WELL VERSED IN THE WHY

Critical thinking mastered by asking why, not how

By Mary Chin, Lead Mathematics Teacher, Arete Prep

At Great Hearts, we ask students to be critical thinkers in each of their classes. For mathematics specifically, we want students well versed in the "why" as opposed to focusing on the "how."

When students understand why they solve a problem with a particular strategy, they are more equipped to tackle new problems. If they merely focus on the "how" and memorize a process, they may be able to repeat that process on a very similar task but they are not able to transfer this knowledge to any new task.

To understand the "why" also means focusing on the deep connections between ideas. If our calculus students truly understand a derivative as a slope and also are able to make connections between slope, rate of change and speed, they are then able to apply these derivatives in myriad situations.

When I think about developing critical thinkers and problems solvers, I really hope that we are training our students to act like mathematicians or scientists who spend more time and energy understanding and making sense of a problem before following through with a strategy for a solution. In his book *How to Solve It* (a favorite amongst math teachers), G. Polya summarizes this idea well: "The worst may happen if the student embarks upon computations or constructions without having understood the problem."

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How should we approach this problem? Why does this strategy work in this case? What may be a more efficient method? I am interested in these types of questions to stimulate critical thinking. An even more telling example is giving students problems that don't have enough or have too much information. Typical textbooks give just the right amount of information to solve a problem. If a student recognizes the need to ask for more information or realize that she is given superfluous information, then she is really working to make sense of the problem.

To develop well-rounded students with finely tuned, critical thinking skills, it is important to encourage them to analyze and question the world at-large. This year at Arete, we are focused on "fostering the heart of the learner." We really want our students to be life-long learners and a good way to start that process is to ask them to think about what is going on in the world around them. We don't want students to think that knowledge is something that comes from outside but rather something that they develop and find within themselves.

I'm reminded of a quotation from Plutarch: "The mind is not a vessel to be filled, but a fire to be kindled." We specifically look to instill a sense of wonder and depth of inquiry in our classrooms. As educators, we need to ask questions too. Are students looking merely for correct answers or are they looking to make connections and wonder about what is happening?

If they do not stop to consider the beauty or the connections, then they are likely not enjoying what they are doing. On the other hand, the more that students can wonder and stand in awe, the more likely they are to be on a path of being a life-long learner. If students merely answer the questions and do not look further, they may not enjoy what they are doing and, therefore, may not be able to have the stamina for long-term learning.

Photo by Jared Platt

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