

Benefits of a Math Club Association

How our math club association contributes towards solving educational problems on a national scale while providing other benefits related to math club.

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"Education is the key to opportunity and economic progress, for our young people and our nation." – Allan Golston, Bill and Melinda Gates Foundation

What areas of need currently exist?

Mathematics is a rich and multifaceted subject, with a variety of applications in occupational, practical, and/or simply recreational fields. However, in order to fully optimize the uses that math has to offer one first has to comprehend the basic underpinnings of math. It is through their school curriculum that students are given the essential tools needed to understand the language and basic functions of math.

Unfortunately, many students tend to lose focus in mathematics particularly later in high school, weighed down with burdening questions such as "Why does high school math matter to my everyday life?" and "Why was I an 'A' student in math until I reached Calculus?" that many of them leave unanswered. This is a trend that tends to occur in high school regardless of whether the said students had an interest in math in elementary and middle school. This is indicated by the growing gap between mathematics ability levels in high school students: some students in public high schools have the ability to skip up to three grades in math, whereas some students are held back one year. In comparison, most public high schools do not allow students to skip grades in subjects such as English or History.

Thus, generally in high school only those who have had a former interest in math will continue to have an interest in math, while many who have formerly kept an interest in mathematics throughout middle school and elementary school become disinterested in high school mathematics. This contributes to a widening gap between those rich with knowledge in mathematics and those who struggle to maintain a basic understanding of mathematics, while the number of students interested in math throughout their entire K-12 educational years dwindles progressively.

The drop-off trend of interest in mathematics is reflected in national educational comparisons amongst the United States and other industrialized countries. A 2008 study on international benchmarks in mathematics found that of out the industrialized OECD

(Organization for Economic Cooperation and Development) countries, U.S. fourth graders performed at a level of proficiency 9% higher than the average while U.S. eighth graders dropped to 2% below the average (Phillips, American Institutes for Research 2008). The comparison shows similar results even at the upper-echelon of performers:

“Looking only at the top 5 percent of test-takers [on the 2003 TIMSS examination], American fourth-graders beat the average of wealthy nations by 13 percentage points. By the eighth grade, however, the tables have turned, with America’s brightest students falling 10 percentage points behind their foreign peers. If we carry this comparison to the final year of high school using the 1998 12th-grade TIMSS results (the most recent available), we discover that America’s top students placed last in combined science and math achievement among all the industrialized nations for which data were available.”(Coulson, Education Report 2005)

These results indicate that American fourth-graders have mathematical capabilities well above those from the average industrialized countries, while performance and interest levels in mathematics drop below the average as results are conducted for students of higher grade levels.

It is crucial to the economic and occupational success of the general student body to continue performing well in mathematics throughout their entire educational years, and not just during elementary school. Previous studies have shown that important developmental milestones occur in the later years, as “for many talented students the decision to enter the science and engineering pipeline occurs between grades 5 and 8” (Campbell, 1991; Terman, 1954) and “amongst female math competitors, there is theoretically a drop-off in participation between grades 8-12 based on participation ratios in the American Mathematics Competitions” (Desjarlais, 2009). This trend indicates that it is important for the current educational curriculum to not only improve testing scores in middle and high school math students but to sustain their interest in mathematics during those years.

How math club addresses these areas of need

1.) Introduction to math club

Having experience working with extracurricular math clubs since 2001, members of our organization have observed that the impact of a standardized and well-led math club on elementary/middle school students is substantial. Not only are elementary/middle school math club members exposed to high school concepts at an earlier age, they are given these materials in a positive learning environment without the stresses of an official grading system. Moreover, math club students have plenty of guidance and quality assistance that would be unavailable in a typical public classroom environment, due to a smaller number of graded assignments and students that demand attention. Math club presents math in a fun, logic-puzzle fashion that alleviates pressure to the students and is generally more enjoyable. Students are also able to draw motivation from going to state-wide competitions, and competing in team and individual events as a school.

