


Figure 1: The yearly projected population increase of students, teachers and schools in the *KIDS* program in semi-logarithmic scale.

Second year addition of one elementary school and one middle school

Third year addition of one high school

Fourth year addition of two elementary schools

Fifth year increase the number of students by 25% from all eight schools

For each of the four other universities/school districts partners added from the second year, only half of the students, teachers and advisors population (with respect to the first year) will be annually implemented into the program.

Faculty from the institutions of higher education will visit selected schools on a regular basis to ensure appropriate guidance and advancement of research projects. Meetings between advisors and teachers will occur during those visits. The number of meetings

will depend on the availability of those involved. The faculty personnel of the institutions of higher education will also include postdocs and graduate students; regular rotations of the university faculty and staff will ensure maintaining low loads. The research projects will be conducted on local school campuses and will be implemented after school hours at a rate of 4 hours per month. The teachers will be the primary supervisors of the students.

Each year some projects will be selected for a *KIDS* meeting and will be divided into two groups: 50% will be oral presentations, and 50% will be poster sessions (or science boards). The audience for this meeting will primarily consists of other pre-college students and parents. A Selection Committee (chosen by the Organizing Committee) will be in charge of reviewing all the projects from all the partners involved in *KIDS* and will perform the partition. All grades must be represented (when possible), i.e., elementary, middle and high school students must be present at the *KIDS* meeting. Since the number of projects increases each calendar year, competition between the students will become more stringent and will raise the standards for high quality work. The location of the *KIDS* meeting will be on the campus of Hampton University the first year and could be changed to other venues in the future.

While in the first year only four (4) committee members are needed³, forty (40) committee members must be selected at the end of the program due to the student population size (Table 2). In this way, sub-division of the presentations can be performed (i.e., parallel sessions). This table was obtained by allotting 10 minutes per student for an oral

	Year0	Year1	Year 2	Year3	Year4	Year5
Judges	2	4	10+15	12+18	14+21	16+24
Total Students	20	60	250	300	400	500
Oral/Poster Sessions	10	30	125	150	200	250
Parallel Sessions	0	2	5	10	10	10
Oral Session (hours)	1.67	2.50	4.17	2.50	3.33	5.00
# Days	1	1	1	1	1	1

Table 2: The projected yearly *KIDS* meeting organization.

presentation. Consequently, a one-day meeting is possible. Note that postdocs and graduate students will be involved as committee members for the *KIDS* meeting to ensure proper manpower.

For the proposed project, the HU Science Center will provide major support in the coordination of science, mathematics, and technology experiences for K-12 teachers and students from school divisions in and around the Tidewater Region of Virginia, as well as out-of-state school divisions that will participate. The Center will contribute in overseeing the identification and/or development of curriculum materials suitable for the population being served. Where possible, the science, mathematics, and technology lessons will be aligned with the various types of pure science research being conducted within the HU School of Science, especially the Physics Department. By having major portion of the proposed projects being coordinated by the Science Center, continuity in the conduct of project activities can be maintained as the various faculty and students participants transition.

All collaborators will work closely with the project’s external evaluator and several

³This number assumes two (2) members per parallel session.

advisory boards so that the quality of what is being conducted can be of the highest. They will also actively participate in the dissemination of information about the project at local, state and national professional meetings so that our efforts might serve as a model for others.

The Science Center has an extensive history in developing and implementing enrichment programs for students ranging from pre-schools to college level and even extending to Elderhostel participants through its director. Variety of ongoing connections of the Science Center to nationally recognized science education organizations such as the Lawrence Hall of Science of the University of California at Berkeley, the Woodrow Wilson Institute based at Princeton University, the National Science Resource Center of the Smithsonian Institution, and several informal education institutions in Virginia would be possible. Association with these organizations will allow participants in the *KIDS* program to both benefit from and contribute to ongoing successful science education initiatives.

3 Action Plan

This section describes how the partnership between the institutions of higher education and the local school districts will be done under the *KIDS* program described in this proposal. The particular case of Hampton University and the Isle Of Wight County School Division will be emphasized to serve as a model for interaction of proposed activities between the other institutions and their school districts. A schematic overview of the *KIDS* program is shown in Fig. 2.

3.1 Review Committees

This proposal has established an External Advisory Committee and an Internal Review Committee to ensure annual reviews of the program.

