

‘Opening a Can of Worms’
The Schools/ Math/Science/ 2-4 year Colleges and the Job Market
Are We just ‘Fishing’ for Solutions?
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ABSTRACT

The content of this paper confronts some of the biggest problems educators face in the teaching of math and science. The article focuses on a grass roots method called the Algebra project. The Algebra project has improved algebra skills among groups of students who are either steered away from upper level math or who may not ever have the chance to take an advanced math course. According to the data by the department of labor and statistics many jobs are going unfilled. This paper discusses where the jobs are, the courses that are the gateway to employment and the skill sets students need to fill the jobs. Math and science courses need to be used as a tool for liberation of such a problem. We have to ask ourselves why we have a society where only a small group of students are prepared for their future. We need to determine where the knowledge gap is and provide courses that prepare students for the job market and transfer credit from the 2 year to 4 year colleges. This paper also looks at factors that effect change, who the change agents are and what mind set implement solutions.

Keywords: the Algebra project, experiential inquiry learning, science education, math education, self efficacy, science methods, math methods, inquiry-based, change agent

INTRODUCTION

The data in the paper was inspired by a project called the Algebra Project Radical Equations written by Robert Moses, questions thought of while researching about two year colleges in a graduate online course, and an analysis of statistics from the department of labor used in a math education project.

Like most tough solutions, the transformation of education to jobs may take a grassroots approach. In order for a radical diverse changing approach to solve such an expansive problem, true change takes time and effort. An ounce of prevention (correct teaching method) can be worth

a pound of cure. Many factors need to be explored to understand the size and scope of providing students with the right education for the existing job market. The questions posed in this paper attempt to help one understand those needs and how we begin to solve the problem.

What is the Algebra project?

The history of the project came from an innovative math educator who developed the Algebra project to improve underrepresented/poor usually excluded students. The project was created using the methods of the civil rights movement. The project was radical because it closed the gap between universal education and universal completion of a college sequence in high school. The project was unique because it connected civil rights with math rights. The organizer becomes part of the learning community, aware of the strengths of resources, and ways of doing business. Math became the vehicle to give hope to the next generation of learners by using new methods of acquiring literacy in math and science, new technologies, and computers applications.

There are five steps in the Algebra project curriculum process. In the process students are involved in the experiences they share and learning is experiential. Students reflect from their culture, form abstract conceptualizations out of the reflection and apply the abstraction on their experience. Step two is to build a pictorial representation with modeling. Step three is an intuitive language where people talk and discuss the physical event in their own language. Next is a structured language that selects features of the event that is important for further study. Students develop mathematical models for the events. The last step is symbolic representations where students construct symbols to represent their ideas in teams and then in class.

The most recent projects are taking place in New Orleans, La., Halifax County, NC. Jackson, MS., Petersburg, VA., Summerton, SC., Miami, FL., and Cambridge, MA. The current project is a Young People’s project a youth initiative to develop college and high school math literacy workers who will lead after school sessions for younger students invited from community based

organizations. The goal is to make changes in the way teachers teach. Teachers attend workshops based on corporate education methods geared on the five step process and a freedom to learn. True freedom comes from self control and self discipline.

What are the objectives of the Algebra project and who does it target?

The key word here is you. Some of the issues and trends in Science and Math education shed light on an old problem, the inadequacy of our primary and secondary math and science education programs to demand for high tech skills that are expected to double. National Science Foundation chairman James J. Duderstadt, stated that “The most important factor affecting the long-term production of scientists is the tragic inadequacy of our primary and secondary science and math education program.” (p. 9 Radical Equations)

According to the data by the department of labor statistics many jobs are going unfilled. Math and science need to be used as a tool for liberation of this problem. We have to ask ourselves;

- 1.) Why do we have a society where only a small group of students are prepared for the future?
- 2.) Why is there a knowledge gap?
- 3.) How do we stabilize such a society?

To encourage the algebra project there needs to be exposure to role models and career opportunities. Students need to be taught to think not just memorize. There needs to be parent involvement at home and more self efficacy. Seventy four percent of minorities felt they needed more career counseling. There is less discrimination in math and science. There are programs such as “Career Linking” implemented by teachers counselors, and university faculty, that was designed to increase students self esteem through counseling, parent participation, and ‘real-world’ experiences. These new methods would include the use of inquiry-based, discussion, problem solving, and group projects with more students centered learning, and less memorizing.

Where are the jobs?

According to the department of labor statistics, the American Electronics Association (AEA) defines high-tech workers as those versed in computers, photonics, software services, data processing and defense electronics. High Tech workers earned eighty two percent more than all other fields. Sixty percent of new jobs will require skills acquired by only twenty two percent of young people entering the job market.

