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## **Full Length Review Article**

### **CHALLENGES AND ISSUES OF INNOVATIVE METHODS IN TEACHING MATHEMATICS**

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#### **ABSTRACT**

Today's mathematics teachers are experiencing major changes not only in the mathematics content they teach, but also in the way they teach. Now teachers are called on to teach new, more challenging mathematics to a very diverse audience using active learning approaches designed to develop understanding. In this paper, I address the challenge and issues of innovative methods on teaching mathematics. To meet this challenge mathematics teachers need the support and encouragement of students at all levels. The challenges addressed here are new curriculum materials, high stakes tests that are not aligned to new curriculum, integration of technology, and block scheduling. The issues such as the role played by mathematics textbooks, the national numeracy strategy, international comparisons of mathematical attainment, the values adopted, implicitly and explicitly in mathematics teaching, how to use and not to use classroom resources also discussed.

#### **INTRODUCTION**

Innovative methods of teaching are a goal of many educators. Teaching students in ways that keep them engaged and interested in the material can sometimes be a challenge. Visualization, technology tools and active learning are a new and innovative method of teaching is a crucial skill for high school teachers. Brain research has shown that certain methods and approaches can truly enhance the learning process. Applying innovative learning and attention-management techniques to classes is a win-win for both students and teachers.

##### **Visualization**

Visualization is an especially good teaching strategy for reading and literacy teachers. Visualization skills help them to understand, recall and think critically about subjects they study.

##### **Wisely managed classroom technology**

Computers, tablets, digital cameras, videoconferencing technology and GPS devices can enhance a student's learning experience.

Possible uses of classroom technology include using video games to teach math and foreign languages, leveraging Skype to communicate with classrooms or guest speakers from around the world, or multimedia projects that allow students to explore subject matter using film, audio and even software they create.

##### **Active Learning**

Peer instruction, discussion groups and collaborative problem solving: Students break into small groups to do research online, chart out ideas and discuss ways to meet the challenge. Groups upload their work to a blackboard site, where the teacher can review it. At the end of class, each group shares what they've learned with their peers. Innovative methods of teaching can help high school students get the most out of their education. When teachers decide to use innovative materials in their classrooms, several questions arise. Educators and researchers are encouraged to help teachers refine methods and establish links between their beliefs and effective innovation. Nearly all of these teachers came through school when mathematics consisted of a collection of facts and skills to be memorized or mastered by a relatively homogeneous group of students taught using a lecture approach. Students in middle and secondary schools require an education in mathematics that goes beyond what was needed by students in the past. This is a significant challenge to today's mathematics teachers.

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## Challenges in innovations

In all math classes, the sequence of activities was the same. First answers were given for the previous day's assignment. The more difficult problems were worked by the teacher or a student at the chalkboard. A brief explanation, sometimes none at all, was given of the new material, and problems were assigned for the next day.

The following list contains some of the challenges facing mathematics teachers today:

- Higher expectations
- New curriculum materials
- High stakes tests that are not aligned to new curriculum
- Integration of technology
- Block scheduling.

Each of these challenges calls for support and encouragement from the educational leaders of these teachers.

### Higher Expectations

Students who have never experienced success in mathematics will be placed into 'academically challenging' courses ... some students will blossom in the hands of well-trained, caring teachers who teach a different kind of mathematics ... other teachers will continue to teach the kind of algebra they have always taught in ways they have always taught, even though their audience is drastically different. These latter teachers, Seeley points out, will claim that the students could not handle the higher expectations and will issue failing grades confirming their belief that some students cannot deal with some of the mathematics curriculum. Seeley points to an alternative and equally unfortunate scenario: "In other districts, compassionate teachers concerned about the potential for students failing or teachers pushed by administrators concerned about high failure rates, will see to it that algebra becomes accessible to their students by watering down the content of their course" Neither scenario will have a positive impact. The key to avoiding the situations described by Seeley is teacher professional development.

### New curriculum materials

The current offerings from major textbook publishers are now beginning to address directly the vision put forward new Standards. Video and computer delivered instructional resources are also beginning to show promise. Teachers need time and guidance to examine these new offerings, consider them while working with students. With such a growing wealth of materials and new delivery systems, teachers can plan courses by using materials from different sources. While this enhances the students' experience, it makes planning for instruction more time-consuming.

### High stakes tests

Too many of the tests used today to measure success focus on too few areas of mathematics. Many tests fail to assess students' achievements in problem solving, communicating mathematical ideas, connecting mathematics to reality, and

reasoning mathematically. The tests do not address any of the primary standards that the authors of the standards document hold are the basis for the authentic learning of mathematics: problem solving, communication, reasoning, and connections." Through assessment we communicate to teachers, to students, and to parents what we value in learning. We are at a time when our curriculum and our instruction speaks in the language of inquiry, constructivism, and active learning while many of our assessment methods listen only to the rapid recall of isolated facts. The Advanced Placement Calculus examinations and the new AP Statistics examination include high-level, open-response questions and actually require the use of a graphing calculator with specific features. Both the SAT and the ACT now allow the use of calculators.

