

# **A SURVEY OF THE USE AND EFFECTIVENESS OF TECHNOLOGY BASED MATHEMATICS INSTRUCTION AMONG TEXAS HIGH SCHOOL AND COLLEGES AND UNIVERSITIES: A PRELIMINARY REPORT**

**Reza O. Abbasian**

Texas Lutheran University  
Department of Mathematics and Computer Science  
Seguin, Texas, 78155 USA  
[rabbasian@tlu.edu](mailto:rabbasian@tlu.edu)

**John T. Sieben**

Texas Lutheran University  
Department of Mathematics and Computer Science  
Seguin, Texas, 78155 USA  
[jsieben@tlu.edu](mailto:jsieben@tlu.edu)

## **Abstract**

In this paper, we will present the results of a survey of technology-based mathematics education among Texas high schools and colleges. In our survey we have focused on the type of technology used (mathematics software, web-based instruction, statistical software, etc), the proportion of courses that used technology and the effectiveness of these tools in teaching mathematics.

**Keywords:** technology-based mathematics instruction, Maple, Geometer's sketchpad, statistical packages, CAS in high schools, CAS in colleges

## **Introduction**

The authors have used technology in the mathematics and statistics classes for over twenty years. We believe that technology, when used appropriately, can enhance a student's understanding of complicated topics in mathematics and statistics. For related background information on the use of Maple, Geometer's Sketchpad and other mathematical software see previous entries in the ICTCM Proceeding by these authors. Most mathematics students, in high schools and the undergraduate level, do not have the maturity and the background knowledge to be able to complete meaningful mathematical experiments. It has been our experience that technological tools such as Maple and Geometer's sketchpad may compensate for some of the shortcomings of an inexperienced researcher. These tools are powerful enough to allow a student to conduct various mathematical or statistical experiments to achieve reasonable results. In our conversations with our colleagues we have encountered many points of view regarding the effectiveness (or lack thereof) of using technology in mathematics education. There is anecdotal evidence that technology is used widely and effectively in high schools and colleges around the country. Maplesoft reports the sale of 3800 site licenses. Even if only a portion of these licenses are sold to universities, it indicates a large demand among universities for Computer Algebra Systems. Geometer's sketchpad in a recent press release claims that about half of high schools use Geometer's sketchpad. However, there is no solid evidence about the effectiveness of these tools. To the best of our knowledge, there has never been a comprehensive survey of

schools, colleges and universities, concerning the use of technology in the state of Texas. We hope by the time we have completed our survey among high schools colleges and universities, that we will have, with a reasonable degree of confidence, found the answers to several questions- chief among them: What kind of mathematics software ( Maple, Mathematica, Derive, Mathlab, Geometric sketchpad, etc)) is being used? What type (if any) of Statistical package (Minitab, SPSS, SAS, etc) are available? What proportion of mathematics and/or statistics courses use the software and to what extent? Is there an extensive use of web recourses for teaching mathematics? Is there a use for MS office products such as Excel in teaching mathematics and statistics? What is the general attitude of the faculty towards using technology? Is there any assessment tool for measuring the success of technology-based mathematics instruction? And if so, what are the results? For us at TLU, this is the first step of our research towards establishing a summer Institute at TLU which will help local high school teachers and our mathematics education majors to become familiar with some of tools and incorporate these tools into teaching of the mathematics. We also hope that our colleagues who use (or intend to use) technology to approach the task with proper strategies informed by our survey.

### **Summary of the results**

Our goal was to reach an understanding of how pervasive is the use of computers and mathematics software in the state of Texas. The survey is actually the first part of a two part study. We want to understand who is using the computer algebra programs, geometric exploration software, etc. and then we want to investigate the effectiveness of teaching with the help of the technology components. To understand usage in Texas we developed separate surveys for high schools, two year colleges, and the senior colleges. Highlights of our results follow.

In Texas high schools 70% report that most of their faculty make frequent use of computers and software in the teaching of mathematics. That is in sharp contrast to the senior universities where only 37% report that most of their faculty make frequent use of computer technology for teaching mathematics. Not surprisingly, we found that universities are more likely to use CAS and statistical software than high schools and two-year colleges. But high schools and two-year colleges are more likely to use excel and other software such as on-line homework and tutoring (figure 1).

When the subject was limited to Calculus I and II the picture was overall brighter for Texas. We found that both Texas two year colleges and universities have a greater percent of faculty using Computer Software in conjunction with their calculus courses than do their counterparts across the nation[1].

Statistics is a subject renowned for collecting, organizing and analyzing large amounts of data and one would expect that this would be the first subject to be taught using computer technology. Surprisingly our surveys reveal that Texas two year schools and universities are significantly behind their counterparts in the rest of the USA in using statistical software in the teaching of statistics[1]. Slightly less than half of the faculty at Texas two year colleges and universities use statistical software for teaching statistics.