Thus, younger students regardless of math ability are able to nourish their problem solving abilities and tackle advanced concepts that they would later see in high school. As a result, the popular trend is that students from elementary, middle, and even early high school math clubs would go on to improve their math skill level in high school by performing well in their regular level classes, and skipping math levels when their math abilities surpassed the classroom pace. Students are usually motivated to do so themselves through advanced placement tests or summer courses. Effectively, math club students who stay in math club throughout the duration of their educational career follow a path directly opposite the trend that the national mathematical statistics display: dedicated math club students continue to improve their math skill abilities while the average math abilities drop in high school. What is more profound is that math club students are motivated to do so themselves.

Math club can also be a low-investment, high return resource for students that produces win-win benefits for all, even in high school. New members can come to math club free of cost to learn under the guidance of more experienced math club members, who will have the necessary bandwidth to give students in need of help the individual attention they

need, more so than teachers do. These tutors not only receive community service hours and recognition by the club, but also will hone their own math abilities by tutoring to others. Motivated members who have gained a newfound respect and love for math also are willing to share their passions with others regardless of the tangible benefits they will receive. Their love for math is enough for them to share it with others, so that others may enjoy math and see it for what it really is: an enjoyable hobby that happens to have practical side-effects in today's Information Age.

In addition, there is a wealth of math resources on the web and in print that are specifically designed to assist students in their pursuit of studying math. Of these resources, there are a few notable standouts that have been ingeniously crafted to be helpful for all students regardless of math ability and talent (such as the Art of Problem Solving series). These resources were written by former math club members who have found ways to channel their love and deep understanding of mathematics in a way that is relative, enjoyable, and understandable for middle school level students who are brand-new to math club. However, their work is profound enough to have an impact on even college-level students. This is due to the fact that such resources train the **problem solving** aspect of math, whereas the mainstream curriculum focuses on memorization and concept-by-concept exercises. If there is a single most unifying aspect amongst all the branches of mathematics, then it is the logic of problem solving.

This approach teaches not only the curricular concept (such as algebra, geometry, or calculus) but the logic development necessary to understanding mathematics that will be useful in all other branches of math. Thus, that is how an algebra student can be taught to tackle difficult geometry problems with only basic conceptual knowledge of shapes, and how a math club member can be taught to succeed in a math class several years above their age. This technique does not discriminate amongst age or math class background: logic is an inherent process that must be given attention itself. This is why a ninth grader with no knowledge of calculus but an extensive knowledge of problem solving will have the capability to solve a difficult math problem that a college student with years of experience in calculus will not be able to solve. Just ask any math club member: *“Math club math’ is different than ‘school math”*. It is also essential to the development of problem solving that these students be given

problems to figure out on their own, before they seek guidance on the problems they cannot solve. This best trains the logical aspects of math: solving a problem that one doesn't yet know how to solve. **In summary, math students learn the meat of mathematical concepts in school. They learn math concepts as well in math club, but most importantly, they learn how to learn.**

2.) How math club addresses areas of need

Outside of math club, math is less a matter of logic, but simple memorization. Memorization is a technique that works perfectly well until the students reach Calculus, a field of mathematics that draws very little upon the interconnected fields of math before Calculus. Students with a strong logic foundation in math succeed in Calculus, while students who follow the technique of memorization tend to struggle. This is because the foundation of Calculus relies on a discrete concept that is different than typical, linear mathematics: the instantaneous rate of change. Students experienced in problem solving are not new to having to face new areas of mathematics and therefore learning Calculus is no different of a task to them than learning other new concepts in math club. Students who relied on memorization, however, find that the vast majority of their formerly learned knowledge is useless to assist them except for one or two concepts. Moreover, in many cases calculus is a fast-paced class due to its high standing in high school, and students who struggle early tend to fall behind quickly (a conflict for calculus students, teachers and parents alike). Problem solvers can make the adaptation quickly, and while other students relying on memorization have been able to do so as well, it takes them much more effort and dedication to do so. Many calculus students find themselves going through the course without a basic understanding of the foundational concepts. They simply try to absorb and regurgitate the material on tests, which is not only a painful strategy but one that will fail them in the long run unless they make quick adjustments, starting from ground zero.

This contributes to the negative social stigma surrounding high school mathematics, and is what makes it especially negative (on top of the fast paced learning required of IB and AP students) compared to middle and elementary school complaints of math. A well-run math club

will also make it fun for math club students to learn how to learn math by training their problem solving abilities through fun and enticing problems. Through math club, students are not only in a community more separated from the negative social stigma of math, but no longer have to face aforementioned conflicts that burden other high school students. Math club students tend to make the transition into calculus more smoothly, and tend not to lose focus about the purposes of math.

