

# The Impact of Computers and Associated Technology on the Teaching and Learning of Business Statistics at the University Level

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## Abstract

This article explains how recent changes in the teaching & learning business statistics are influenced by the increased use of computer and its associated technology. This paper also attempts to illustrate on how the pedagogy associated has also undergone a major transformation due to computers.

**Keywords:** Computers and associated technology, Business Statistics, Teaching & Learning

## 1. Introduction

Statistics as a discipline is an offshoot of Mathematics and has existed for many centuries. In schools and in universities it continues to be one of the subjects which are often considered to be difficult by students who try to avoid it. Statistical concepts are sometimes complex, abstract and involve laborious computations.

But the way statistics is learnt and taught has undergone a paradigm shift since the advent of computers. With the advent of first computing devices and eventually introduction of computers and related technology has changed the entire approach with which Statistics is being taught and learnt these days. Of course there are some advantages and disadvantages associated with the increased usage of computers in teaching and learning of Statistics but overall its use has lead to better understanding and handling of the discipline.

## 2. Impact on pedagogy

Advantages of using computers in teaching and learning Statistics definitely outweigh the disadvantages. One of the few disadvantages that come to mind is that more and more students are getting over dependent on computers even for the simplest of the computations. What once seemed logical has now been replaced by sophistication. This dependence leads to a student not grasping the technique(s) employed in reaching a particular solution. In my opinion the beauty does not lie in the correct solution but it lies in the process which leads to that solution. Computer oriented solutions more often than not ignore the process part of the solution. This is because the process is carried out in the CPU (central processing unit) of the computers. That is why it becomes imperative for teachers to give hands on experience to students on calculating problems manually as well, even if it takes more pain and time to do the same. This will also help in understanding on how the formulas are derived and how they differ from one situation to another and also on how the formulas can be adapted in unique situations. In the next sub-section I explain the recent changes and developments in the computer related technology that has affected the teaching and learning pedagogy of statistics.

### 2.1 Text Books

In recent years Statistics text books come with a CD Rom full of exercises, their solutions and data files. These data files can be used by the students to play around with and this aids learning by doing. Advent of computers has not only helped students but also teachers as it has become a lot simpler to teach and a lot more practical. The CD Roms which come with the text books often have MS PowerPoint slides with them and one can easily adapt those slides to suit his or her own teaching requirement. They are also appended with sufficient number of files full of data which could be easily used to play around with by students and teachers alike. This helps save a lot of teachers' and students' time in search of real life examples for analyses purposes.

### 2.2 Statistical Packages

Many applications have hit the market since the advent of computers. Their use in the classrooms gives students an opportunity to play with the real data. Fortran, Lotus 123 etc were some applications which were very popular

during nineteen eighties and early nineties but with the introduction of MS Office (MS Excel, MS Word, MS PowerPoint, MS Access) in 1995 provided the user with a very friendly software. MS Excel in particular has proved to be the friendliest of all the applications available in the market for statistical purposes. SPSS, Minitab, LISREL, Systat, Stataquest etc are some other packages that are used for statistical computations. Each of these software have their own positive and negatives and have different degree of ease with which they could be used. MS Excel and SPSS are widely used packages used in the universities. They are user friendly and cost-effective at the same time. Apart from this it is much easier to explain many concepts with the help of computers which otherwise need a very elaborate manual solution. Solving a Linear Programming Problem (LPP) is a good example. It would take a long time to solve a LPP by way of Graphical Method or by Simplex Method. But MS Excel-Solver solves the same in a matter of seconds once the problem is correctly formulated.

### *2.3 Research*

Advent of computers and related technology has helped researchers and their research work by manifolds. What used to take months and years in the early twentieth century and ever before could now be achieved in a matter of a few days and weeks. As Statistics is the study of collecting, editing, analyzing, compiling and presenting data. Use of computer has improved the quality of each one of these steps significantly.

Using internet one can send questionnaires and collect responses from potential respondents spread across the world (Prabhakar 2005 & Walker & Prabhakar 2006). The ease with which questionnaires can be filled-in and sent back using computers has undoubtedly improved the response rate. This has collection and comparison of data from different parts of the world much easier. Computer helps in analyses of data too. With a click of mouse one can create beautiful charts and pictorial presentation of data. Examples are many including regression analysis, correlation, trendlines, pie chart, bar charts etc. Business management students in particular stand to gain from these features as they would need these skills to function effectively once they join a management position at the completion of their studies.

### *2.4 Modeling*

Research in social sciences involves the evaluation of one or more models that have been developed based on theory that propose relationships among some or all of the variables in the model. Models help bring theory close to reality.

Modeling helps represent the abstract concepts in more understandable form. Computing technology has helped the field of modeling in a tremendous way. Simulations on computers have made modeling much easier and interesting. Factor analysis has lead to the technique of structural equation modeling which is made possible using a statistical package known as LISREL (Linear Structural Relationships).

Sample size requirements for SEM are generally based on the rule of thumb. A sample size of 100, 200, or even more subjects is considered good enough to deduce certain logical conclusions. (Boomsma, 1982; Marsh, Balla & McDonald, 1988).

Although models are generally based on data but for the sake of understanding, below I provide an example of the Structural Equation Modeling in the context of the factors mentioned in this article and their interrelationship and effect on success in teaching and learning. In an empirical research the path coefficients would also be indicated on the arrows.