The External Advisory Committee (EAC) will review the program each year preferentially between the month of September and the the month of April. This summative review will primarily consist of ensuring that the goals of the program are met, and will provide critiques and suggestions for its improvement and/or optimization. The Internal Review Committee (IRC) will also review the program on a yearly basis; however it will be scheduled at least three (3) months prior to the EAC. The IRC members listed above only review the Hampton University/Isle Of Wight County specific part of *KIDS* . Each of the other institutions will provide its respective members for their (local) IRC. The task of the IRC is to provide a formative review, i.e., more practical suggestions since, being local by its nature, the reviewers have specific information concerning the needs and possibilities of the main stake-holders, the institutions of higher education and the school divisions involved in this program. The suggestions made by the IRC will be implemented before the EAC review.

3.2 Role of the Institutions of Higher Education

3.2.1 Leading Institution: Hampton University

The faculty members of the Physics Department and Science Center at Hampton University will provide projects and supervision, as well as postdoctoral fellows, graduate and

K-12 Instructional Development in Science (KIDS)

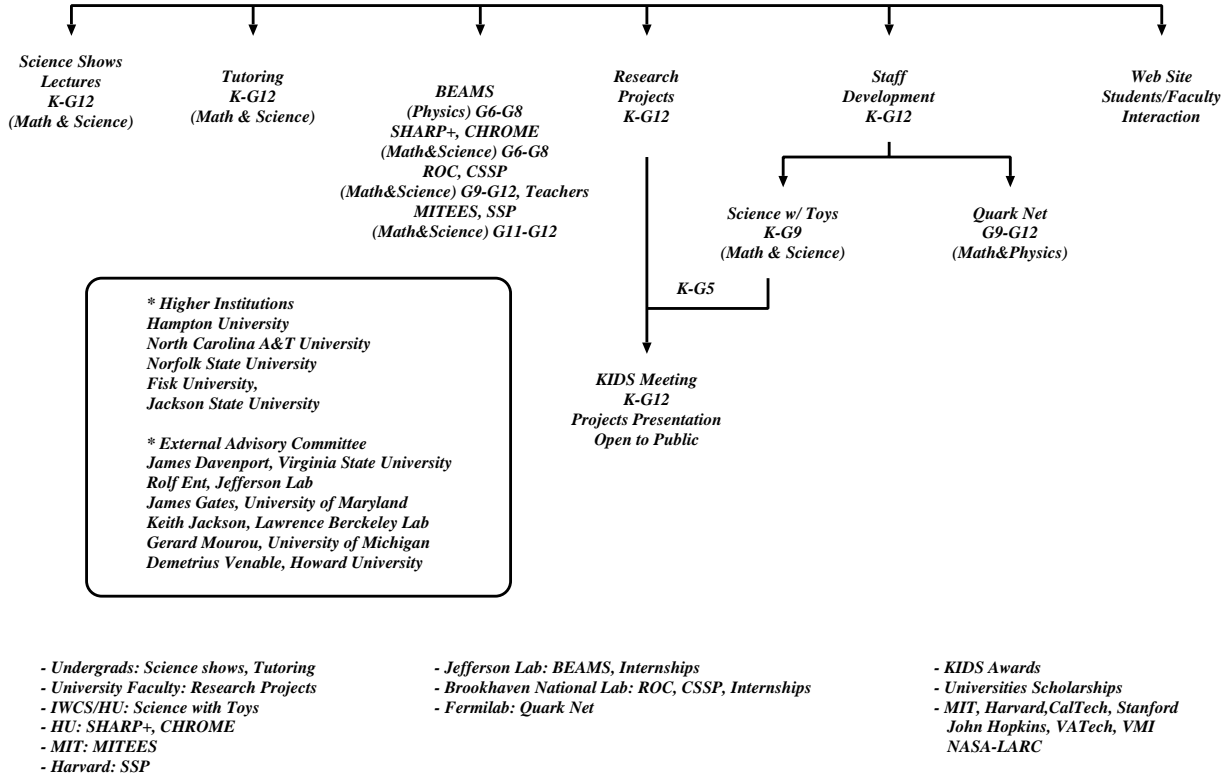


Figure 2: Schematic overview of the *KIDS* program. The grades targeted are indicated in parenthesis for each activity.

undergraduate students (see Table 3)⁵.