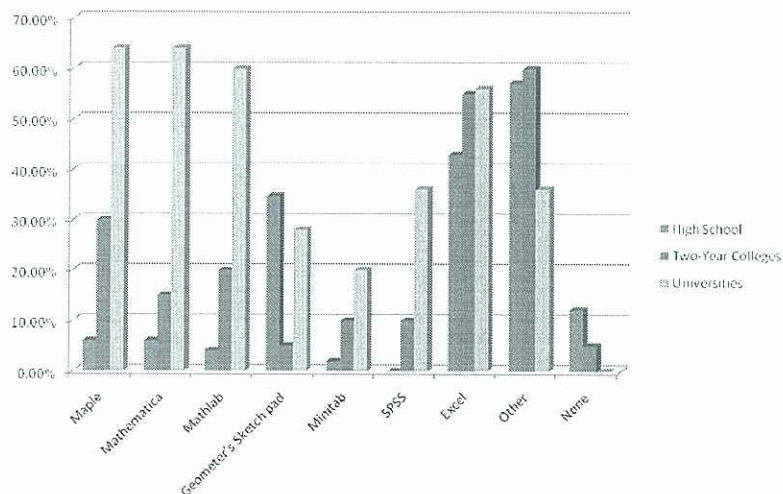


Figure 1: type of technology used by high school, two-year colleges and universities

If we just look at the use of CAS, a surprising pattern emerges. The use of CAS by faculty in Hungary [2] matches almost exactly the use in the USA and the use in the United Kingdom matches almost exactly the use in Texas. Why this is so is an open question but bar graphs of the responses to the question, “Does your faculty use CAS: never, occasionally, frequently?” are strikingly similar (figure 2).

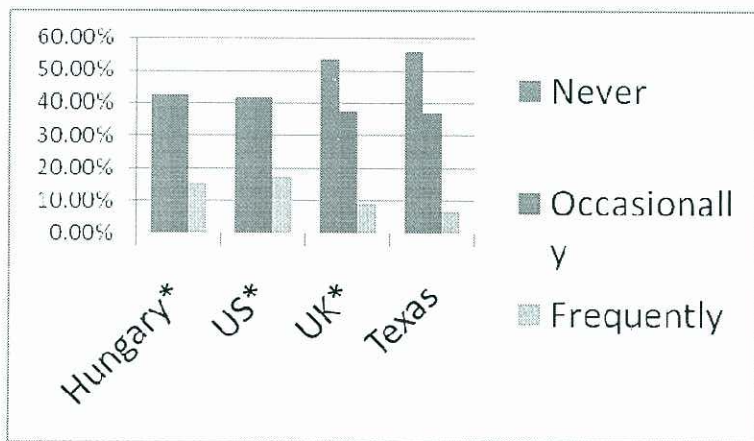


Figure 2: Use of CAS in Texas, US, UK and Hungary

The good news, at least if you believe in the power of CAS, GES, etc., to be a useful tool in the teaching of mathematics, is that in the past five years the use of technology in teaching has increased substantially in Texas high schools, two year schools, and universities. Also, in Texas 80% of high schools and 100% of the universities responding to the survey provide their students with access to the computer based mathematical tools.

Assessment of the impact of the computer based mathematical tools is notoriously difficult. We found that 59% of the high school faculty rated 80% of their graduating students as either intermediate or experienced users of the technology tools. But the

two year schools and universities found, respectively, 30% and 25% of their incoming students to be intermediate users of the technology and none were rated experienced (figure 3).

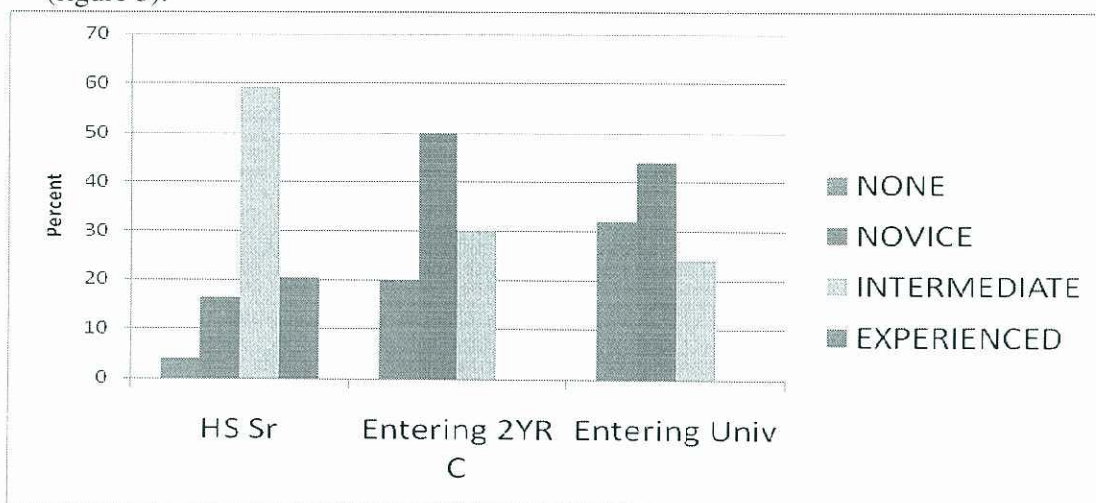


Figure 3: Assessing the ability of the student in using technology

While about 75% of the Texas high schools, two year colleges, and universities have learning outcomes for the use of technology in mathematics, 42%, 53%, and 68% of the high schools, two year schools, and universities reported to us that the use of technology has not been assessed. This emphasizes the importance of the next phase of this study. Next we intend to develop some reliable assessment methods for the use of technology in teaching mathematics.

## CONCLUSIONS

Our most encouraging finding in our survey is that, in Texas, the use of technology is increasing at every level: high schools, colleges and universities. There is ample evidence that our students appreciate the use of technology in our classes and are learning to use these tools to learn mathematics. The most alarming result of our survey is that after 22 years of ICTCM, less than 50% of the university faculty are using technology in their classes on a regular basis.

## ACKNOWLEDGEMENT

We would like to thank all the individuals who in spite of their busy schedule found time to complete our survey.

## REFERENCES

- [1] CBMS Survey 2005, *% of Calculus I & II taught using Computer Software or on-line resources*
- [2] Lavicza Z. *The Use of CAS in university-level mathematics teaching*, PhD Dissertation, University of Cambridge, 2007