### *2.5 Statistics online and interactive programs*

It is commonly believed that customary methods of teaching statistics to students are not very effective (Yilmaz 1996). There are numerous websites dedicated to interactive learning of statistics. Some of these websites have a solution engine that does the analysis part once you put some data in the boxes provided. Therefore in effect those are real time data crunchers and are instant solvers. There are many paid websites which help students to learn in a tutorial mode using a username and a password. Also there are downloadable interactive statistical programs which generally need to be paid for. Interactive Statistical Programs is a comprehensive system for learning and teaching purposes (Maridakis and Winkler 1984). 'Statistics for the terrified' is an example. These programs have simpler explanations of otherwise complex issues with a lot of examples and pictures and exercises with detailed explanations.

### *2.6 Off shoring and online Tutions*

Many professional organizations have sprung up in recent times understanding the fact that that students at all levels are terrified with statistics and math. These organizations are normally run by a team of teachers who provide online support to registered students and charge fees in return. The best thing about these arrangements is that they are not limited by boundaries. Teachers may be based in one part of the world and students in another. They may never see each other but are connected through e-mails or common platforms like Groove or Blackboard which allow access

and saving and modifications to files to the authorized participants. Students can ask or send questions to their tutors and tutors can respond to the questions by solving them or suggesting on how the solution can be achieved. This concept is no different than that of off shoring the services, for example, opening call centers abroad. Similarly some countries have historical and natural expertise over others in the field of Statistics. India and China in particular have individuals with comparatively better skills in statistics due high importance given to math in the primary and secondary school stages. India in particular has an English speaking population with statistical expertise and many students in the USA and in UK are opting for online tuitions from India. Also, the online tuition costs are merely a fraction to that of what one would spend on a tutor located in the western world.

### *2.7 Assessment & Evaluation*

Assessment & evaluation are often very time consuming and tedious processes. It takes a big chunk of teachers' time to set assignment or examination questions and then check the examination sheets. As discussed above computer programs and internet has also changed the face of assessment and evaluation as there are many real time tests available online which gives the score of an individual with the click of mouse. Many international online aptitude tests use this method to assess students, examples include GMAT, GRE, SAT etc. These tests are not primarily statistical tests and are administered worldwide for entrance into specific courses. They include multiple choice questions from a host of disciplines like English, Maths (including Statistics), logic & reasoning etc. The computer program ensures that each student taking the test gets a different set of questions of similar level of difficulty. This ensures that test takers' scores are comparable. Similar methods are employed by some universities. But online statistical tests are more common where multiple choice questions are considered to be an appropriate form of assessment.

### **3. Conclusions**

Computers and its associated technology is perhaps the most researched field in this era. High volume of research, interest of corporate houses and potential of huge profits ensures that much more is to come and the present state of advancement is nothing but only a phase of development and will be overtaken by faster, broader and better technology. These changes would definitely affect the discipline of statistics in many ways some of which could be foreseen now and many others can't be. Teachers and students alike need to be adaptive to the changes in the environment by way of continuously updating their skills for good.

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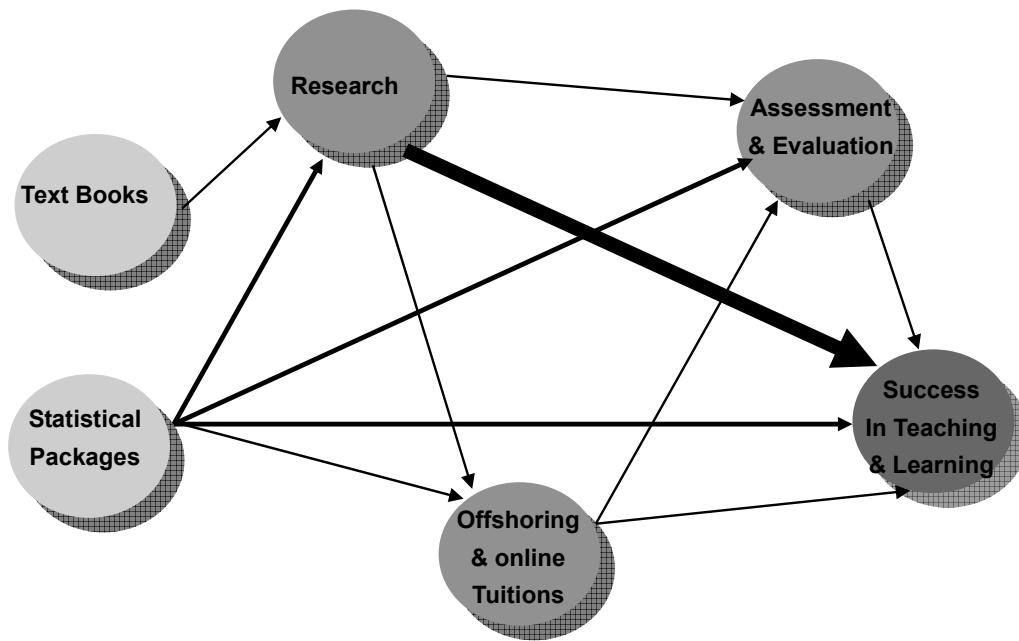


Exhibit 1: An example of Structure Equation Model