Prior to receiving funding for the proposed activity, a sample of schools and teachers from Isle Of Wight County will be selected along with few advisors from Hampton University to pilot the program. This *Pre-Year* or test year will be primarily dedicated to understanding the structure needed for implementing such an activity. Very crucial information will be gathered and valuable experience will be gained from this year to ensure success of the *KIDS* program. Funding for this test year will be provided by the Physics Department through: the Center for the Origin and Structure of Matter (COSM) [15], the Center for Advanced Medical Instrumentation [29], and various additional funds from the fusion, material and optical research groups. More than 90% of the entire Physics Department faculty is involved in some degrees of funding for this pilot year. Therefore, no funding is requested from NSF for this year. In the *Second Year* (Year1 of NSF funding), only the Isle Of Wight County and Hampton University will be involved in *KIDS*, but now at full capacity. From the *Third Year* (Year2 of NSF funding), four new Universities and school districts will be added.

⁵Note: Faculty members will rotate within the Physics Department and Science Center.

External Advisory Committee (EAC)	
Dr. Demetrius Venable	Physics Department chair, Howard University dvenable@howard.edu (202) 806-6245
Dr. Gérard Mourou	Engineering Department, CUOS Director, University of Michigan mourou@eecs.umich.edu (734) 763-4877
Dr. Keith Jackson	Materials Sciences Division, Lawrence Berkeley Lab khjackson@lbl.gov (510) 486-6894
Dr. Rolf Ent	Hall C leader, Jefferson lab ent@jlab.org (757) 269-7373
Dr. James Gates	Physics Department, Maryland University gatess@wam.umd.edu (301) 405-6025
Dr. James Davenport	Chemistry & Physics Department, Virginia State University jdavenpo@vsu.edu (804) 524-5438
Hampton University/Isle of Wight County Internal Review Committee (IRC)	
Dr. Harold Marioneaux	Interim Dean of the School of Science, Hampton University harold.marioneaux@hamptonu.edu (757) 727-5255
Dr. Donald Lyons	Physics & Engineering Departments, Hampton University donald.lyons@hamptonu.edu ⁴ (757) 727-5923
Ms. Harriet Jaworowski	Coordinator of Instruction, Isle Of Wight County School District hjaworow@iwcs.k12.va.us (757) 357-0716
Ms. Elisabeth Fuller	Grant Administrator, Isle Of Wight County School District efuller@iwcs.k12.va.us (757) 357-0747

HU Faculty	Department	# Projects
Dr. P. Guèye	Physics	2
Dr. K. Maung Maung	Physics	2
Dr. O. K. Baker	Physics	2
Dr. A. Bowman	Biology/Science Center	3
Dr. Kewesi Ewur	Chemistry	2
Dr. Grace Ndip	Chemistry	2
Ms. Cynthia Blackburn	Mathematics	2
Mr. Michael Druitt	Biology	2
Dr. A. Uzzle	Physics	1

Table 3: The Hampton University Faculty members involved in *KIDS* . The names listed above are only for the first years of the program (Year0 and Year1).

A total of twenty projects will be proposed in Year0. Starting in Year1, each proposed project will have three sub-projects. For example, in Year1 the program will permit allocation of sixty projects for sixty students. The list of projects will be decided during

the summer and proposed to the schools by August of each year. These projects have to be approved by both the institution of higher education and the school district. For the following years, the number of proposed projects will increase until it reaches a maximum of 10/advisors in the fifth year⁶ (see section 2).

Regular meetings with teachers and students will be held throughout the year until the date of the annual *KIDS* meeting at which the research projects will be presented as oral and poster sessions. An Organizing Committee (OC) and Selection Committee (SC) will be responsible for the organization of the meeting and selection of the projects. The OC will be selected by the *KIDS* board (see section 5). The SC will be nominated by the OC. Both OC and SC have to include members from the institutions of higher education and the local school districts (for example, Hampton University and IWCS for Year0 and Year1).

a) Student specific: In addition to research projects, the program will implement lecturers at the schools from the university faculty members. These lecturers have the primary goal of identifying potential careers in science and providing role models for students. Each faculty member is required to give one lecture in a month between the month of September and April.

The already established *physics shows* at Hampton University⁷ by the undergraduate students of the HU Physics Department will be reinforced to strengthen the *KIDS* program at IWCS schools at a rate of three shows per year. Typically, about six shows per year are performed (funding is provided by the Physics Department). These shows maintain the interest and excitement of the students in science, especially in physics. After school tutoring assistance already exists in the Physics Department at Hampton University and is primarily done by the undergraduate population. This assistance will be expanded by including Isle Of Wight County . A 0.5 credit will be given to these students as part of their research course. Regular rotations will be performed to permit time for their normal studies.

