UAB Grand Challenge: ***Successfully Transitioning Education Momentum in Schools***

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In a recent Pew Report on "Public and Scientists' Views on Science and Society," the general public and scientists agreed that science, technology, engineering and math (STEM) will play a critical role in the future of the U.S. economy, and that U.S. STEM education falls far short of that in many U.S. competitors, thus putting the U.S. at considerable future economic risk. There is optimism that new STEM education standards (the Next Generation Science Standards (NGSS) and Common Core) will improve the competitiveness of U.S. students;[1] however, the novelty and complexity of the new integrative standards pose a great challenge to U.S. K-12 teachers, who must successfully transition from teaching primarily individual facts to integrated concepts learned via inquiry and discovery. The question is where to start any intervention? STEMS focuses on facilitating the successful transition from elementary to middle school science, and then bridging students to high school and college and finally to productive careers. Young children are inherently inquisitive and throughout K-5, students are largely allowed freedom to explore science; however, once they transition to middle school, their interest learning, especially in STEM, declines rapidly, with student interest not recovering even by the end of middle school.[1,2] There are many changes in student life between K-5 and 6-8 school, e.g., departmentalized classes, sense of freedom, greater focus on athletics and the onset of puberty, together resulting in many students getting "stuck" in the middle."[3] Further, the transition from K-5 to 6-8 negatively impacts math performance. For instance, a study of Florida schools shows students in K-5 show steady progression in math competency; however, in 6th grade they display a sharp drop in math scores and the decline continues through grade 10.[4] This drop in math comes at the very time that the students will need increasing math competency for the challenges of the science course they are taking.

Alabama's situation is even more dire. The latest NAEP results show Alabama students at near the bottom of the nation in math and reading in grades 4/8, and significantly below national averages, with the deficit greatly increasing between 4 and 8. In Birmingham City Schools (BCS), 14 of the system's schools received an F for 2017, with only 2 of the systems' 10 middle schools receiving a B or C, and high school performance is no better. Further, teachers are overwhelmed with the administration demands to carry out scripted lesson plans and maintain order in the classroom. This leaves little time for the teachers to insert any inquiry-based learning, even when they have the resources to do that (e.g., State Education resources). Thus, even innovative teachers are stuck, with little time to experiment with individual student learning techniques, little time to keep up with best practices or do anything innovative.

The school system is often trying to survive the onslaught of charter and other voucher eligible schools, e.g., since Katrina, the New Orleans public school system has all but melted away and nearly 75% of the former students are now in private charter schools. Are charters the answer to creating a 21st Century workforce for Alabama? Probably not. While initial reports were excellent on charters, the latest information indicates that students in charters do no better and often worse than public school peers in reading, science and math.

Any effective program to remediate education to support a 21st century economy, will require the efforts of the entire community. This collaboration must leverage university and business support (to guide what skills are needed and back the efforts), parents (without whose active support students will flounder) and the entire K-12 leadership and staff. This proposal recognizes that compromising one area for the sake of building education in others is not acceptable. Thus, the approach is integrative. Science needs to be taught in such a way that it encourages reading,

writing and math. Math needs to be taught as an integrated discipline, not as an isolated subject. Even in college, graduate and professional schools, students often want to isolate subjects, learning information in one class, but not generalizing their learning to another class.

The main mechanism that this proposal offers is one that will train teachers to integrate teaching in their schools both horizontally (across subjects) and vertically (across grades). It will also encourage collaboration between teachers in the same schools and an openness of teachers and administrators to use 21st century inquiry-based teaching tools that allow the student to "discover." This proposed program would develop area K-12 teaching Model Schools that would be heavily supported by school districts, universities and business enterprises. Unlike charters, the program would develop a limited number of Model Schools in a given district, staying within the district's financial and leadership umbrella, but giving partners a greater autonomy to make decisions on selection of teachers, curriculum, educational approaches, etc., allowing for the expansion of educational opportunities for the students in the schools. The approach would require that these schools not be populated by stellar students, but be a cross section of the population in which they are located, similar to the schools that have developed at Baylor Medical School and UCLA. The concept would potentially include all UAB schools as specified below. After 1-2 years of training the teachers at the Model School, teachers from other schools would rotate through the Model School for 6/12 m, to gain insight into new learning concepts. UAB faculty and perhaps postdocs would lead "grand rounds" experiences to bolster teachers' understanding of subjects they teach (especially important in science, given the half-life of most information). In English and reading these sessions would also stress best practices and new information, e.g., on learning and memory, physical activity, health and how diet, sleep and obesity affect learning. The concepts laid down in the Model Schools would expand to other schools to which the teachers go, thus broadening educational excellence via the graduates.

Throughout this process, teachers, parents and administrators must be intimately engaged in the development and running of the program, and also in researching and understanding what works and is worthy of duplicating and what does not work. Involving the teachers as leaders will greatly assist the advancing of the program goals of enhancing student education in all subjects. As the program matures in years 2-3, other local school systems would be included, but also we would reach out to UAH and UA to develop similar programs based on their local school systems. Also, the program would be increasingly dependent for expansion on support from businesses in Alabama and State and Federal support via grants and contracts.

In addition, the Model Schools must address the assessment of concepts learned and retained. Often teachers begin their classes with wonderful engagement strategies, but the bell rings at 50 minutes, with no time left for the full activity, or the assessment of the session. A Model School must use formative and summative assessment strategies throughout a class period/year. The Model Schools must also develop long term Professional Learning Communities (PLCs) that work together across grade levels and subject disciplines. For example, students must realize basic graphing skills in mathematics are the same graphing skills in science. Similarly, population data and graphs can be analyzed in social studies, science, and language arts.

The 5-year deliverables will include 1) the creation of 3-6 Model Schools in Alabama that will be "A" rated, 2) alignment with and support of local schools by businesses and local universities, 3) Model Schools training of ~2,500 teachers, parents and administrators in learning management techniques and knowledge (including best practices for teacher, administrator and parental learning communities), 4) teachers who take an active role in K-12 education research, developing sustainable, reproducible, effective model in K-12 education for the State and Nation.

Partners:

Birmingham City Schools Board of Education
All students, teachers, parents and administrators in BCS schools (especially the Model School)
Birmingham Business Alliance to assist in bringing businesses together to support building education
Birmingham City Council
Birmingham Botanical Gardens (great educational resources and facilities)
Birmingham Black Business Alliance
Center for Community OutReach Development (UAB-CORD)
Local/area companies, e.g. southern Company, Spire, Drummond Coal, ASIPCO, Southern Research
School of Education and their New School team
School of Engineering and their ability to recreate space within the classroom
Schools of Medicine, Dentistry, Health Professions, Nursing, Public Health and Optometry relative to addressing health needs
UAB College of Arts and Sciences and the UABTeach program
All UAB schools relative to grand rounds type education opportunities for the teachers/students/parents
McWane Science Center
UAB Hospitals
UAB as a community
NSF/NIH/USDEduc/ALSDE as funding partners

1. Sorge, C. What happens? Relationship of age and gender with science attitudes from Elementary to middle school. Science Educator 16:33-37, 2007;
2. West MR and Swerdt, G. The Middle School Plunge. Education Next. 12:1-7, 2016
3. Rockoff JE and Lockwood, BB. Stuck in the middle. Education Next 10:1-7, 2010
4. (Schwerdt G. The Impact of alternative grade configurations on Student outcomes through middle school and high school. Ed Week. 2011, http://www.edweek.org/media/gradeconfiguration-13structure.pdf)