

## TECHNOLOGY TOOLS FOR DISPLAYING MATHEMATICS AND GRAPHICS

Dr. Mary B. Martin and Dr. Dovie L. Kimmins  
Middle Tennessee State University

Box 34, Department of Mathematical Sciences, MTSU; Murfreesboro, TN 37132  
[mmartin@mtsu.edu](mailto:mmartin@mtsu.edu)    [dkimmins@mtsu.edu](mailto:dkimmins@mtsu.edu)

Presentations which involve mathematical equations and graphics force decisions regarding the production of the mathematical material in an efficient and effective manner. In addition to quality of type-setting and graphic production, there are also concerns regarding the learning curve for the software, the cost of the software, compatibility between programs, and formatting for different media. This presentation will address the issues of software selection, cost, and compatibility. A brief overview of formatting issues will also be provided.

### THE OPTIMAL COLLECTION

The optimal collection of software should be flexible, cost effective, and powerful with respect to graphics and mathematical equations. An additional desirable feature is an easy learning curve for the selected software. Finally, there are basic functions to be fulfilled in the production of any publication or presentation document. The recommendations for an optimal package must include at least one product which will fulfill each functional need. The following table summarizes the information for the optimal software collection. The collection recommended here will allow for the production of sophisticated presentations, deliverable through a variety of media. Prices were those available at the time of publication.

<b>Software package</b>	<b>Web site</b>	<b>Price</b>
PowerPoint	Local bookstore or office supply store	\$179 (academic version)
Word	Local bookstore or office supply store	(Included in above price)
Excel	Local bookstore or office supply store	(Included in above price)
Scientific Notebook	<a href="http://www.mackichan.com">Www.mackichan.com</a>	\$129
Dreamweaver	<a href="http://www.macromedia.com">Www.macromedia.com</a>	\$ 99 (academic version)
SnagIt	<a href="http://www.techsmith.com">Www.techsmith.com</a>	\$ 40
TI-83 GraphLink (optional)	<a href="http://education.ti.com/us/product/accessory/connectivity/down/downgraph.html">http://education.ti.com/us/product/accessory/connectivity/down/downgraph.html</a>	\$ 20 (cable)
<b>Total Cost:</b>		<b>\$467</b>

There are advantages and disadvantages to each of these packages; each of them will be presented according to the roles they play in document/presentation production.

## THE BASE SOFTWARE PACKAGE

Each presentation must have a base format for the type of presentation to be given or the type of document to be produced. The base software package should be chosen according to whether the presentation is to be made in print format or projected/displayed. In addition, the base software package should be flexible, compatible with other packages, and readily available at off-site locations if needed. The two basic base software packages are most likely to be Microsoft PowerPoint and Microsoft Word. The most widely used software product used for paper document production is Microsoft Word. Although Scientific Notebook is an option, it will be discussed later as it is not a first choice.

### **PowerPoint**

**Usage:** PowerPoint is the most universally used software package for information which is to be displayed via computer, computer projection, or video projection. It is also desirable for the production of poster presentations and handouts which outline a presentation. It may be used for internet display, although it uses a lot of space and can be slow sometimes. PowerPoint can be used to write interactive programs for tutorial packages. Once again, this can involve large files. The learning curve is reasonable, especially since there is a lot of overlap between PowerPoint features and Word features.

**Functionality:** PowerPoint is widely used as a document presentation base. It readily interacts with most programs, has a reasonable learning curve, and is available on most computers. PowerPoint accepts images in jpg or gif format, has readily available clipart options, and links to Excel and Word as needed. All of these features make PowerPoint an acceptable base from which to write a presentation which is to be projected or made with handouts. One use of Powerpoint which is often overlooked is in the of dynamic tutorials, such as those produced by Flash, which are interactive in the sense that the user controls actions on the screen through the use of buttons. The file size is considerably larger; however, most students have copies of PowerPoint on their own machines.

### **Word**

**Usage:** Widely used as a print document software package, Word can be used to produce reasonable html files. Once again, this method produces large documents. Word is not good for producing documents which are to be projected.

**Functionality:** Word also interacts with most programs and the learning curve is reasonable. Word is almost universally available. Word accepts images in jpg or gif format and links to Excel. Word has Equation Writer, which can be installed with Word or added later from the installation disc. Equation Writer is an acceptable equation producer provided the display is not to be in html format and that there are not too many equations. Word saves each equation as a separate jpg file, which is difficult for web display and for file management.

difficult to use solely for projection documents. Scientific Notebook will store equations in an html format for use on the internet. Finally, creating documents with extensive calculations is easier because Scientific Notebook will execute the calculations without the need for a calculator; the answer is already typed and ready to copy into the document.

### **SnagIt**

**Usage:** SnagIt is a screen-capture program which allows the user to capture an exact copy of anything which appears on the computer screen, apply annotations or edits, and send the image directly to file, printer, webpage, or email; it can also capture video clips of the computer screen and text. SnagIt is useful with Mathematica, old copies of Scientific Notebook, and any other source of images to be inserted in your document – especially composite pictures. A more complete video capture program, called Camtasia, is available from the same company.

**Functionality:** SnagIt is easy and intuitive to use with minimal settings necessary to achieve good results. There are fixed region, shapes, and hand-drawn options for selecting the input region. It is also possible to capture an image with surrounding text. Text can be captured from a document or other source, stored as a text file and then opened in a standard word processor. SnagIt works well to reduce the number of files in a mathematical document since you can capture up to a half page of text and equations at a time and insert as a picture into an html document. The annotation feature is also extremely helpful for tutorials. The video capture can record sample computer key-strokes and screen activities for tutorial purposes, or illustrations of the use of virtual manipulatives from sources such as the National Library of Virtual Manipulatives for Interactive Mathematics ([www.matti.usu.edu](http://www.matti.usu.edu)). Finally, if one wants to capture portions of graphics, images, spreadsheets, or web pages, then SnagIt is an excellent option.