Employment and wage estimates in the United States in April of 2008, totaled 146.3 million employed, the employment population ratio was 62.7 percent and the number of unemployed persons equals 7.6 million. Job losses totaled 240,000 in the first quarter of 2008 according

to the Bureau of Labor Statistics. Seventy percent of all jobs require technology and by the year 2010 all jobs will require technical skills. Eighty percent of all new jobs do not exist yet. In the year 2006, 1.3 million jobs went unfilled.

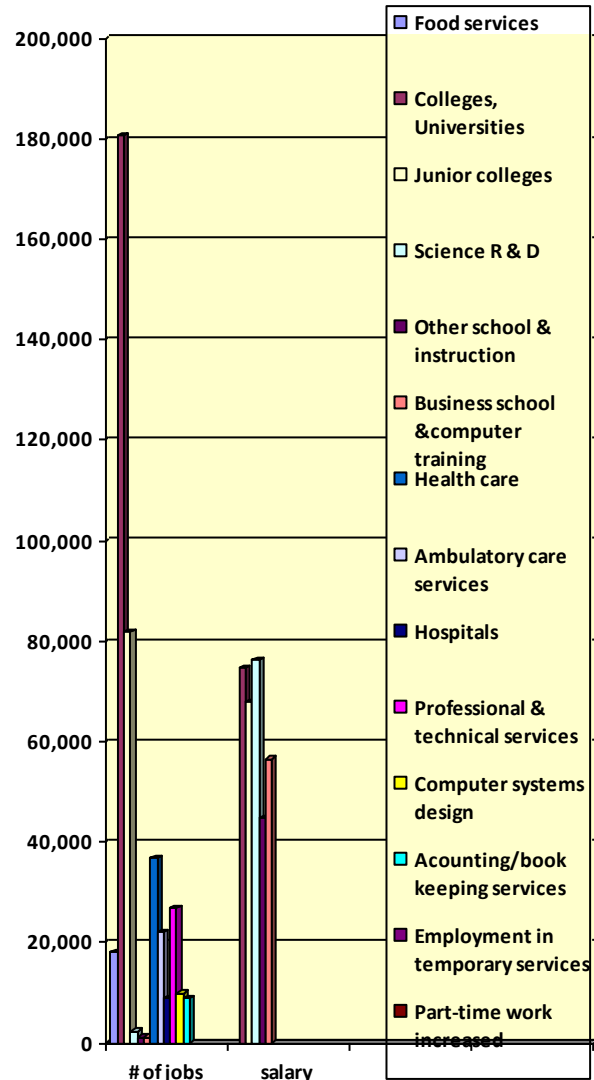


Fig. A The graph and chart depict the types of jobs available according to the department of labor and statistics. The chart shows the fields that are most prevalent.

How does earning power differs between high school and college graduates?

Those without a high school diploma earn \$22,000 annually and \$1.1 million over a life time. Students earning a high school diploma earn \$31,000 annually and \$1.4 million over a lifetime. Students who

graduate with an associate's degree earn \$38,000 annually and \$1.8 million over a life time. Students with a bachelor's degree earn \$50,000 annually and \$2.5 million over a life time.

What are the roadblocks to offering effective coursework in math and science?

We need to prevent setting our students up for failure. Only forty five percent of the schools offer advanced math courses and seventy four percent of those who want to take it are minority girls. Eight two percent of students completing bachelors degree with intense high school curriculum and only nine percent share a least intense curriculum. Eighty two percent of high school students plan to go to college. Low income minority students have a high college remediation rate and low completion rates. One student claims that, "they show me how to fill out a McDonald's application in my life skills class. I think that they should have a least taught me how to fill out a college application or told me what the college requirements are."

Some additional issues rest in the fact that we need to educate minorities in mathematics so that they graduate and can enter a two year college. Illiteracy in math is unacceptable; forty percent of students taking freshman calculus fail. African American students make up fifteen percent of the population. In 1995, 1.8 % earned a Ph.D. in computer science, 2.1 % engineering, 1.5 % physical science, and 0.6% in mathematics. Seventeen percent of all U.S. scientists and engineers are minorities and close to ninety percent of minority students take remedial mathematics. Math literacy and economics access gives hope to the young generation.

There has been a change in the distribution of education in the job market over the past thirty years. There has been an increase of sixteen percent of students in the amount of receiving an associate's degree and bachelor's degree and higher which only increases the number of students entering into the work force. Sixty percent of all new jobs will require skills in which only twenty two percent of the young entering job market have. The jobs that require the use of the computer pay fifteen percent more than jobs which do not. Seventy percent of jobs require technology literacy.

