

# JMP Starting Statistical Thinking in Business Statistics Courses

Mary Ann Shifflet

University of Southern Indiana

## **Abstract**

In a college of business at a high access university business statistics is among the most dreaded, but also one of the most important classes. The ability to access, visualize and make decisions with data is critical to success in business and is therefore important to all business students. Traditional business statistics courses tend to be somewhat theoretical and formula driven. As it became obvious that this approach was not working well for most of our students, we were forced to rethink our approach, our goals and our techniques. The objective was to simplify the formulas and calculations so students could better focus on how to use data for decision-making. The result is a course that centers on statistical thinking and problem solving tools, and takes advantage of the power and simplicity of JMP. In this talk we will provide examples of how JMP is being used, and will discuss the redesign, the implementation, the successes and the challenges inherent with any course restructuring.

## **Introduction**

For students graduating with a Business degree the professional world they face is one that requires proficiency in data driven decision making. Yet, often the content that receives the least attention in the business curriculum is statistics, and anything data related. Not only is statistics not given much attention, but it is often seen by students as a required box that needs to be checked in route to the degree. In this paper we will describe one attempt to improve the relevancy, usefulness and student success in a basic statistics course in a college of business through the use of JMP software.

## **A Need For Change**

If you tell someone you teach statistics or Business Statistics in particular, what reaction would you expect? Probably not a positive one. If you are in the business world how many new hires do you expect to be able to use data effectively? Probably all of them. Add to that mix a university that is high access and you have some sense of the challenge we faced in the Romain College of Business.

The statistics course had high DFW rates – students receiving a D, or an F, or withdrawing from the class. Although the course was a prerequisite for many classes, the fact was, it was a dead end class. There was little to no reinforcement any place in the curriculum. Our quantitative curriculum was not much of a curriculum. In the summer of 2012 a small group of faculty and administrators involved in quantitative courses within the college came together to discuss the direction we should take with our curriculum and came face to face with the reality that Elementary Statistics was all there was in terms of student exposure to statistics.

We started with a review of what we wanted students to be able to do and what we thought they could actually do. We started by looking at the entire curriculum and quickly narrowed our focus to the one class every business major in our program takes

– Elementary Statistics. We quickly came to the conclusion that we wanted students to be able to do something with data – anything - and most students - even the good ones, coming out of that course could not do much with data that was of practical value.

## **The Redesign**

As we began to think about what a “new and improved” version should look like there were many factors to consider. The reality of our student base, accreditation concerns, prerequisite concerns, technology availability, capacity, grad school readiness etc. We wanted something truly innovative, not just a repackaging of the same old thing. We wanted to add technology but we didn’t want to just add technology to what we already had. The elements we agreed upon for the redesign were:

- A problem solving focus not a “here’s the data what do I do with it focus”.
- Minimize formulas
- Incorporate technology
- Be innovative, not just repackaging same old thing
- Students should see relevance of content
- Focus on statistical thinking
- Heavy reliance on case studies

## **Deciding on Technology**

The decision about what technology to add was not an easy one. Most basic statistics textbooks use Excel as the technology. One explanation often given is that we don’t know what technology will be available when students get a job, but everyone will have Excel available. Some of us even chose to use no technology – because we knew students would face a variety of technology options in the future. Additionally, we know that in the two years to graduation the technology learned could be obsolete. So the thought was “why bother”? As we considered this issue we finally realized that the rapidly changing technology landscape is exactly why students need to learn some technology for data analysis. Students need to experience problem solving with technology. Even if the technology changes they will have had the experience of learning new technology, using help features, exploring output, and would be better equipped to handle whatever technology they face on the job.

JMP was our technology of choice for several reasons, not the least of which was that we had some experience with JMP from consulting and corporate training. Secondly, JMP is easy to use, easy to teach and has GREAT resources. And, serendipitously – the Dean had a site license on his desk ready to be signed. So the technology and redesign went hand in hand.

The site license was critical to the success of the redesign – particularly the technology portion. The site license allowed us to install JMP on the lab computers in the classroom, making demonstrations and in class activities possible. It also allowed us to make the software available to students for download on their own computers. That meant that students could easily and inexpensively access the software for homework outside of classroom time. Having the Dean provide the software for free also signaled to students its importance.

