

Classroom research: As close as your own students

Barbara Malcom and Sheila Parker

Teachers often try to apply ideas they have encountered in research articles. Although applying the research of others is one way for teachers to improve their teaching performance, undertaking research in their own classrooms provides additional opportunities for growth that results from closely observing their own students during the course of the research. The purpose of this article is to encourage teachers to give classroom research a try. We believe that the benefits of this approach far outweigh any extra work that may be needed.

A teacher's instant response may be, "I already have too much to do. Why should I try classroom research?" Our response is that classroom research improves both teaching techniques and the interactions that occur in the classroom. Our educational system tends to limit initiative and responsibility and encourage conformity and control. Society, pupils, and teachers deserve better. Classroom research gives teachers the opportunity to form hypotheses based on actual experiences. If you want to put a "spark" into teaching and create a dynamic and energetic environment, then classroom research may help.

Benefits from Our Research

We believe that the hallmark of a professional is self study. In our research with our own students, we found numerous benefits, including increased understanding of ourselves. For example, when Sheila did research on her questioning techniques, she found that she usually presented fewer questions to her failing students than other students. She concluded that she did not question those students having difficulties because she did not want to embarrass them in case they did not know an answer. She also discovered ways to ask questions that would lead her students to the correct answer.

Before beginning a study of calculator use, Barbara believed existing research findings that about 50% of the Algebra I curriculum lent itself to calculator use. She found that only about 24% of the selected chapters in her textbook were appropriate for calculator use. After doing the study, Barbara felt that her willingness to be introspective had increased. As

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a result of Barbara's participation in the study of calculator use, Barbara was less ready to accept others' research without first testing it. She had assumed that all of her students' parents would encourage the students to participate in the calculator use study. The best student in the class, however, was not allowed to participate, which was a major disappointment.

By conducting research we gained confidence in our ideas because conclusions were grounded in observations and data from our own students. We also found that conducting research with our students improved the rapport within our own class. Our students enjoyed being part of a large project and having the opportunity to express how they felt about mathematics. When the students realized that we valued them as learners, they participated more enthusiastically.

Conducting Your Research

It is great to get excited about carrying out a project, but you need to know how to conduct research properly. The first stage is planning the study. Choose a problem that can be researched but is not so complex that you will become discouraged. Consider situations you want to improve or change, events that are irritating to you, or perhaps a new idea that you want to try with your students. Many teachers have beliefs about what should occur in the classroom, but what they actually practice is different. If you want to see if your beliefs and practices are consistent, then classroom research can help.

After you select a topic, library research is in order to see what types of studies have been conducted in your area of interest. It is important to realize that every study is only a piece of a body of research. You may come across a study that you find interesting which you can replicate to see if the conclusions will be the same for you and your students. Examining other studies will certainly give you some ideas on how to get started.

Another big part of planning is deciding how you will carry out your research. The research methods you choose should not interfere or disrupt your teaching commitment, and the methods of data collection should not be too demanding on your time, or you may not complete your project. Also, keep in mind that different techniques for data collection have advantages and disadvantages. The following are possible techniques for teachers conducting research.

Write your general impression of events that occur in a notebook. These field notes should address a specific issue. For example, Sheila kept notes on questions her students asked so she could address those questions in the future with other students. The use of field notes taught Barbara that her plan book was too

small. The information she gained about herself and the details of each class were valuable and educational. A way to look at yourself and your classes is by keeping field notes. For these reasons we will continue to use field notes this year and in the future. This method is simple, but it is sometimes difficult to remain objective.

Have your students keep diaries. Students can provide you with different perspectives. Barbara asked her students to write in their diaries about the project, their use of calculators, and about specific story problems that were used as class starters. Writing about the story problems identified which problems the students enjoyed the most and least, and gave Barbara specific ideas about difficulties the students were having in problem solving. These facts can be used to improve her teaching of problem solving strategies in future classes.

Alternatives to diaries are interviews and questionnaires, although interviewing students is rather time-consuming. Both of us chose to use questionnaires. To make it easier for us and our students, we usually gave them a choice of answers instead of open-ended questions. For example, Sheila asked her students, "When I ask you a question, how do you feel? confused, proud, embarrassed, glad." Try to stress that there are no 'right' or 'wrong' answers or you may get teacher-pleasing results.

Other techniques are audiotaping and videotaping which provide accurate and detailed evidence. Although taping can be time consuming and expensive, it can be worth the investment. Taping is useful for validating one's opinions or providing alternative conclusions. Be sure you can operate the equipment before you begin class. On one occasion, Sheila used audiotaping and noticed halfway through the lesson that the tape recorder was not playing because she had not pressed the button firmly. Barbara used the video-camera once with a tripod and did not tighten the screw. As a result, in the middle of filming, the camera tilted and filmed the floor.

You may want to have a colleague observe you and your students. Provide the observer with an observation form to help the observer focus his or her attention. Always pilot the observation form before you begin the study. When Sheila had an observer pilot a form she created, the observer said it was too difficult to use, and the observer then helped Sheila develop a new form. If your form is confusing to the observer, your results will probably be inaccurate.

A rating form was used by Barbara, Sheila, and their students in each lesson to rate problems as to whether a calculator was helpful. The results from the rating forms and the results from the observer forms provided different perspectives and added to the validity of the research.

Always remember to pay close attention to ethical procedures. First, get parental consent. All data gathered should be kept confidential, and credit should be given to all sources that were used. The methods you choose must be reliable so that you can formulate hypotheses confidently and develop strategies applicable to classroom situations.