The BEAMS (Becoming Enthusiastic About Math and Science) program at Jefferson Lab [19] will include 100 students (50/week for two weeks) from IWCS in the first years (starting in Year0). This program was established in 1991 at Jefferson Lab [18] and primarily targets sixth through eighth grade students (i.e., middle schools). Its main objectives are: (i) to redress the problem that minorities and females are lost from science, mathematics, engineering, and technology career pipeline long before they reach college, (ii) to strengthen the motivation and academic preparation of students so they graduate from high school as scientifically literate citizens ready for further education or worthwhile careers, (iii) to motivate students to continue learning, and (iv) to provide teachers with activities based on the science and technology at Jefferson Lab. The student population will be adequately modified in successive years.

Additional opportunities to students will allow them to attend other pre-existing nationwide pre-college programs⁸:

- ROC and CSSP at BNL [23]: the RHIC Online Classroom (ROC) is an interactive online activity that allows students (and teachers) to construct an experiment by

⁶Note that advisors are assisted by their undergraduate and graduate students.

⁷The *physics shows* consists of physics demonstrations performed by undergraduate students. They are routinely done at local schools in Hampton, Newport News, . . . and provide exposure of physics to pre-college students.

⁸All of the pre-existing programs listed in the document are called *KIDS special programs*.

solving problems. The Community Science Program (CSSP) is a six weeks summer research program.

- The Minority Introduction to Engineering, Entrepreneurship and Science (MITE2S) [24] program, at MIT [25] and the Secondary School Program (SSP) at Harvard [26] provide challenging freshman classes to juniors and seniors high school students⁹.

Five (5) students from each school division will be selected to attend those special programs.

Full scholarships in the Physics Department at Hampton University will be given to outstanding high-school students in physics from IWCS from both secondary schools in the county in order to attract them to the undergraduate physics program at Hampton University. They are provided by the Center for the Origin and Study of Matter (COSM) [15], the Center for Advanced Medical Instrumentation (CAMI) [29], and the Center for Atmospheric Science (CAS) [30]. For other science subjects, other scholarships and financial support are provided by the Chemistry Department [31] and the School of Science [32]. If any of these students decide to attend another college, the scholarships will be offered to the next best students. In addition, summer internship scholarships awards will be given by the HU Science Center for mathematics and other science subjects, and include middle and high school students. For elementary schools, winning prizes will be given to recognize their effort and maintain their interest in math and science. To open possibilities to the *cream of the crop* students, *KIDS* awards of \$3,000/year for their bachelor degree will be given to five (5) students selected within all of the school districts involved in *KIDS* to attend colleges like MIT, Harvard, CalTech . . . Lastly, support from NASA/LARC [34] through university grants will permit students to access colleges in the nation¹⁰.

The severe need in mathematics reinforcement encountered by IWCS students (see section A) will shape the research projects from Hampton University to have an emphasis on mathematics. Research projects, by definition, help in the understanding of abstract mathematical concepts by providing real life examples to students. By covering all of the subjects taught in classrooms in mathematics and science, *KIDS* will allow better understanding of both advanced and non-advanced mathematics through analysis and treatment of the data, and reasoning during the research projects.

Lastly, both Jefferson Lab [19] and Brookhaven National Lab [23] have provided dedicated summer internships for two (one for each) high-school students from *KIDS* .

b) Teachers specific: To prepare teachers and strengthen the physics course and curricula at these schools, the *KIDS* program will place two teachers in part of the Quark Net summer program each year. Established in 1999, Quark Net [20] offers teachers research experience in high-energy physics and opportunities to evolve their teaching to a more student-centered mode of instruction. Teachers join Quark Net centers associated with high-energy physics research groups at local colleges, universities and laboratories throughout the nation. Teachers, with the help of local mentor-physicists, take part in

⁹Special recommendations to those students will be made from the *KIDS* board to attend MITE2S and SSP; but they will still need to follow the appropriate procedures for entering the programs.

¹⁰For the particular case of NASA/LARC, grants with this agency could be increased to allow support of students from *KIDS* .

the construction and testing of detector components, create data sets and develop online experiments for students and help develop classroom detectors.

