Statistical Discovery.™ From SAS.

BU brings dynamic instruction to intro statistics classes

JMP® add-ins make learning more interactive – and more fun

"What's behind Door No. 2?" That probably isn't a question Boston University students anticipated having to tackle when they signed up for an undergraduate statistics class.

But as part of a university initiative to revamp introductory courses and engage students more actively in the learning process, statistics professor Luis Carvalho and his teaching fellow, Ian Johnston, redesigned the curricula for two courses to make instruction more dynamic and interactive.

Traditionally, courses like "Basic Statistics and Probability" and "Applied Statistics" involve worksheets of problems and small groups of students seeking to solve them, perhaps punching up some numbers on a calculator.

"We had that old model in mind, but we wanted to infuse it with something a little more exciting," Johnston explains. "So we decided to keep the worksheet, but put it on a computer, and have them analyze the data in JMP."

Johnston taught himself JMP® Scripting Language (JSL), then used it to build add-ins. These custom-designed scripts really enlivened the instruction, encouraging students to ponder quandaries big and small, including the odds of correctly guessing what lies behind Door No. 2.

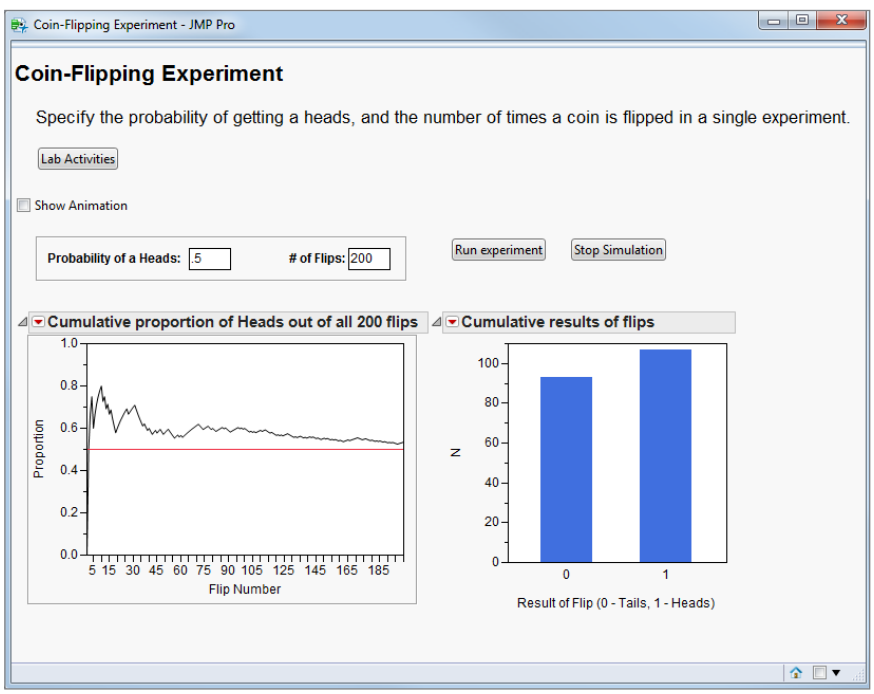
Let JMP® write JSL

Carvalho's expertise is in Bayesian statistics with applications to high-dimensional data and biology. He and Johnston are working together on a genomewide association study examining risk association for diseases while Johnston pursues his PhD. Restructuring Carvalho's undergraduate statistics courses became another joint effort.

"We wanted to create a class that had a lab that allowed students to analyze data, and in that lab we wanted students to use some kind of software," Johnston says, "but we didn't yet know what that software should be."

Mia Stephens, a JMP Academic Ambassador, was invited to come to BU, and she gave, in Johnston's words, "an awesome presentation of what we could do with JMP. We were all very impressed."

One particularly interesting example involved a regression model with a least-squares regression line. Stephens created a scatterplot, fit a line to the data and showed how JMP can provide



The Coin-Flipping Experiment Add-In lets students learn about probability and run simulations adjusting various factors.

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>
> **Ian Johnston**
> Boston University

feedback, in real time, on how well the line fits that data.

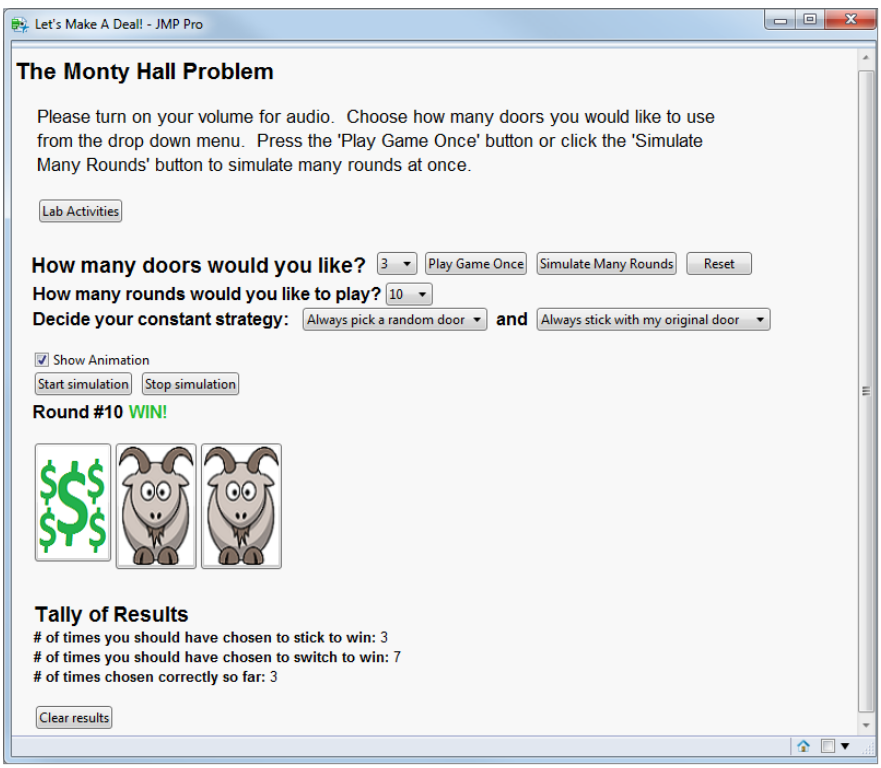
"You could really understand the method," Johnston said. "We were blown away by that, and we immediately saw how engaging this software could be for a student."