Labor and Job Statistics United States May of 2011

- 153.7 million in the workforce
- 13.9 million unemployed at 9.1 %
- Adult men 8.9%/ Adult women 8.0%
- Teens 24.2 %/ Blacks 16.2 %
- Hispanics 11.9 %/ Asians 7.0
- Long term job losses total 27 weeks – 6.2 million or 45%
- There are 8.5 million part-time workers and 822 discouraged workers who believe there are no jobs for them

- Professional and private sector up (44+)
- Book keeping up 18,000
- Mining 7,000 jobs added
- Manufacturing industry added 243,000 jobs from a recent low in 2009
- Local government 446,000 job losses
- Average hourly wage \$22.18

What courses are the gateway to employment?

By the year 2010 all jobs will require technical skills and eighty percent of these jobs still do not exist. We need more qualified workers. In 2002, 1.3 million high-tech jobs went unfilled. Certain math courses are required for a good paying job. Algebra one, Geometry, Algebra two are required for a job in Arts, a/v technologies and communications. Trigonometry, precalculus and statistics are required for jobs in architecture and construction, business management and administration, finance, government and public administration, hospitality and tourism, human services, distribution and logistics. Trigonometry, precalculus or calculus for jobs in agriculture, food and natural resources, education and training, health science, law, public safety, corrections and security, science, technology, engineering and mathematics.

How are job skill sets changing?

If we reflect from the part in the 1950's, sixty percent of the jobs were unskilled. In 2005, fourteen percent of the jobs were unskilled. Eighty six percent of the jobs require higher levels of training than a high school diploma. In 2010, more than two thirds of new jobs will require education beyond high school. This change implies that we need knowledgeable educated workers who need technical skills, interpersonal skills; high tech workers earned more than eighty two percent more than workers in other industries. Robert Moses noted that the central key to success is economic access, a technical shift. The cotton gin changed the demand for a workforce (machine cost was \$5.26 and labor was \$39.41) Automation changed the auto industry demand for the work force.

New technology emerges to include fiber optics, computers and electronics, polymers, research and development, and information technology. "The world that our students will become a part of will demand much of them. All students should have the opportunity to face those demands fully prepared. High expectations, translate into pedagogy that empowers students to reach those expectations, are imperative." Idorenyin Jamar & Vanessa R. Pitts.

Why is the Algebra project so important to employment and society?

"To many of our students fail to graduate from high school with the basic skills they will need to succeed

in the 21st Century economy, much less prepared for the rigors of college and career. Although our top universities continue to rank among the best in the world, too few American students are pursuing degrees in science and technology. Compounding this problem is our failure to provide sufficient training for those already in the workforce.” Bill Gates

The algebra project encourages the objective to provide math literacy to students. The hidden culture of the computer age is math based. In algebra students learn how to manipulate symbols, problem solve and critically think. Younger generation needs algebra to function in society, prosper economically and participate effectively in the workforce, and adjust of life- altering experiences.

According to attorneys Joseph B. Tulman and Mary G. Hynes write, “In overwhelming percentages, they are poor children and they are children of color. Large percentages of children in the delinquency system and adults in the criminal system are severely undereducated, and literacy skills in these populations are strikingly low.” (p. 12 Radical Equations) For example, forty percent of students taking freshman calculus in U.S. universities fail. Prisons grow enough each year to fill New York’s Yankee stadium. A young man born this year has one out of twenty chance of living some part of his life in jail, if he is black his chances jump up to one out of four. The crime rate in teens is going up one percent each year. (oas.samhsa.gov)

What are the State requirements in Math?

Only thirteen states require Algebra two, nineteen states require Geometry, and twenty nine states require Algebra one. Forty five states require students to take certain courses to graduate from high school. “Organizing around algebra has the potential to open a doorway that’s been locked. Math literacy and economic access is the Algebra Project’s foci for giving hope to the young generation. Instead of weeding all but the best students out of advanced math, schools must commit to everyone gaining this literacy as they have committed to everyone having a reading-writing literacy.” Robert P. Moses

Where are the knowledge gaps in the educational systems?

There is a gap in knowledge transfer from high school, to community college to four year college, and potentially this gap comes from the lack of many things. The algebra project suggests a plan and model with methods to fix the problem. However, we need to hit the ground running and we need more projects like the Algebra project to save our students from failure or getting lost in the system. We also need a strong education system that makes sure transitions are smoother and more effective.

