# Math in Advance: The Big Change

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# Chapter 1 - Introduction

## Mathematics need to be changed in the U.S.

The Program in International Student Assessment (PISA) conducted an international assessment in 2006 where United States ranked 25th of 30 in the Organization for Economic Cooperation and Development (OECD) in mathematics, and has stayed at the bottom in the following years (Darling-Hammond, 2010). She explained that political forces have repeatedly pushed most mathematics teaching in the United States back to the routines of the drill-and-practice methods. She reported that the PISA assessments require more complex advanced analysis and knowledge used than most U.S. tests. This program defines literacy in mathematics that increasingly emphasized in other nations' curriculum and assessment systems. Unfortunately, this new mathematics tendency reflected in PISA assessments is often discouraged by the kind of textbooks and testing most often used in the United States (Darling-Hammond, 2010).

## Remedial Courses and Add Post-Secondary Math in High School Curriculum Attempts

Consequently, Bonham (2011) reported that there is considerable public debate about the unpreparedness of students entering colleges. To solve this problem, a large number of students place into remedial or developmental courses. Attewell, Lavin, Domina, and Levey (2006) reported that remedial education is widespread, and their analysis indicate that about 40% of traditional undergraduates take at least one such course, and remediation is even more common among older nontraditional students. However, according to Bonham (2011), remedial math courses students are prevented from achieving their educational goals because they never complete these courses.

Bellomo and Strapp (2008) reveal inadequate high school preparation in terms of disciplinary content or depth, conceptual grasp, or study skills, and show how course scope, goals, structure, and analysis of the curriculum to prepare high school students to face undergraduate degrees in mathematics. The theme of this qualitative research is to show a solution to increase the quantity and quality of students pursuing studies in mathematics at the university level. Instead the remedial solution in university, Bellomo and Strapp (2008) introduced high school students to a list of college classes like Calculus, Statistical Methods, Differential Equations, Linear Algebra, Probability Theory, Discrete Mathematics, Elementary Theory of Numbers, History of Mathematics, Abstract Algebra, and College Geometry. Although this program has not currently been field tested, the proposed Survey of Advanced Mathematics Topics class could increase the quantity and quality of students pursuing studies in mathematics at the university level.

Another attempt to anticipate calculus in high school curriculum was found in Rodrigues and Le (2011). They explained how to help graduates succeed in college, a high school redesigned its senior year as a bridge to post-secondary education. They reported that the University Park brings into the senior year of high school, college-success courses about college policies and expectations, acquire time-management and study skills, address test-taking anxiety, and a college placement test to seniors to detect their readiness for college math. These courses can diminish the gap between the high schools and the colleges.

Hannah, James, Montelle, and Nokes (2011) also reported that from 2003 to 2008, almost 400 students around New Zealand took the University of Canterbury (UC) course in Advancing In Mathematics (AIMS). This course is equivalent to a full first-year university calculus and algebra

course delivered in a high school style. The students on the AIMS course form their own peer support groups which can be seen to continue during their first year of college study. This is a important positive factor of accelerated study programs.

Hill (2010) explained that concerns about the gap between high school and college have led to cries for change in high school mathematics. Policymakers have urged raising graduation requirements in an effort to increase the number of students who take advanced math classes. However, high school students especially among Black, Latino, and Native American youth and students of low socioeconomic status exacerbates this challenge.

## Chapter 2 - Statement of the Problem

How can we prepare low-middle socioeconomic, Black, Latino, and Native American students to face calculus if Hill (2010) reported that they avoid advanced math classes in high school? Furthermore, Bonham (2011) reported that remedial math courses students are prevented from achieving their educational goals because they never complete these courses. He explained that the reasons of large number dropouts are:

- The remedial math classes at universities are more challenging than the equivalent classes at high school
- The remedial classes tuition are as expensive as a regular college class
- The students do not receive any credit for the remedial classes

Darling-Hammond (2010) reported that even minor changes in the secondary curriculum is going to cause bureaucratic fighting among education leaders and teachers. I believe that the idea to implement calculus as a national standard curriculum for mathematics high school students is completely discarded. In the next section, we will see an innovative math private school as an easy solution to minimize this problem.