Two teachers from the *KIDS* program will attend a four-week summer staff development program. They will spend two weeks with Quark Net, one week at the Fermilab [21] staff development workshop and one week at the Hampton University [8] Quark Net follow-on program. The remaining two weeks will be allocated to discuss/implement mathematics and physics subjects, and hands-on activities to match the needs and levels that students are expected to achieve upon completion of their K-12 education. This will provide adequate training to attend colleges like Hampton University, and potentially to pursue major in mathematics and sciences. In particular, research projects for the *KIDS* meeting will be tested thoroughly by both advisors and teachers using students from other K-12 programs (i.e., SHARP, CHROME . . . at Hampton University which already partner with the Physics Department and the Science Center). Note that all teachers available at that time would be able to participate in these two-weeks of training (it is not limited to the two teachers selected for the Quark Net program).

Teachers are not only involved in the BEAMS program [18] at Jefferson Lab, but also in the *KIDS* Science with Toys (KST) [28] program (see Appendix F) which is a dedicated elementary and middle school teachers summer program built from the *Teaching Science with Toys* developed at the Miami University in Ohio [33]. This program is offered by the Isle Of Wight County [14] and Hampton University [8] partnership. Four (4) teachers per year from each of the school districts involved in *KIDS* will attend this program. Finally, the ROC and the Laboratory Science Teacher Professional Development (LSTPD) programs at BNL [23] will have participation of two (2) teachers from *KIDS* ; the latter being a six week program on BNL site. All teachers from IWCS participating in *KIDS* will get recertification points for their participation, in addition to graduate credit points (see below).

3.2.2 Sub-awards Institutions

All of the activities listed above which apply to Hampton University and Isle Of Wight County will be investigated and adapted for implementation at other institutions sub-awarded through *KIDS* . As stated in section 2, only half of the population of teachers and students is anticipated to be part of the sub-awarded partnerships.

3.3 School District's Role

3.3.1 Leading division: Isle Of Wight County School Division

The Isle Of Wight County school division will provide both the students and the professional staff to work with Hampton University students and staff in the *KIDS* program. Office space will also be provided for the *KIDS* administration so that an operating base for the program can be established on site. Teachers who participate in the project will be granted recertification points, subject to approval from principals. Virginia licensing provides a number of options under which professionally certified staff can renew their licenses within a five-year period (180 points are required within each five-year period). Teachers who engage in training and instructional activities outside of contracted teaching time can receive points. The partnership with Hampton University will also allow

teachers to get graduate credit points. Registration to one of the 500 level courses gives a 3 credit hours points that will be used for that purpose.

IWCS communities will also provide a forum for school-university-parent interface. As parents understand the goals of the program and are able to observe the activities which involve their children, greater support for education will result. The perspective of parents can help strengthen the program to meet unique community needs.

As we expect that this program can serve as a model for other university-school division partnerships across the nation to engage in similar programs, the Isle Of Wight County School Division will share results with other educators. We expect that there will be both modifications and refinements over the course of time, and that experience will help others avoid pitfalls and maximize benefits to students.

3.3.2 Sub-award divisions

Implementation of the *KIDS* program in Norfolk, Greensboro, Jackson, and Nashville will use the expertise of the Isle Of Wight County School Division gained within the first years of the program to suitably implement activities within their schools.

3.4 Data sharing

To provide an efficient way of uniform distribution across all of the partners involved in *KIDS*, as well as establishing a uniform database and student support, a (temporary) web page has been created [36].

Students registered in *KIDS* will be tracked throughout their education, even after leaving high-school to monitor the efficiency of the program. A uniform personal data sheet will be provided in this way, as well as data for each partner.

A network will be established among the partners so that resources can be easily accessible through internet, i.e., analog to a virtual grid network where all computers part of *KIDS* will have the possibility of viewing all *KIDS* data from all computers. This availability to all *KIDS* partners will establish a very efficient way of communication.

A special email account has also been created for students: any question that students may have can be asked through this account which can be answered by faculty and staff from all of the higher education institutions. A regular rotating list of personnel from the institutions of higher education will be maintained to provide students with direct contact information if needed.

3.5 Timeline

KIDS will be implemented within the partnerships as outlined in Table 16 of Appendix H.

4 Results from Prior NSF Funding

As stated in previous sections, a planning year will be held in 2002-2003 to establish the infrastructure for the *KIDS* program. Seed money comes from the Physics Department at Hampton University through various centers and research groups: the Center for the

Origin and Structure of Matter (COSM) [15], the Center for Advanced medical Instrumentation [29], fusion, material and optical groups . . . and no funding is requested for this year.