The decision was made to incorporate JMP into the courses. JSL would be used to build add-ins, which would serve as interactive worksheets. Students would learn basic statistical concepts in lecture sessions and then use JMP with real data in their labs, with the add-ins animating theories introduced in the lectures.

"We wanted them to be able to pull up data sets on the computer, analyze them in JMP, record their results and give their interpretations right away – a one-stop procedure, and all through JMP," Johnston explained.

First, though, the add-ins had to be designed.

"Luis and I would come up with a script that we wanted students to run," Johnston recounts, "and I would be trying to duplicate that script in JMP, to enable it so that students could open up an add-in that would allow them to run that exact script."



Using the Monty Hall Problem Add-In, students can explore this classic problem, adjust the number of doors, and see the effect of a given strategy by simulating many rounds of the game.

But he was having trouble. So he let JMP do it for him with the Save Script function, a feature that writes the JSL needed to produce the analysis shown on any report.

"That was so helpful," Johnston said. The more I could see JMP writing JSL, the easier it was for me to see what I was missing on my own.

"The best writer of JSL is JMP itself."

Which door?

"The add-ins, and JMP in general, have helped my students be more engaged," Carvalho says. "They use the add-ins to perform simulations and get a better grip of theoretical concepts."

Students enjoy the dynamic approach to learning, Johnston says. "They all want to take part, and they're all having fun. It's so nice because it truly is interactive. If one student wants to argue in favor of what he's done, he can very easily show other students and have them try it on their own laptops."

Sometimes Carvalho and Johnston create the data sets and sometimes the students create their own. One data set came out of a survey the students took before the course began in which they were asked, among other things, their favorite music genre, how many states they'd visited, how many numbers they had in their cell phones and how many of those numbers they had memorized.

The students explored the distribution of this data and fit models to it.

Then there was the Monty Hall – of "Let's Make a Deal" – problem, which came to life with the add-ins.

You're a contestant on a game show and there's a car hidden behind one of three doors. You pick a door. The host then opens one of the other two doors to reveal… no car. You then have the option of switching your choice of doors. Should you?

You should. As Marilyn vos Savant has argued in her "Ask Marilyn" column for *Parade* magazine, those who switch have a two-thirds chance of winning the car.

It's a puzzler. So Johnston designed an add-in that allowed the students to play 100 rounds of the game with 10 doors each.

"I wish you could see the students argue about it – and they're running the simulations while they're arguing. They're playing the game: 'I don't believe it; it just doesn't make sense.' They think they can disprove it."

They don't want to believe that with two doors left the odds aren't 50/50. "But," Johnston says, "the add-in brings them around."

They've now learned something about statistics – and had a bit of fun.

"My experience is that they now really appreciate being able to come up with meaningful plots and statistical summaries that help answer questions raised in the beginning of their projects, especially toward the end of the course when they're more mature and more familiar with the statistical concepts," Carvalho says.

"JMP has a very amenable interface," he adds, "and it's good to have a low barrier when exposing students to statistics. That's what I enjoy most about adopting JMP in class."

JMP® ahead

Johnston agrees that JMP's drag-and-drop, point-and-click interface makes it the ideal choice for students who, for the most part, are new to statistics.

"We feel that for this type of class – basic statistics and probability, and the first applied statistics class – it's easy for them to get used to JMP, to do the inferences that we discuss in the lectures and to not have to focus on the programming aspect of statistics," he says.

Students can also log onto the JMP website and submit a question or reference the documentation files. "It's very easy to get answers to your questions," Johnston affirms.

Both Carvalho and Johnston cite the JMP Graph Builder as a favorite tool – both for students and themselves.

"It's unbelievable," Johnston says. "You can drag and drop and create so many different kinds of plots, and then when you're satisfied, you hit the 'done' button and copy and paste it into whatever document you're writing."

Johnston thinks many of his students will continue to use JMP.

"I get emails from students after the course is over wanting to discuss what they're doing with JMP," he says. "It's gratifying."

CHALLENGE

To make basic statistics classes more engaging.

SOLUTION

JMP Scripting Language is used to build add-ins, which serve as interactive worksheets, animating theories introduced in lectures.

RESULTS

Students are clearly more engaged by this interactive approach to the curricula. They're now more prone to debate one another's findings and delve further in their analyses.

ONLINE

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