## Chapter 3 – The Change Is an Innovative Math Private School

### Introducing *Advance*

This section will be used to introduce an innovative private math school in Hawaii called "Advance in Math" or "*Advance*" for simplicity. The goal of this innovative school is to offer math courses for secondary and undergraduate college students.

### Related History

In 1992, I founded a private tutoring center called "PATRICK CHEVALIER ENSINO CLUBE DO ESTUDANTE S/C LTDA", which provides high quality teaching at a low cost to help young people improve their math skills. Since I had students from a variety of well-regarded schools of Sao Paulo – Brazil, I observed very interesting methods and techniques that students had been taught at their respective schools. I realized that a few days of intensive learning would enable even low background students to pass examinations and jump to the next grade. My strategies and techniques used to improve math achievement are:

- Teaching enthusiastically, with humor,
- Summarize the topic. For example, I like to give a procedure that the students can easily follow step by step to solve a problem,
- Be simple ( e.g., remove steps from a traditional algorithm),
- Use exercises that the student normally has difficulties with,
- Recognize students successes and praise them so that they became self-confident.

These tutoring strategies and techniques have worked well on students who have failed in a traditional math class. In fact, teaching enthusiastically with humor, summarizing the topic,

being simple, using complex exercises that the student normally has difficulties with, recognizing students successes and praising them so that they became self-confident can be used to facilitate the study in advance. In the next section, the Advance philosophy will be introduced.

### *Advance* Philosophy

My philosophy of study in Advance is to use the tutor strategies and techniques before the traditional math class starts. This means that students should be enrolled in *Advance* before going to a traditional math class in their respective school. An advantage of this innovation is that students can learn without any pressure from grades of a traditional math class. In the next section, we will introduce the project to create *Advance*, one school that can make a difference.

### *Advance* Courses

The secondary and undergraduate students can be enrolled in math courses like Algebra, Trigonometry, Pre-Calculus, Calculus Differential and Integral in advance. This means that students, 12 years old or more can take a math class in *Advance* to improve their background before they take it to their respective school. The advantage of this innovation is that the students can be prepared and focused in math without any pressure from grades of a traditional math class. Each course would meet three times per week for one hour. This would translate to twenty five session per course. I estimated it to be from $400 to $500 for a course, and the students would be from families having a median to high socioeconomic status.

### Extra Activities

The school may promote extra curriculum activities such as hiking, BBQs, soccer games, but under supervision of adults. The safety of the students is a paramount consideration.

**Study in advance requirements**

Instead of a traditional school where the student is forced to attend, *Advance* will accept secondary and undergraduate students of 12 years or over who really want to improve or learn math with an innovative setting. The parents or guardians and the students will be aware that the students need to have self-discipline, responsibility, good behavior, and respect for peers, teachers, and staff to assure success in any course presented by the school.

*Advance* need to educate its students:

- To respect the current math technique. The students can learn a math technique in advance differently from the technique adopted in their current school. In this case, students must use consistently the current technique learned at the current school. If a student really wants to use the technique from Advance, the student needs to get permission from the current teacher to use it.
- To share math knowledge. To know math knowledge in advance is a privilege that needs to be shared with humility and respect.
- Be confident. Student sometimes spend to much time checking and rechecking a question in an exam. One strategy is the students should believe in themselves, and they do their exams without worrying about making mistakes. This way, the students normally save time to test their solutions at the end of the exam. For example, John was not self-confident to succeed in his math exam. He spent almost all time of the exam on the first question because he was not sure if his solution was correct. He

failed his exam because he didn't do the other questions. Instead, if he had tried to do all questions the chance to pass would have increased.

## Chapter 4 - Benefits of Advance

This section will be used to show the benefits of studying in *Advance* not only is it to offer math courses for secondary and undergraduate college students, to improve math background, but also to feel their hearts with meaning and purpose, and present to them the Catholic Marianist values.