A sample of students (20) and teachers (2) will be selected form Isle Of Wight County for this pilot year. Students will be participating in the BEAMS program and teachers in Quark Net. The starting date for this pilot year is January 2003. Preliminary results from this pilot year will be disseminated throughout the partnership members for learning purposes.

5 Partnership Management/Governance Plan

The administration organization of the *KIDS* program is outlined in Fig. 3.

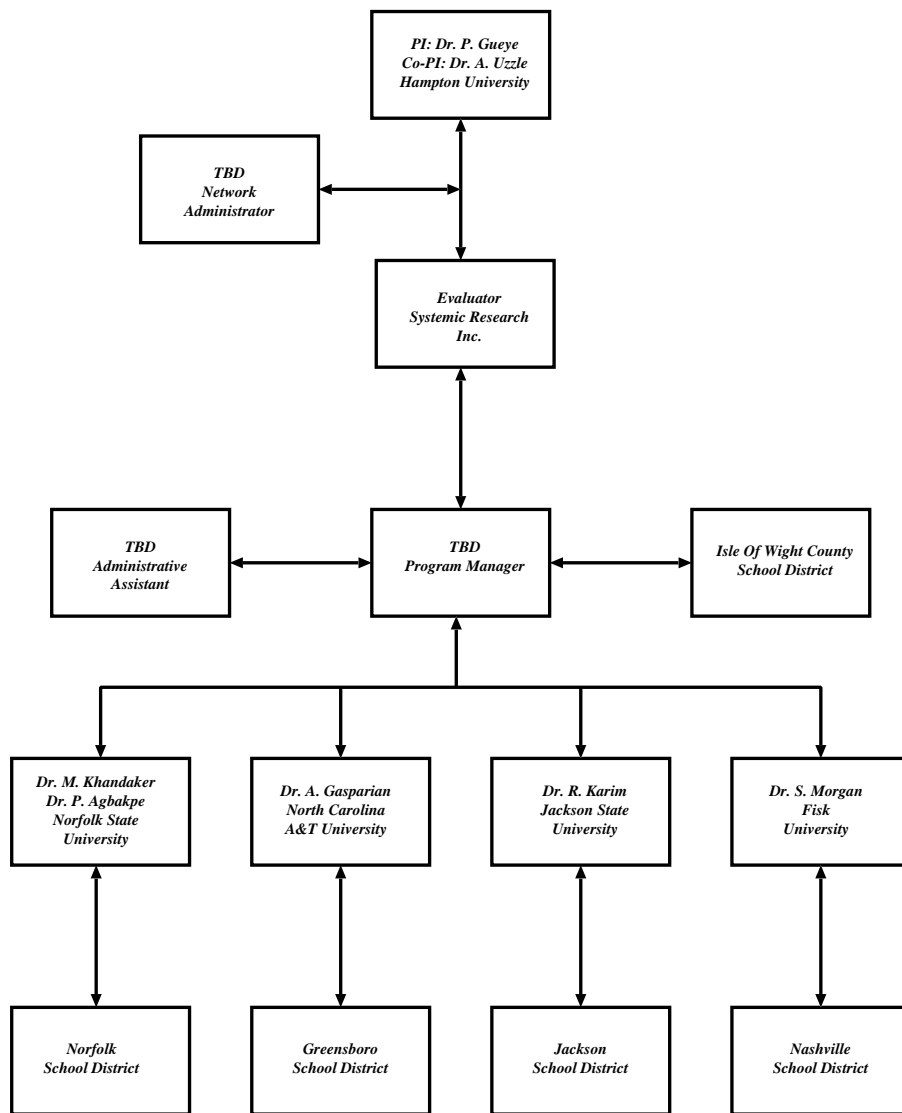


Figure 3: The *KIDS* program organizational chart.

Dr. Guèye (PI) and Dr. A Uzzle (co-PI) will be overseeing the *KIDS* program, and will ensure that goals and objectives outlined in the present document are achieved. These persons will be responsible for maintaining appropriate data collection to justify and support the evaluation of the program, and for reporting to the National Science Foundation (NSF).

Data will be collected for the program, analyzed, and presented in appropriate format by a project evaluator chosen to be Systemic Research Inc. [35], which has precedent in providing adequate quantitative and qualitative information for such endeavor to the funding agency.