### Integration of Technology

Most mathematics teachers working today learned mathematics without the use of technology. A few were pioneers as computers began entering the classroom teaching programming languages such as BASIC, but in mathematics, as in other subjects, the promise of computer technology has not been fully realized. Unlike other subjects, a particular technology has had and continues to have a profound influence on mathematics instruction. Hand-held computers with built-in mathematics software (known to most teachers as graphing calculators) are successfully changing how mathematics is taught and learned. Teachers are using the graphing calculator in visualizing concepts, exploration, experimentation, generalizing, and checking solutions to algebraic problems. In addition, training [has] led to the restructuring of topics taught in mathematics. Many teachers are omitting or giving less attention to certain topics ... also, many teachers of algebra are using real world problems to motivate their students and they are also using the graphing utilities of the calculator to solve equations and inequalities. Graphing calculator technology has the advantages of low cost and high portability. Teachers can assume that their students will have access to the technology outside of class, even at home. Special computer labs are unnecessary, and with equipment like calculator-based laboratories (CBLs), data gathered in science class can be stored in the calculator for use in the mathematics class.

### Block Scheduling

The increasingly popular move to block schedules offers a particular challenge to mathematics teachers. Classes of students actively discovering concepts while using technology and experimentation are better suited for longer time periods than more traditional lecture-format classes. Before adopting a change to longer class periods, an assessment of teachers' willingness and ability to lecture less and involve students more is advised. Effective staff development addressing new techniques will likely be necessary and adequate planning time is needed as teachers adopt new methods. The mathematics curriculum should also be reconsidered when making a dramatic scheduling change. It seems naive to assume that the familiar Algebra I-Geometry-Algebra II sequence of year-long five-day per week 50-minute classes will work as well in a alternating or semester block schedule. Teachers should consider additional courses or topics that address data analysis or discrete mathematics. Integration of these and other topics

as well as other subjects, particularly science, should also be considered. Semester block scheduling offers yet another challenge.

Students' who take a one semester mathematics class, then pass on math for one semester and a summer are likely to have difficulty when they begin studying mathematics again. It has been conjectured that if the learning is more meaningful, the difficulty will be minimized. There has been no definitive study to document whether the gap in learning is truly a problem. Mathematics teachers in the United States are among the most innovative in the world. They reach a broad, diverse audience of students teaching mathematics content that, in many cases, was not part of the curriculum they studied when they were students. They make increasing use of technology and other teaching strategies that they themselves never experienced as students. With the strong support and leadership of school principals and superintendents, mathematics teachers will build on the moderate successes of the past decade and develop our students' potential in mathematics into a wellspring for our nations' future.

### Issues in innovations

Issues in Mathematics Teaching brings together a number of key, and sometimes controversial, issues in mathematics education, which will be of concern to all those teaching the mathematics. It focuses in particular upon the social context of teaching mathematics and its impact upon teachers and pupils with diverse social and cultural backgrounds.

The issues include:

- The role played by mathematics textbooks
- The national numeracy strategy
- Incorporating ICT
- International comparisons of mathematical attainment
- The values adopted, implicitly and explicitly in mathematics teaching
- How to use and not to use classroom resources

Issues in Mathematics Teaching makes complex issues accessible without trivialization and will be of interest to all those charged with teaching mathematics. However, tech devices in the high school classroom require teachers to add a component to their classroom management. Giving students laptops or tablets means teaching them to use devices respectfully and preventing damage to the equipment. Tech-savvy teachers gave Education Week the following advice on using classroom technology: Explain that the use of tech tools in class is a privilege not everyone has and if abused, it can be discontinued.

During class, teachers should move around the classroom or use monitoring software to ensure students are using their devices appropriately. When they understand that their teacher will intervene if they go off-task, students know they must focus on their assignment. Put students in charge of the upkeep of devices. Classes can learn tech terms, basic maintenance tasks, and appoint a few students to serve as tech monitors responsible for distributing and storing equipment. Doing this creates a sense of value and ownership for the welfare of classroom technology.

### Conclusion

Teachers need the commitment and support of educational leaders as they adopt new curriculum materials and new methods of teaching. Teachers find it time-consuming and demanding to examine their beliefs and adjust their teaching practice and may be inhibited by conditions within the schools. For example, teachers often feel pressure to appease administrators by implementing an innovation without examining their own beliefs and developing their own adaptation of an innovation. Being a Mathematics teacher our aim is to examine how teachers answered fundamental questions about their adoption of a mathematics innovation, and how these answers impacted their success with the innovation.

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