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"THE ROLE OF TECHNOLOGY TO LEARN STATISTICS"

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It is very difficult to imagine learning and teaching statistics today without using some form of technology. However, just 20 year ago that was very common. Today's statistics classes may be taught in classroom with a computer projected on a screen, or may take place in a laboratory with students working at their own computer. Student commonly own a calculator more powerful than the computers of 20 years ago. Others may use a portable computer (laptop) at school, home and on the move. An ever growing formatof teaching today is over the internet, in the form of a web-based course with video-taped lectures, interactive discussions. Collaborative project and electronic text and assessment materials. The technology revolution has had a great impact on learning and teaching of statistics, perhaps more so than many other disciplines. This is not so surprising given that technology has changedthe way statisticians work and has therefore been changing what and how we teach and learn.

This paper presents overview of the role technological tools to learn and teach statistics, to understand and reason about important statistical ideas. The main goal is to provide some background of how the technology tools are used in learning statistics to students and researchers, a sense of the research findings and open questions on how technology impacts to learn statistics, and specific advice for implementing technology. I first summarize some of the common technology tools (soft wares) currently in use in statistics education and how researchers and students can be utilized to support student learning.

Technology tools for the teaching and learning of statistics and probability:-

The types of technology used in statistics and probability instruction can be broken into several categories: statistical software packages, educational software, spread sheets, applets/stand-alone applications,graphing calculators, data repositories etc.

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There is much overlap in the capabilities of the tools across all possible educational uses of technology. I provide a brief summary of some statistical tools available and some of their benefits and limitations. Other resources such as the American statistician or the journal of statistical software regularly provide more comprehensive software reviews. It is important to remember that the focus of instruction should remain on the content and not the tool, and to choose technology that is most appropriate for the student learning goals, which could involve a combination of technologies.

Statistical packages are software designed for the explicit purpose of performing statistical analyses. Several packages have been used by (statistical program for social science), S-plus, R, SAS, Minitab. While development of these packages has focused on uses by industry, they have also evolved into more menu-driven packages that are more user friendly for students. The term menu-driven is used to describe a software program that is operated using file menus instead of commands. Menu-driven is commonly easier for most users as it allows the user to navigate using the mouse and to hunt and peck a bit more, which has both advantages (students don't feel as lost) and disadvantages (often using a trial and error strategy rather than real thought when choosing a command). As these packages become more user friendly, they are being increasingly use in introductory courses**.**

Minitab:

The statistical package Minitab in particular has always had a pedagogical focus and is becoming increasingly feasible as a tool that allows student exploration and construction of ideas (e.g. writing "macros" for repeated sampling, graphics that update automatically as data values are added or manipulated, ease of changing representations).

Data desk:

Data desk is a similar package but has focused on data exploration and interactive graphics from its initial development. Data desk provides many unique tools that allow students to look for patterns, ask more detailed questions about the data, and 'talk' with the program about a particular set of data.

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R (verzani 2005):

R is a language and environment for statistical computing and graphics that provides a wide variety of statistical and graphical techniques, including linear and nonlinear modeling, statistical tests, time series analysis, classification, and clustering. It is freely accessible and is being increasinglyused to learn statistics and to do job as data analytics.

More cost effective alternatives to these packages include student versions which are smaller in scope (does not work for as large of data sets) and several standalone statistical packages are also now available for free or atminimal cost, online, for example. Stat crunch (West, Wu & Heydt 2004), is a fully functional, very inexpensive, web-based statistical package with an easy- to-use interface and basic statistical routines suited for educational needs. Different kinds of statistical software programs have been developed exclusively for helping student learn statistics

Fathom:

A flexible and dynamic tool was designed with the input of many statistics educators and educational researchers to help students understand abstract concepts and processes in statistics, and does not attempt to have thecapabilities of more traditional statistical software tools.

Tinker plots:

This tool has been widely field tested in math classes in grades 4-8 in both US and other countries with very positive results. We can begin using tinker plot without knowledge of conventional graphs or different data types, without thinking in terms of variables or axes. By progressively organizing their data, we gradually organize data to answer their questions and actually design their own graphs.

Spread sheets:

❖ **Spread sheets such as excel are widely available on many personal computers.** However, care must be exercised in using excel as statistical educational package statisticians often criticize excels calculation algorithms and choice of graphical displays. For example, it is still very difficult to make a box plot in excel. Excel does have some strength in helping

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students learn to organize data and in "automatic updating "of calculation and graphs as values are changed, and some advocate excel due to its widespread use in industry and relatively easy access (Hunt 1996). Recommendations for using technology in statistics:

Research studies on technology in statistics education have pointed to several effective ways to use technology in the statistics. Below we provide a summary of what **we believe to be the most important issuesto consider:**

- ✓ Students become focused on the numerical calculations. This tendency can be exacerbated in a computer rich environment, especially in using statistical package that easily produce large amounts of output-learners focus on the output instead of the process. Rather than let the output be the end result, we believe itis important to discuss the output and results with students and require them to provide explanations and justifications for the conclusions they draw from the output and to be able to communicate their conclusions effectively. Although we can spend time entering data. It is more useful to have them do only small amounts of data entry and spend more time exploring, analysing and interpreting data.
- ✓ Collaborative learning is often particularly helpful in statistics education and technology can be used to facilitate and promote collaborative exploration and inquiry, allowing us to generate their own knowledge of a concept or new method in a constructivist learning environment.
- ✓ Technology should be chosen to facilitate student interaction and accessibility. Maintaining the focus on the statistical concept rather them on the technology. This choice can depend on the learning curve, portability, and flexibility of the tool. e.g., whether the technology tool can be utilized in other places in the course such as using the same software to carry out other data analysisor simulation tasks.

Summary:

Technology has been and will continue to be a major factor in improving student learning of statistics. Despite the endless capabilities that technology offers, instructors should be careful about using sophisticated software packages that may result in the students spending more time learning to use the software than applying it even in our

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advanced technology used in courses. Choice of a particular technology tool should be made based on ease of use, interactivity, dynamic linkages between data/graphs/analyses, and portability. Good choices if used appropriately can enhance student collaboration and student-instructor interactions, and often a combination of several different tools will be necessary.

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Minitab (http://www.minitab.com) or
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