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Introduction

If someone had told me when I was in secondary school that one day I would write a book about helping students succeed in maths and science, I would have been quite surprised. Back then, when I was a student in intermediate algebra, I struggled with maths, like many students. But when I asked my teacher to spend some time with me after school to explain "balancing equations" and "getting rid of unknowns" – concepts that were not only unfamiliar, but intimidating – he gave a very curt and cold reply. He didn't have time. He had to get home before peak hour.

What was I to do? I felt quite abandoned. Then I remembered my friend Thomas Turner. His friends called him Tommy or just Thom. Maths and science came naturally to Thom. He could ace those exams as easily as drinking a glass of cool water. I, on the other hand, would have to study past midnight to make a mere 70%. So I went, books in hand, to the park where Thom was practising his basketball jump shot, and yelled, "Tommy! Can you explain this stuff to me?" That afternoon, Thom made all of my fears disappear, because he explained algebraic concepts using a language that I could understand.

But children shouldn't have to rely on their peers or even their parents to help them master these subjects. Their teachers must be able to explain maths and science concepts and operations using language that demonstrates a relationship to the real world. When this kind of teaching demystifies maths and science, children can

connect maths and science to their own daily lives. They lose their fear of these subjects and start to believe they can achieve success. As they engage with the subject, they develop the critical thinking skills so crucial to maths and science mastery. This process of making connections to the real world is particularly important for children who are educationally at risk.

There is a pervasive cultural attitude in America that mathematics is abstract, difficult and mastered by a select few. The American way of teaching maths, which reduces mathematical concepts to a series of procedures to solve a problem, reflects this attitude (Allen, 2003). All too many children struggle with maths and science as a result, and yet the extent to which today's children will succeed in the marketplace as adults depends upon their mastery of maths, science and computer technology. Mathematics and science "are the very areas from which the continued growth of the American economy will depend, and from which a high level of cognitive competence will be expected from its workers" (Armour-Thomas, 1992, p. 21). Children at risk are especially vulnerable to being left behind in this new economy.

Comer (1987) defines children at risk as those who underachieve despite intellectual endowment and, as a result, will underachieve as adults. Slavin (1989) states that a student described as at risk is in danger of failing to complete his or her education with an adequate level of skills. The six common denominators of the educationally at risk appear to be:

1. Academic underachievement
2. Poor school attendance
3. Low self-esteem
4. Negative attitudes toward school
5. Retention at year level for one year or more
6. High dropout rates from school

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Given these challenges, it is not surprising that these youngsters face more challenges achieving in maths and science. But if schools can enable at-risk children to succeed in maths and science, these six common denominators could virtually disappear.

Creating math instruction specialists is beyond the scope of this resource, which does not attempt to teach mathematics and science to professionals who already have the knowledge base. At any level, however, teachers who are not certified in math and science cannot adequately prepare children in basic math and science requirements.

Ensuring Success in Maths and Science: Curriculum and Teaching Strategies for At-Risk Learners further develops ideas from *Nurturing At-Risk Youth in Math and Science* (Tobias, 1992). This volume continues to address the plight of at-risk children who struggle to master mathematics and science, explores why students fall behind in maths and science as they progress through the higher year levels, and offers proven curriculum and teaching strategies to address the complex issues that contribute to maths and science failure.

Part 1 conceptualises the problems behind failure in maths and science, defines long-range goals and describes the research and philosophy that support those goals. Closing the maths and science performance gap will require the collaborative efforts of state departments of education, TAFE colleges and universities, and local schools. It will require us to hold all students to high expectations and to revisit the way standardised tests are created, administered and evaluated.

Part 2 discusses in detail how to redevelop maths and science curricula to ensure success for all children. Collaboration is critical to curriculum redevelopment and effective education. Each school must work with school administrators, educators and families to conduct its own needs assessment, and then design and implement a curriculum plan to address its students' needs in maths and science.

Part 3 provides tested examples of maths and science lessons that were developed in collaboration with teachers. Each lesson is followed by a brief analysis of its significance to meeting the challenges of ensuring success in maths and science for at-risk learners. Also included are lessons that families and caregivers can use to reinforce maths and science at home.

Strategies are concentrated in the primary and middle years (P–8) since proficiency in these subjects should begin as early as pre-prep. Maths and science skills are linked to the development of children's ability to read and critically think, which should also begin as early as pre-prep. The *Multiplying Inequalities* study (Oakes, 1990) and the Third International Mathematics and Science Study (1995) both state that P–8 children (particularly children at risk) must be afforded the opportunity to take critical subjects in primary and middle years as preparation for maths and science subjects in secondary school.

Although this resource was inspired by the plight of at-risk learners, the strategies presented here have profound implications for all children and their future success as adults. Maths and science skills are already crucial in the marketplace. To prepare our students for the *future* marketplace, in which maths and science are sure to be even more vital, we must first prepare ourselves. Fortunately, we have the benefit of the maths and science of educational research, which has shown that by using the right strategies, we can ensure success in maths and science for all of our children.

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