A program manager will be hired for the *KIDS* program to assist in the overall management of the program. This person will provide assistance to the PI and co-PI with annual reports, budget management, and coordination with other institutions and school districts (among others) for the *KIDS* program. For the particular case of IWCS, a support for the administration of the *KIDS* program will be provided by hiring a program manager specific to the work related to this school district. The personnel from IWCS involved in *KIDS* will be working in a very close relationship with the PI and co-PI in order to advance the program.

An administrative assistant will be hired the third year of the program to assist the PI, co-PI and program manager. Primary responsibilities will include secretarial and travel-related work, as well as assisting in the planning of the *KIDS* meeting.

A network administrator will be hired to establish and manage the network between all partners, supervise all personnel accounts under the *KIDS* database, and maintain the *KIDS* web page.

The sub-award institutions will replicate the Hampton University/Isle of Wight County partnership in their local areas. They will have similar persons who will be hired to work on this program¹¹

A *KIDS* board associated with the program will be formed and will consist of:

- Dr. P. Guèye (PI) and Dr. A. Uzzle (co-PI)
- A representative from the Isle Of Wight County
- A representative of the teachers from the Isle Of Wight County
- One representative from each sub-award partnerships
- A representative from the project evaluator,

The *KIDS* board will meet regularly throughout the year primarily for evaluation and assessments of the *KIDS* program.

6 Evaluation Plan

Systemic Research, Inc. a corporation with principal offices in Norwood, MA, will provide evaluation services to Hampton University's *KIDS* program, for the five year program period beginning in SY 2003-2004. Both formative and summative evaluation instruments will be developed and implemented focusing on the objectives and goals of *KIDS* and

¹¹It is left to the partners (institutions of higher education and their local school districts) to establish the appropriate structure for that matter.

their impact on participating K-12 students, teachers, school districts, and faculty, undergraduate students, and institutions. The proposed evaluation will explore how the infrastructure and dynamics of stake-holder partnerships will improve student achievement, increase the number and diversity of teachers and their quality, enhance mathematics and science curricula, and change institutional cultures for sustained nation-wide educational reform.

6.1 Evaluation framework

An evaluation framework will be developed based on the overarching goals of the MSP program, and the specific goals of the *KIDS* program. Five evaluation questions have been formulated to guide the evaluation process:

1. Has the *KIDS* program resulted in more students enrolling in, and successfully completing advanced mathematics and science courses ?
2. Has the gap between underrepresented and majority student subgroups of students enrolling in, and successfully completing advanced mathematics and science courses been narrowed ?
3. How many students have received tutoring from undergraduate students; what has the impact of this tutoring been ?
4. How many students and teachers have participated in the *KIDS* special programs; how many recertification points have teachers received. Has the *KIDS* program contributed to improving the quality of the K-12 mathematics and science teaching force in the targeted districts ?
5. Has the *KIDS* program resulted in the increase of hands-on activities being incorporated into the classroom resulting in a more challenging curriculum being implemented ?

6.2 Evaluation Instruments and Data Collection

Evaluation instruments will be designed to collect the quantitative and qualitative data necessary to assess the program. These will include:

- MSP Key Indicator Data System (MKIDS) 1 (quantitative) and 2 (qualitative)
- Academic Data Collection System (ADCS), an activity database
- Student Progress Monitoring System (SPMS), a longitudinal student progress database
- Student, teacher, and faculty surveys and evaluation forms

The MSP Key Indicator Database (MSKID) will collect both quantitative and qualitative data elements identified in the evaluation framework. Annual student outcome data and teacher data will be collected from both school system and partner entities using MSKID. Student outcome data will be disaggregated by race/ethnicity, gender, socio-economic, and disability status, including both number of students and percentage of total student population. Major student outcome data will be collected and analyzed from participating schools and control schools (schools in the districts not participating in the *KIDS* program and/or previous years data), including:

- Norm and/or criterion referenced assessment test results;
- Enrollment in and completion of gate-keeping and advanced mathematics and science classes;
- Number of high school graduates proficient in STEM (defined as those who completed a minimum of pre-calculus, biology, physics and/or chemistry courses);
- Number of high school graduates matriculating into college;
- Number of students participating in science projects and *KIDS* special programs.