### **Excel**

**Usage:** In the context of mathematical document production, Excel is most useful for the production of tables of values for functions, pie charts, and some calculations. It is also needed by those persons who teach mathematics via a spreadsheet system.

**Functionality:** Excel has a limited usage; however, when you need a spreadsheet, it is most compatible and nothing else will readily substitute. Excel documents can be pasted into PowerPoint and Word so that they are editable inserts. Excel is also somewhat useful in executing calculations.

### **TI GraphLink**

**Usage:** TI GraphLink connects a Texas Instrument graphing calculator to a computer and with the use of free TI GraphLink software allows one to make screen captures of

calculator images for use in documents or presentations. The image can be saved as a picture file in eps or tif picture formats and then pasted into Word or PowerPoint.

**Functionality:** The quality of the graphics captured from a TI calculator using GraphLink is not as good as that of the graphics captured from Scientific Notebook. However, if the document's purpose is to teach graphing calculator keystrokes or illustrate the output from a graphing calculator, GraphLink may be a desirable option. In addition, one can capture a list of calculator menu items or a list of functions. If one already owns a TI calculator, it is a low-cost way to produce 2-dimensional graphs of moderate quality into a document. Note: TI Connect Software is the newest generation of connectivity software and is usable for each type of TI graphing calculator.

## CREATING THE FINAL DOCUMENT

The software presented here will allow one to create any document, including mathematical symbols and graphics, with a reasonable facility, learning curve, and transportability. This list, while there are certainly substitutes available for the recommended software package, has been found by the authors to be the most cost effective, the most versatile, and the easiest to learn. When creating a document, there are many factors to consider which impact the quality of the presentation. Although often ignored, the following factors should be considered in the creation of a document for presentation or distribution:

1. Select the correct base document for the venue or media needed in the presentation.
2. If a print document is to be produced, use the clearest black and white options.
3. If a projected document, check font size and color on the projection system (or a similar one, if the actual one is not available). Stay away from reds and extreme colors (very white or very dark).
4. If a poster presentation, use PowerPoint to produce pages and always print in color. Use a light or blank background. Plan the placement on the poster board, and the number of pages, early in the construction of your presentation.
5. Construct outline and format of document (such as background choices and font choices); leave blank space for graphics and/or equations and insert them later.
6. Plan ahead if you also plan to include print documents as hand-outs.
7. Add enough graphics, clipart, and drawings to make the presentation interesting – but do not make it cluttered. A graphic on every page is excessive. Consider using a university or department logo on each page.

Additional information on constructing good presentation documents is available in a variety of sources and, in general, is not specific to the mathematical content.

A quality collection of appropriate software can improve all of your presentations and documents and yet need not be excessively expensive. The learning curve can be reasonable and the results can be quite impressive. The list presented here is comprehensive, cost-effective, and appropriate for almost all needs.

## **Dreamweaver and Flash**

**Usage:** Dreamweaver may be used for creating basic web pages, while Flash is a companion software package which can be used for the creation of web movies. Dreamweaver and Flash are html based packages which offer increased functionality over a Word/PowerPoint combination. These are recommended if one is going to make extensive web documents with interactive tutorials.

**Functionality:** The learning curve is steeper for creating web pages with Dreamweaver than it is for Word or FrontPage; however, the increased ability to add interactivity makes it well worth the effort. Dreamweaver works well as a target document for images captured by SnagIt. While interactive tutorials may be created through judicious use of PowerPoint, Flash also provides smaller file size and drastically increased functionality for animated tutorials – such as rollover buttons and the like. The learning curve for Flash is extremely steep and fairly non-intuitive.

## ADDING EQUATIONS, GRAPHICS, AND TABLES

There are several options for inserting equations and graphics into the base document. The exact choice depends on the individual author's knowledge base, the number and complexity of equations to be added, the source and type of the graphics, and the ultimate type of presentation for the document. If there are not many equations and the equations are not complex, the Equation Writer within Word and PowerPoint will be sufficient. If there are extensive equations, 2-D or 3-D graphics, or complicated equations, the best combination for producing the document is Scientific Notebook and SnagIt.

### **Scientific Notebook**

**Usage:** Scientific Notebook is best used for the production of 2-D and 3-D graphics and complicated or extensive mathematical equations. If you are going to produce a standard print document for handouts or standard internet documents, use Scientific Notebook for the entire document. If you are going to make transparencies, video material, poster presentations, interactive internet documents, or projected material, the base document to use is PowerPoint. There is a professional version of Scientific Notebook – called Scientific Workplace – which is available for the production of large scale documents (such as a complete book) and electronic submission of journal articles. LaTeX is the processor base for Scientific Notebook; it contains a Maple-like mathematical package.

**Functionality:** Graphs can be copied from Scientific Notebook into Word or PowerPoint; additionally, equations can be inserted directly also. This method does create a separate jpg or gif file for each equation or graphic. The learning curve for Scientific Notebook is extremely shallow – less than one-half hour for a majority of projects – and the program is extremely flexible. Scientific Notebook uses approximately one quarter of the space for typesetting as Word and keeps all equations within the single document file; however, it is not universally found on all computers and font inflexibility makes it