These are sensitive issues and hot topics in determining the policies and regulations needed to improve the whole educational system. We have a complex policy environment as we educate more than 14,000 school

districts with more than 97,000 secondary and elementary schools. There are approximately 1,300 community colleges with over 500,000 students and close to 700 public four year colleges and 1800 private four year colleges with over ten million students.

Who’s responsible and can provide for educational changes?

Our policy environment includes; 50 governors (plus D.C. and territories), 50 Chief State school officers, Federal Policy makers, House and Senate Educational Committees House and Senate Science Communities, Various Federal Agencies (Department of Education and National Science Foundation), and Numerous private education organizations with differing missions and agendas

The key areas of change include; the educational environment (systemic issues), the policy environment (political issues), the decision-making environment (power issues) Teachers/professors (classroom issues). A change agent is, “A professional whose major function is to advocate for change and to put innovative practices in place within the organization.” (Carlson, 1965) Systemic change also demands profound engagement with and understanding of educational culture. Effective change agents must therefore; “Understand how to balance pushing for change while at the same time protecting aspects of culture, values, and norms worth preserving...know how and when to create learning environments that support people, connect them with one-another, and provide knowledge, skills, and resources they need to succeed. (Waters, Marzano, & McNulty, 2003)

Who really are the change agents?

In order to solve the puzzle one would have to at least look for the experts in finance, science, math, government, state, local and private entities that could make a healthy conscious choice about the changes in the policies and regulations they are enforcing. It really depends on who is looking into the problem and how personally it will effect them. The middle class is at most affected and those that are under privileged. The current policies makers are not middle class and do not feel the impact of their skewed half hearted decisions on the greater majority of the people and communities they affect. They don’t live the problem and have no felt need and therefore have a shot in the dark at solving the problem.

What are the factors that effect change?

The factors in educational change include that most of the changes that occur within education is the result of small-scale, bottom-up innovation within individual schools. Systematic change requires three critical processes; convergence of resources (often people) that provide a starting point for change, mutual benefit to those affected by change, sufficient resources and expertise to sustain change.

The nature of educational systems include huge public systems that are bureaucratic and have competing ideologies, philosophies, ontologies, and pedagogies. These systems play for attention and dominance. They are subject to extreme pressure within and without the system. The system is either valued (professionalized) or often devalued. In some cases employees are over worked, underpaid, and severely under-resourced.

Educators need to be ready and willing to adapt to such changes. Those include; localization vs. scalability, immediate impact vs. sustained change, changing standards vs. changing practice, changing practice vs. changing thinking. Practitioner realities include that it is hard to find channels for direct-to-practitioner communications. Teachers sometimes need proof that there is a need to change and they often lack the time, resources, professional development, and sustained access to experts who can provide effective feedback and learning communities that will support changes to improve the transfer process.

Who are the key stakeholders and what do they need to do to engage change?

- State Government and Policy Makers need
 - To meet the learning needs of their students; To allocate their funds for the highest possible return; To ensure that teachers are adequately trained; To satisfy the community and meet the skills needed of local industry
- University and College Faculty need
 - To get enough students into their programs; To have students come into their programs ready and able to succeed
- Federal Government Policy Makers need
 - To allocate their funds for the highest possible return; To be perceived by voters as doing a good job; To ensure that the country remains economically stable and strong
- Business and industry needs
 - To make a profit by providing what people want; To have the workers they need to do the job

Leaders in education need to create, not just a structure for change, but a culture in which new ideas and practices are critically assessed and selectively incorporated on a continual basis. Change/leaders will always encounter resistance; “To lead is to live dangerously because when

leadership counts, when you lead people through difficult change, you challenge what people hold dear-their daily habits, tools, loyalties and ways of thinking...People push back when you disturb the personal and institutional equilibrium they know. People resist in all kinds of creative and unexpected ways.” (Heifetz & Linsky, 2004)

How do we develop modes of thinking to bring about synthesis and interdisciplinary problem solving?

According to Howard Gardener there are five mind sets we need to incorporate in all systems to interpret the needs of the present global job market and in the future. The mind sets include the disciplined mind, the synthesized mind, the creating mind, the respectful mind, and the ethical mind.

The disciplined mind has mastered one mode of thinking in a scholarly discipline and is able to apply the knowledge past formal education. The synthesized mind takes information from diverse sources and disciplines, understands it objectively and can present it as a whole. Thus communicating by putting it together in ways that makes sense to self and others.

The creative mind builds on discipline and synthesis and pioneers new ways to answer unfamiliar questions. The respectful mind differentiates between groups and individuals and finds ways to interpersonalize the relationships. The ethical mind conceptualizes how the needs of society work together so that everyone can benefit.