Reflecting on Your Research

After you plan your study, and collect and interpret your data, then you should take time to reflect on what has taken place. What are the outcomes of your research? What theoretical implications can you make? What action was taken as a result? Was the action appropriate?

Research does not do anyone any good unless the conclusions are applied in practice. When you have finished your research, you will want to do three things. First, you need to review your procedures and draw conclusions that you can use to improve your teaching. Barbara's students felt that participating in a study on calculator use helped them. Learning this fact suggested to Barbara that she should conduct mini-projects aimed at helping her students increase their own confidence. She learned that, at first, students thought that the calculator would solve all their problems. The students learned that not all problems should be done with the calculator and quickly learned the importance of the data put into the calculator. Calculators did increase confidence for most of the students. Also, Sheila's students conveyed that she needed to ask more challenging questions.

Secondly, ask yourself what you would do differently next time. There will always be room for improvement, but research should become easier each time you do it. A good way to analyze your work is to keep a written record of your research, including the purpose, the procedures, the results, and a discussion of ways to improve your teaching techniques and your research methods.

Lastly, share your results and your experiences with other teachers. We found that our research not only benefited us and our students, but was also interesting and helpful to other teachers. For example, Barbara surveyed calculator use in the middle school where she teaches. She asked the other teachers to give a percentage of the time they allowed students to use calculators and found that the percentages ranged from 0% to 90%. Later in the quarter, she gave a presentation to urge teachers in her mathematics department to let students use calculators. At the end of the presentation, most said they would give calculators a try. This year more teachers are allowing students to use calculators. This was one of the best outcomes of her research project.

Conclusions

You may need some outside sources to get started. An excellent source as a guide to beginning researchers is *Teacher's Guide to Classroom Research* by David Hopkins. Sources for possible research topics are found in *Research Within Reach: Secondary School Mathematics* by Mark Driscoll and *Classroom Ideas from Research on Secondary School Mathematics* by Donald Dessart and Marilyn Suydam.

An experienced classroom researcher is a helpful resource. It was important to share ideas and make improvements in our plans before we shared them with our students. We met frequently with each other and

with Dr. Patricia Wilson at the University of Georgia while we were planning our study. We continued to meet while we were conducting our research and interpreting data. The exchange of ideas helped us to avoid many potential problems and helped us grapple with the problems we did encounter. While doing your research, try to involve at least one other colleague as well as an experienced researcher.

In conclusion, classroom research benefits both the teacher and the student. It enables teachers to be more aware of classroom practices and interactions. When a teacher becomes more aware, then chances are greater that improvements will take place. One of the improvements that usually occurs is a better

relationship with the students. As a researcher, you will learn first-hand even more about yourself and your students. So pick a topic and try it. The results are great!

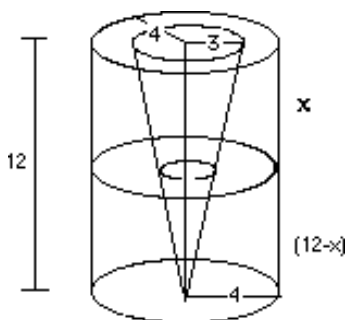
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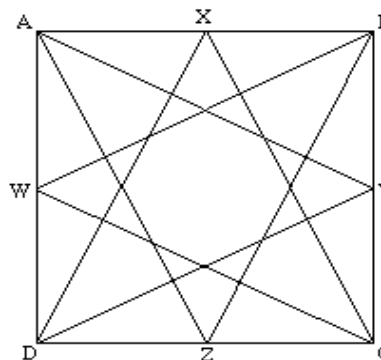
From Dr. Wilson's Notebook...

Cocktail Glass Problem

A cocktail glass is made by drilling a cavity into one end of a right circular cylinder of radius 4 cm. The cavity has the shape of a right circular cone of radius 3 cm and altitude 12 cm, and is concentric with the cylinder. The cocktail glass (standing upright) is cut by a horizontal plane x cm from the brim, resulting in a ring-shaped object and a remaining (smaller) cocktail glass. The ring-shaped object is now melted, the molten glass is poured into the remaining cocktail glass, filling it to the brim. What is the value of x ? (Problem # 4247, *School Science and Mathematics* 90(5) May/June 1990).



Octagon



In the diagram above, W, X, Y, and Z are the midpoints of the sides of square ABCD. The eight segments obtained by connecting the midpoint of each side to the endpoints of the opposite side form an octagon in the interior of the square.

- Prove or disprove: The octagon is regular.
- Find the area of the octagon.

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Dr. Wilson's professional experience includes teaching at high schools, as well as universities. He has been a visiting faculty member at six universities across the USA, and Shanghai Normal University. He worked with the School Mathematics Study Group at Stanford. He has served at the National Science Foundation. Dr. Wilson has had a very active membership in the National Council of Teachers of Mathematics, serving on the Board of Directors, as well as being a member of the Executive Committee and numerous other committees. He was the editor of the Journal for Research in Mathematics Education, and a member of the Journal's Editorial Board as well as the Editorial Research Advisory Subcommittee. Dr. Wilson was an organizer and chair of the Special Interest Group for Research in Mathematics of the American Educational Research Association and was on the School Science and Mathematics Association Board of Directors.

For years, Dr. Wilson has been interested in problem solving. A regular department offering, his problem solving course is stimulating and challenging. His interest in problem solving has spilled over to the use of technology and through him many students have had opportunities to learn about different softwares useful in the teaching and learning of mathematics.