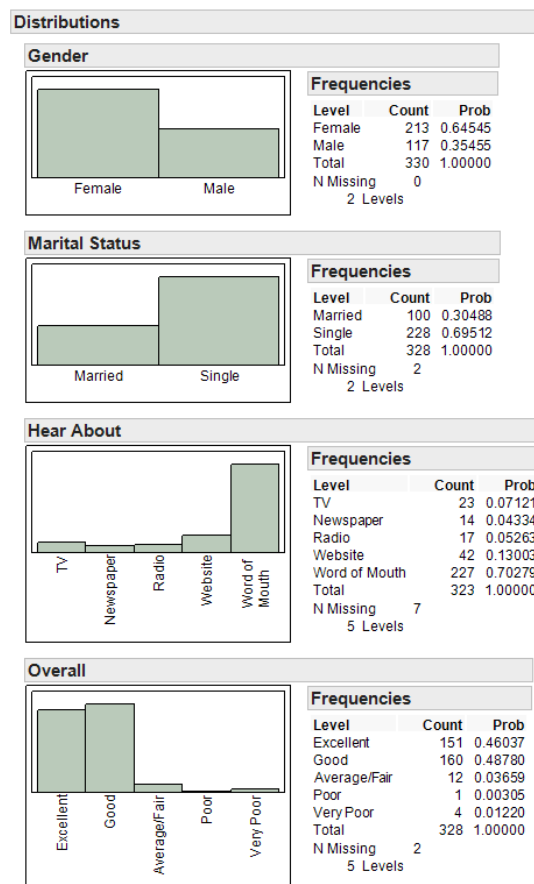
## JMP and Ease of Use

Typically in week one we introduce the software through the use of a case study. We have used several, including a JMP case study called “Film on the Rocks”. This is a simple case that requires basic data summary, allowing students to begin to draw conclusions from data. This simple exercise illustrates to students the ease of use of the software and begins to build their confidence in using data for business decision making. The goal at the end of the case demonstration is for students to walk away saying “oh, I can do this!”.

The case study is a simple survey done to evaluate the customer base and satisfaction for the Film on the Rocks series at Red Rocks Amphitheater near Denver, Colorado. Figure 1 is a simple summary of several of the measures from the survey, using the Analyze>Distribution feature. Students need to know almost nothing about data or analysis to be able to effectively answer some questions like, who attends the event, how do they hear about it, and are they satisfied with their experience. We can then move pretty quickly to some simple business decisions like, where should we advertise. This discussion usually provides an opportunity to reinforce the idea that the data should drive the decisions.

In addition to answering business related questions this case also provides an opportunity to begin to think through the pitfalls of survey research. So, right away we can begin building student confidence about using the software, looking at analysis, and using analysis to draw reasonable conclusions.