K-12 teacher data will be disaggregated by race/ethnicity, gender, disability status, age group, subject and grade level taught, college major and highest degree held. Examples of quantitative teacher data are:

- Teacher demographics by race/ethnicity, gender, disability status, age group, subject and grade level taught;
- Data regarding new teachers, alternative program, induction, pre-service and in-service;
- Certification in mathematics and science;
- Out-of-field teaching;
- Teacher participation in professional development and *KIDS* special programs

Two database software programs developed by Systemic research, Academic Data Collection System (ADCS), designed to collect activity data, and Student Progress Monitoring System (SPMS), a longitudinal student progress database, will be customized for the **K-12 Instructional Development in Science** program.

An evaluation team from Systemic Research will attend the annual *KIDS* meetings and will conduct an annual site visit¹² to participating higher education institution and school district partnerships. Systemic Research will analyze the collected data in the context of project goals. Annual formative evaluations will be conducted to assist *KIDS* staff in making any needed strategy changes. An annual evaluation report will be submitted to Hampton University.

6.3 Evaluation team

Systemic Research has accumulated a significant amount of knowledge-base on mathematics and science educational reform through K-12 evaluative studies on the three NSF systemic initiative programs – Urban Systemic Initiative (USI), Comprehensive partnerships for Mathematics and Science Achievement (CPMSA), and Rural Systemic Initiatives (RSI) – during the last four years. The various reform key indicator instruments and performance rubrics developed for these three studies are readily adaptable to the conceptual framework of the proposed evaluation of the *KIDS* program. The evaluation team gained knowledge of the critical role of partnerships in educational reform through site visits and interviews with participants in all three studies. Systemic research also has been

¹²This site visit is independent of the two annual reviews from the EAC and IRC.

working with numerous higher education institutions funded by three NSF undergraduate programs: Model institutions for Excellence (MIE), Historically Black Universities and Colleges Undergraduate Program (HBCU-UP), and Tribal Colleges and Universities Program (TCUP).

The evaluation team will consist of:

- Dr. Jason Kim: President of Systemic Research, PI for the evaluation
- Mrs. Linda Crasco: Executive Director of Systemic Research, Project Director for the evaluation
- A Project Manager
- A Research Associate
- A Research Assistant

7 Institutional Change and Sustainability

As listed in the budget table (Appendix I), the leading institution, Hampton University, will provide matching funds for the PI of this proposal, Dr. Paul Guÿe, to ensure continuity of this project. As for the pilot year (Year0 in this document), all the faculty in the Physics Department at Hampton University will provide a level of funding for the *KIDS* program, pending on approval/renewal of their research grants.

In section 3, information regarding provision of office space by the leading school district, Isle Of Wight County ,was mentioned. This space will be primarily for the *KIDS* administration so that an operating base for the program can be established on site.

Each sub-award institution will be hiring one personnel whose responsibility will be to ensure the good involvement of *KIDS* in their respective area. Those person are expected to be fully or partly supported by the university/school district after the first period of funding.

Finally, continuity of the program after the five-year proposed activity will be ensured through funds from the institutions of higher education, schools districts, government agencies (NSF, DOE and others), government laboratories, and private organizations. Ongoing discussions are currently being made on that matter.

8 Budget

The yearly budget for the five year program is attached as a separate file to this document. A detail explanation of the budget can be found in Appendix I.

Continuity of the program after the five-years proposed activity will be ensured through funds from the institutions of higher education, schools districts, government agencies (NSF and others), government laboratories, and private organizations. Ongoing discussions are currently being made on that matter. For the particular case of the Physics Department at Hampton University, each faculty having a research grant will provide a level of funding for *KIDS* .

9 Conclusion

Funding of \$24,629,700 is requested to establish partnerships between the institutions of higher education (Hampton University, Norfolk State University, North Carolina A&T University, Fisk University, and Jackson State University) and school districts (Isle Of Wight County , Norfolk, Greensboro, Nashville, and Jackson).

The present document conveys the main objectives of a proposed **K-12 Instructional Development in Science (KIDS)** program which are: (1) to enrich science education for K-12 students in a way that will encourage them to pursue a career in science; (2) to promote and implement a stronger involvement in science by institutions of higher education in local schools to help prepare students for the Standards of Learning tests; (3) to provide an opportunity for K-12 students to present their science projects at a specially devoted meeting modeled after the American Physical Society (APS) meetings; and (4) to provide teachers in mathematics and science appropriate professional development in an enrich science and math environment.