as 1993, shows that a process called deliberate practice may be the best way to gain expertise: that is, people learn a skill best by taking on a challenge appropriate for their level. GEMS mentors and directors strive to challenge students and to make the material accessible and interesting by providing examples of physical principles, and by proving their assertions with real data that the students can see. For example, to teach students about electricity, GEMS used a lesson that gave the students an opportunity to play with light bulbs in series and in parallel circuits, and encouraged them to test the mathematical principles behind circuits themselves. GEMS uses educational research to build a new generation of researchers, also using its own mentor and student surveys to test the effectiveness of different strategies.

But, as the director Edna Crocker says, GEMS is not a tutoring program, “it’s enrichment.” GEMS is about “stimulating girls’ interest” in math and science. According to Crocker, the middle-school age group is a critical age when students can lose interest in math and science, or get really excited about continuing their studies. Mentor involvement is also very important, Crocker says, because mentors discussing their own experiences makes students more interested in college. So GEMS’ real mission is to help students enjoy math and science, independent of classes, homework, and exams.

Perhaps the most important thing mentors do in GEMS is encourage students to form their own hypotheses and experiments. Students often ask questions and make suggestions on their own, like “What happens if we change the procedure for dipping the paper and ink in water?”, “What happens if we try to use hand sanitizer to extract DNA instead of alcohol?”, and “Why did we get lower voltage this time? Maybe we should test with a different set of electrodes to see if the used-up electrodes were causing the problem.”

With the exposure they gain to math and science in GEMS, these girls may very well make the next great discovery in science.

Beautiful ink smears resulted from the chromatography activity. Students compared them to smears from a ‘ransom note’ and analyzed their results.

Students left slips of paper slightly immersed in water to allow water to travel up the paper by capillary action.

At another GEMS session, students built small electric motors out of a D-cell battery, magnet, and loops of enamel-coated wire. The loops of wire are whirling furiously!