

## Notes on Heterogeneous Classes

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Adapted from the Urban School Math Department Handbook

Math classes at Urban are not tracked – no honors track, no remedial track. This has forced us to develop some teaching strategies, which we share below. Since all classes are heterogeneous, even tracked classes, these strategies are integral to good teaching in any school.

Here are the key advantages of heterogeneous classes:

- no ceiling on average and weaker student achievement
- opportunities for students to learn from and teach each other
- greater diversity of learning styles benefits all -- if it leads to greater diversity of teaching techniques

On the other hand, untracked classes have their own problems, mostly revolving around the fact that they are difficult to teach:

- the teacher needs a deeper grasp of the subject matter
- it is easier to aim for the middle -- the extremes are challenging
- there are no models in other schools
- our concern for weaker students being left behind
- weaker students' perceived need: less depth, less breadth
- stronger students' perceived need: go faster, not deeper

### Teaching Strategies

The range of student abilities at Urban is greater than for some other independent schools, but less than in large public schools. We do have extremes at both ends. We have honed some strategies for dealing with this. In placing students in classes, we have a two-year age spread in most of our classes. Instead of offering a watered-down version of a given course, and an honors version, all students take the same course, but they take it at different times in their school career. Thus Math 2 has both 9th and 10th graders, Functions has both 11th and 12th graders, and so on. Of course, this does not make it easy to deal with heterogeneity. To do this well requires a range of teaching strategies, which are outlined below. Some of the strategies are detailed in other documents in our Department Handbook.

#### 1. Alliance with the strongest students

This may be the most crucial component of our approach, and is probably the most difficult to understand. The idea is not to abandon the weakest students (see next section.) Rather, this approach is predicated on understanding that in a student-centered classroom, the top students are the engine that drive the class. If we do not keep the course challenging and interesting to them, we lose their respect and their cooperation, and thus we lose our key helpers in teaching the rest of the class.

Moreover, in the broader political sense, we create a situation where the anxieties of those students' parents can create a backlash against heterogeneous classes and cooperative learning. This is not mere theory; it is precisely what happened on a larger scale in the movement for math education reform in

California public schools. In the particular reality of independent schools, we are being compared to the top schools in the Bay Area, both public and private. If we appear to offer a second-rate program, we become the target of parental and eventually administrative pressures to change our ways.

Finally, we need to keep in mind that our responsibility as educators is not merely to have our students pass the class. This could be accomplished easily by watering down its content and slowing its pace. We have a greater responsibility: passing on the mathematical heritage of our civilization to the next generation. Among our students are the future scientists, engineers, mathematicians, and math and science teachers, and it is in no one's interest to miseducate them.

Specific techniques for this: sponge problems (hard problems at the end of a day's assignment that not everyone has to do); genuinely challenging bonus problems on tests and quizzes; open questions on reports; ...

## **2. Support for the weakest students**

This is the other side of the coin. We support the weaker students by addressing part of class time to them, and by encouraging them to take advantage of Math Café and Consultation Period in order to get help outside of class.

## **3. The elevator approach**

There is no "right level," so do not limit yourself to "aiming for the middle." Do something too difficult and something too easy every day, and navigate through all the levels in between.

## **4. Pursuing deep questions, in order to offer both access and depth.**

These "no threshold, no ceiling" questions are the key introductory problems to most units we teach — Polyomino Perimeter, Angles Around a Point, Geoboard Squares, Iterating Linear Functions, etc.

**5. Multiple representations of concepts** (numerical, graphical, algorithmic, symbolic, geometric, etc.) in order to reach students with different learning styles, and to deepen everyone's understanding.

**6. Constant forward motion / eternal review.** Do not wait for everyone to understand a concept before moving forward. Do not assume all students know techniques and concepts from previous years or weeks: review as much as possible.