Figure 1: Film on the Rocks Output



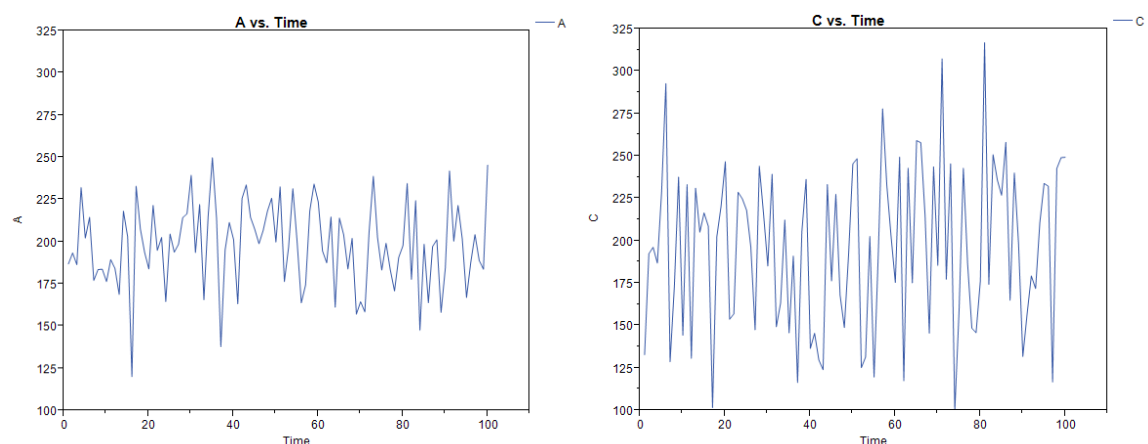
## JMP and Statistical Thinking

Selecting JMP as the technology in the course fit in perfectly with our desire to teach statistical thinking. The fact that JMP is very intuitive and visual aids in the statistical thinking. The inspiration for the statistical thinking came from the book by Roger Hoerl and Ron Snee called “Statistical Thinking: Improving Business Performance”, in which they discuss the idea of statistical thinking and the teaching of statistical thinking in particular. We thought that if we could teach students to think statistically, then the business decision part would come naturally. We used Hoerl and Snee’s discussion of statistical thinking as a basis for our Statistical Thinking Strategy that includes the following elements:

- Existence of variation
- Synergy between data and subject matter
- Complexity of business processes
- Sequential nature of statistical thinking

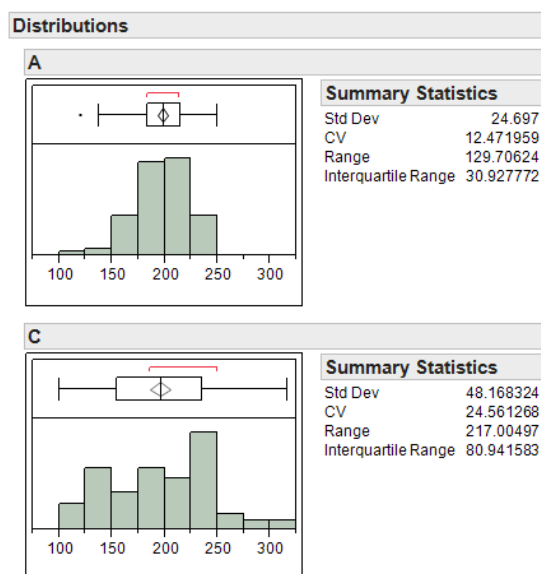
Throughout the course we attempt to tie all discussions to the idea of variability and JMP tools allow us to demonstrate the concepts with easy graphical tools and spend time on what the numbers mean rather than how to calculate them. The simple line plots in Figure 2 generate a discussion of the difference between common cause variability and special cause variability, whether there is a lot of variability or a little variability and why smaller variability is better. This is the germ that leads students to think about the story the data is telling and how to use that story to improve business performance.

Figure 2: Plants A and C Line Chart



Using the Analyze platform allows students to easily obtain histograms and numeric measures of variability as seen in Figure 3. We can compare the two plants and also compare the line plots with the histograms and numeric measures to begin to build some statistical thinking about variability.

Figure 3: Histograms and Numeric Measures of Variability



## The Results

Has the redesign been successful? The best answer is probably somewhat. The data shows a somewhat lower DFW rate, but more importantly the assessment evidence indicates a larger percentage of students are able to use and interpret data. Table 1 gives percent of students meeting or exceeding expectations for four traits of analytical problem solving. All four traits show a marked improvement with the redesigned course. Although there is still room for improvement, we were encouraged by the early results. The feedback from students has also been fairly positive, with many recognizing the relevance and importance of using data and being able to use technology to solve problems. A number of students have also been able to use JMP in other classes, in team competitions, and corporate internships.

Table 1: Assessment results:

% Meeting or Exceeding Expectations	n	Concepts	Information	Analytical Operations	Interpretation
Average 2008 - 2010	110	41	11	33	19
Fall 2013	40	80	50	60	30

## Next Steps

As the redesign evolves there are a number of areas for improvement and further development. The pool of relevant and simple case studies is small so the development of cases is ongoing and laborious. More practice exercises are also important. Since there is no textbook for the course we have had to develop all of the practice exercises

for in class use and homework use. While the redesign has made the relevance of the content clearer than the usual “what do I do with the data” courses there is still a need for more motivation materials. Students in the course are from every business major and more major specific materials would help highlight the use of the tools and techniques in each major.

Statistical thinking is one of the most important skills in today’s business environment. JMP allows students to begin to develop that skill at a very basic level but also has the sophistication to allow students to build on the skill as they become more proficient. Our plan is to continue to improve the course and ultimately spread the use of JMP to other courses in the business curriculum.

#### Reference:

R. Hoerl and R.D. Snee, Statistical Thinking: Improving Business Performance, 2<sup>nd</sup> Edition, Duxbury, Pacific Grove, CA, 2012.