### The soul in the *Advance* Education

Kessler (2007) reported that films, games, TV, and Internet send pervasive messages offering our students a seductive and ultimate empty alternative to the existential search (p.61). She also reported that the classes at public schools are spiritually empty, and the students' inner lives are not their business (p.xii). Consequently, when school systematic excludes heart and soul at class, it increases the number of students who become depressed, attempt suicide, or use drugs (p.xii). The most important *Advance* goal is beyond improving math skills, we want to change students' lives. The first and ultimate step to change students' lives is to add soul in the *Advance* education. The seven gateways to the soul in education are deep connections, silence and solitude, meaning and purpose, joy, creativity transcendence, and initiation (p.17).

The *Advance* students can satisfy their yearning for deep connections because we are a family with strong connections among students, parents and teachers. The students have important connections with peers because they know that math knowledge in advance is a privilege that needs to be shared with humility and respect. The school culture is also expressed through

strong connections among teachers, parents, and students because the effort of the three parts is fundamental to succeed in math. The school will suggest the parents or legal guardians to give a reward for the student such as a gift, a trip, a game, etc. because the *Advance* courses will be very intensive, and the student needs to be motivated.

The *Advance* students can satisfy the longing for silence and solitude. In my classroom, I can give a minute for my students to rest and renew before I start a lecture. Also, I can respect the students' solitude during the class.

The *Advance* students can satisfy the search for meaning and purpose because the students choose to be prepared to face the college math challenges. Note that when students study math in advance, they are making a commitment with themselves to succeed in the university, given directly or indirectly a meaning and purpose in their lives.

The *Advance* students can satisfy the hunger for joy and delight because studying math in A*dvance* is fun. The school strategies and techniques used to improve math skills are teaching enthusiastically with humor, and without grade pressure.

The *Advance* students can satisfy the creative drive, the most familiar domain for nourishing the spirit in school (p.17) because the math exercises selected for the courses has complex solutions that require creative thinking.

The *Advance* students can satisfy the urge of transcendence because studying in advance pushes the students beyond their perceived limits of their ages.

Finally, the *Advance* students can satisfy the need for initiation because the students start to be prepared for the first big challenge in the adult life, to face a university.

In short, *Advance* has a high ambition to change its students' lives and it will be impossible without addressing soul in its education.

**The Catholic Marianist Values**

**Education for Formation in Faith (Mana).** *Advance* is a large Community based on the Catholic faith, hope, love and ethical practice.

**Integral, Quality Education (Aloha).** *Advance* is committed to an integral, quality education with courses and activities that challenge the intellectual, emotional, physical, and ethical dimensions to develop student's life experience.

**Education for Family Spirit (Ohana).** *Advance* offers math knowledge in advance that is a privilege that needs to be shared with humility and respect among its students like a large family.

**Education for Service, Peace and Justice (Pono).** All members of *Advance* needs to help the school and the Hawaiian community. (I have some ideas on how to help, educate, and engage homeless people with the Hawaiian community, but it is beyond this study).

**Education for Adaptation and Change (h'oma'ama'a).** *Advance* is based on a Marianist-founded education that prepares students to face precociously the university math challenges to better service and change their community.

## Chapter 5 - What does Advance need to be implemented

*Advance* will be located South of Oahu, between Manoa and Hawaii Kai. It should be an area free of noise and visual pollution with a natural environment with many trees and large green areas. A rectangular concrete building with three floors, and many windows would be ideal.

Ground Floor: There are reception, dean room, and a parking lot in front of the building.

2st floor: There are two medium classrooms with big windows for 50 students each, a teachers room, and a restroom.

3nd floor: There is one large auditorium with big windows for 100 students, a teachers room, and a restroom.

Concern: At some points an elevator and handicap access will need to be provided.

## Chapter 6 - What personnel involved to make the *Advance*.

The faculty would be carefully selected, seeking those teachers who already use innovative methods for teaching math. Teachers hired would also receive a special teacher training in some techniques used in countries other than the U.S.

As dean, I would manage and mediate any problems and/or conflicts which might arise between teachers, staff, students, parents/guardian or neighbors.

I need help from the Hawaiian community leaders and financial institutions to start this important project of my life.

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