3.) How a math club network helps proliferate and establish math clubs

It is now safe to say that I have established that math clubs are important to student knowledge and success and happiness in the math classroom environment. However, one important distinction must be made: **the purpose of our association is not to change how people feel about math, but it is to increase the accessibility and availability of resources they have in front of them to pursue a math education and hobby for themselves.** They must reach out themselves to find these opportunities – in the end, math can still be much of an acquired taste and it is safe to say that math is not for everybody. Our organization does not try to reverse social stigma. It simply will combat social stigma, to make math available for those who DO want to pursue it. The amount of people that fall into this category is not scarce. In fact, the majority of the steady math club members at Skyline (all but two: one of my friends and myself) formerly fell into this category, which composes about 90% of our club attendance today. Several of these students came from either schools outside of the state that did not have math clubs, or other feeder middle schools into Skyline that did not have math clubs (only Pine Lake M.S. had a standard math club). One of these students, who is a motivated and strong member of today's math "A" team in the top four students in the club, had tried in middle school to pursue math for himself, but had failed due to a lack of resources on how to start a club, a lack of opportunities and encouragement from those around him, and even a lack of resources on how to find a way to further his own math knowledge outside of school in a satisfactory way.

Starting a math club is no easy task, and thus it is not common and usually not available for most schools and most students. The Washington Student Math Association aims to help ease the process of starting a math club. We draw upon our former experiences in math club to

find a standardized and efficient set of guidelines to assist willing parents and willing students to become leading coaches and leading club presidents. We provide a strong network of enthusiasts with knowledge of math competitions, resources, and experience running math clubs. Assistance is given from our organization to aspiring math club leaders and members in the form of local lecture seminars held at either a central location or at district meetings across the state. These seminars will demonstrate the usefulness of math and its fun aspects through interactive math activities commonly done at math club. These seminars will invite keynote speakers that will demonstrate and serve as examples for how successful, strong, and unique math clubs can be built up with an efficient use of resources regardless of situational factors.

Our organization also provides a mailing list and website for the benefit of starting math clubs. Our online resources present the basics of math club and distribute sample flyers, agendas, calendars, schedules, and activities. An online math forum is available for 24/7 discussion on FAQ's and tips on how to start a club. The organization will also function to "mother" new clubs, and "nurture" existing math clubs, through a combined synergy of the most enthusiastic math club presidents across the state.

The organization will be student run: math club members and officers as volunteers, members, or officers of our association. One of the biggest benefits of being a part of such an organization is that it requires a relatively low obligation with a high return, and smoothes the process out of leading a club. This is due to the fact that our association functions as a symbiotic network exchanging and spreading useful information. Once the organization is established, organization members will only need to attend/prepare for periodic events and meetings that will be spaced well apart during the school year, and simply share the activities and knowledge from their respective math clubs via the emailing list, website and/or forum.

What makes our organization special is that it will **proactively reach out** to other organizations and school districts across the state to garner interest. Reaching out will be done in several different methods: through the PTA, through weekend schools such as Northwest Chinese School and other ethnic schools, through tutoring centers, and primarily through school districts. District leaders of the organization will be required to gather all members of the organization in their district to present at the district meeting to school presidents about

the benefits of both this organization (WSMA) and math club. In turn, this will hopefully motivate parents of the PTA to distribute flyers to attract potential math club leads amongst willing parents and students. On the high school level, this may attract math teachers who will not only realize that starting a math club is not only possible under their circumstances, but made much easier and simpler under the guidance of this organization. The benefits of a math club to a math classroom are also numerous, most namely that it is a resource for teachers to use to further student progress in mathematical skills development and testing scores.

To summarize, there are a multitude of problems regarding education in mathematics that our nation faces today. Although math club is a resource that has the potential to solve many of these problems, math clubs are difficult to start and maintain, and establish. The Washington Student Math Association aims to help others establish and maintain math clubs.

For more information about our association, our services and our mission; please visit our website at: <http://wastudentmath.org>