Together the five mind sets can inspire one to be able to solve complex interdisciplinary and moral dilemmas.

Do community colleges really prepare students for the job market?

The answers are inconclusive as the problem is immense. Although a lot of entities have come to the rescue we need precision and accuracy to get closer to the answers. Government monies and grants are pouring in some budgets and schools to fix some issues and others are left in turmoil. Students need to be educated enough to choose the right career path and eventual job that meets the demands of the job market, and community colleges have to foot the bill for students who are already under educated. There seems to be no equal distribution of resources or knowledgeable persons (change agents) to ensure the money gets allocated appropriately (fairly). There needs to be the correct visionaries to oversee the needs of the schools, students and job market. Those best educated and knowledgeable should be appointed so that they can enforce the regulations, laws and policies that encourage pedagogical, philosophical changes and for a sustainable education and job market.

What are the advantages and disadvantages of choosing a community college?

There are many advantages of attending a community college those include; less extensive than a four year college, more focused instructors and quality instructors, a degree in two years, great for non-trade students, it is close to home, classes are more career oriented, and lots of opportunities for high school students.

The disadvantages include; you don't get a bachelor's degree, less college atmosphere, less interaction among students, transferring credits can be a nightmare, fewer campus resources, and too much "home".

How does the community college affect those with disabilities?

Some students such as Robert T. Calloway, went to community college to overcome dyslexia and longed for a degree in engineering and mechanics. He did so in a Veterans upward bound program at Allegheny Community at the age of forty two after serving in the military. He noticed he had dyslexia while reading technical manuals from his platoon sergeant. The program he entered was awarded two federal grants totaling more than \$1 million dollars that was used to help finance its stem project. Some of the money was used to develop curriculum to help students with disabilities study, learn software, prepare for job interviews and work in groups.

Two years after Mr. Calloway enrolled at Allegheny he graduated with an associate's degree in precision fabrication, another in robotics and automation technology, and a professional certificate in automation technology, and a certificate in computer-aided drafting and design. He graduated and transferred to a four year college to pursue a master's degree in manufacturing and a possible engineering degree.

What about the 'Green' job market?

The government just passed a \$787 billion Recovery & Reinvestment Act to provide monies for a growing green job market. Community colleges can have a role in using some of the monies to train students and prepare them for the growing environmental technology industry and 'green workforce'. This report coincides with a better attitude of the presidential administration to assist in the need for environmental solutions. One can say this is a grass roots way of attempting to solve the problem. Columbia University and IBM have connected to prepare students with resources and skills for a growing job market. The smarter cities skills initiative opens IBM's global resources to Columbia faculty and students including access to forty IBM innovations. The sustainable issues will include business, law and engineering, and help students find new ways of to make infrastructures more sustainable.

What do the students need to be ready for the job market?

There has been a surge in community college admissions. The enrollment is up to 11.4 percent over the past year according to the American Association of Community Colleges. This could be due to the type of workforce training, and lower tuition.

Students need to be better consumers of information and of their choices in regards to their education. Students need to individually decide how they carry themselves professionally handle their education and approach to the jobs. There are many services available at the two year college to ensure career placement. The key to such transformation is how much effort and determination a student applies to the direction of their chosen endeavor. Students ultimately need to know how to; write/speak/present, communicate effectively. They need to be able to work in teams, use time wisely, be organized, research, have investigative skills, understand management, persevere, and have work ethics and personal productivity.

CONCLUSIONS

In answering my own questions related to this study, the Algebra project speaks for itself but we need more projects like it. Community colleges are potential avenues (roads) with opportunities for projects to retrain those who have lost their jobs and those who may not have been able to afford an education. If the Senate Bill 1440 passes transfer credits will ensure that students have more opportunities for even higher education, and jobs training. It will also standardize and stabilize the type of curriculum needed to get there.

In time, these educational grass roots influences may fuel or depleted economy and encourage investments into higher education. After all higher education, a greener more biodiverse future and economy may just power our future. We have professionalized organizational change, educational technology, organizational change, educational change and educational leadership. We need the correct follow through with diverse educational leaders aware of the scope and sequence of the problem and a plan to get the job done.

In conclusion, we have funneling problem. We have thousands of students who need an effective education and jobs and many educational systems not prepared to get them there. One size does not fit all and most systems expect any shoe to fit. The data alone in this paper is telling us that we are not working hard enough to solve this problem as many jobs go unfilled, students are undereducated, and some students are filling up prisons not jobs. Ideas in this paper suggest avenues for change. There needs to be a way to direct or redirect the traffic for more efficiency and towards stewardship effective solutions.

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