



## Davidson College

### Challenge

Despite the large quantity of sports data now available, it's difficult to understand which statistics can actually help teams improve.

## Statistics are a slam dunk for Davidson

What began with one math professor and three undergraduate basketball fans became a sports analytics powerhouse that helped the Davidson Wildcats up their game.

At a school that gets a lot of attention for its basketball bona fides, one math professor boasts an elite team all his own. Tim Chartier, PhD, Professor of Mathematics at Davidson College, leads Cats Stats, an extracurricular group of math and sports enthusiasts who offer their statistical insights to coaches at Davidson and beyond. In a program that bestows no academic credit or pay, Chartier has experienced significant interest from both students and athletic teams since its founding in 2013. What started as a group of three students has doubled every year and now has 60 students performing a variety of statistical analyses for teams and media outlets.

The goal of the program, Chartier says, "is to actually supply mathematical and statistical information to coaches that will help their coaching. It's quite difficult ... because you have to learn what they want and supply what they actually need." But that's exactly what Chartier and his Cats Stats squad are now doing. And they're doing it on a big scale.

### Finding 'coachable' information in a sea of data

Insight into player and team trends is not always "coachable" information, but fans and commentators enjoy discussing various game dynamics, and such metrics have garnered acclaim for Chartier's program - such as its success in a popular March Madness bracket challenge. "My initial research in data analytics was largely focused on ranking, where the target application was largely internet search," he shares. Wanting to find a more useful application for his mathematically driven ranking methods, however, eventually led Chartier to sports.

"Suddenly it hit us - we could create March Madness brackets from [our ranking methodology] and compare it to how everyone else was doing," recalls Chartier. Using mathematical models, his research group - and

since then, his students - have submitted brackets to ESPN and done well, with one bracket beating 99.9% of all other brackets in the country. "When we hit that [milestone], it was like, whoa! This is kind of its own thing."

With this initial success, Chartier taught the methodology to his math students, eventually creating the Cats Stats program with three particularly enthusiastic individuals. Cats Stats began by offering analytics to the Davidson men's basketball team, hoping to refine their own statistical skills and maybe even help the team in the process. Initially working with the basketball team for two months, Chartier and his students developed various performance-based metrics, such as ways of identifying team weaknesses, figuring out how to improve offensive strategies, etc. Eventually, their statistics helped Davidson's coaching staff identify key factors affecting gameplay, letting coaches focus and save time during game prep.

### Jumping into big data

As an extracurricular activity, Cats Stats attracts students with an array of backgrounds; although they share a love for sports and statistics, their mathematical training varies. JMP® has allowed them to move forward with analytical methods without having to slow down to learn more complicated statistical programs or coding. This savings was borne out, Chartier says, particularly with a recent biology student who was interested in working with Davidson's basketball team. "The main tool he used in the beginning was the decision tree tool," Chartier says; this student was interested in predictive statistics for winning.



JMP just opened things up. I don't really know any other way we would have noticed [an important correlation between fouling and shooting average].

Tim Chartier, PhD, Professor of Mathematics



While the team's three-point shooting percentage seemed an obvious predictor given the Wildcats' well-known skills in that area, a deeper investigation of the data showed a relationship with fouling that puzzled both Chartier and his student. But with the clear visualization tools in JMP, they presented data to assistant coaches Matt McKillop and Will Reigel. Once the coaches saw the data, "they could completely describe why we were finding [these kinds of outcomes], from how the team plays," Chartier marveled. "This was one of the biggest examples of where JMP in particular just opened things up ... I don't really know any other way we would have noticed it."

While Cats Stats members collect much of their own data at Davidson games to provide targeted analytics for the Wildcats, they also use publicly available data to understand their competitors. Many popular college basketball websites host a trove of statistical data. "We pull the data down and organize it in tables using JMP." With such large data sets, JMP gives Chartier and his students a user-friendly tool for taking a big-picture view of the data and then identifying areas where they can drill down for more detailed analyses.

## Bringing bracketology to a new level

One student who has taken advantage of these data sets is Charlotte Eisenberg, a math major and field hockey athlete from Haverford College, who recently spent a summer assisting Chartier. Eisenberg sought to create her own regression method to predict the outcome of the NCAA basketball tournament, using various data from sports sites like kenpom.com and masseyrating.com. "As I listened to what she wanted," Chartier recalls, "I said, okay, you need to learn JMP, because it's the only shot you have of figuring this out."

With such a massive quantity of data, it was important for Eisenberg to first determine which metrics correlated to a team's success in the tournament and decide how to incorporate their predictive power into

her algorithm. She started by importing data for all 351 Division 1 teams into JMP, using the histogram tool to visualize the data and better understand the overall variability of different statistics.

JMP gave her the tools to break down the data into usable parts. "For a basic example, my opponents' steals are highly correlated with my team's turnovers because every time my opponent steals the ball, my team records a turnover," Eisenberg says. JMP also allowed her to evaluate nonlinear correlations, like player experience. Eisenberg "had an idea that the top teams are often either heavy with 'one-and-done' freshman or heavy with well-developed upperclassmen experienced in playing together." As it turned out, she found a nonlinear correlation between experience and success and was able to use JMP to model it. "What was neat with Charlotte's work was also the way that she could use JMP to present what she saw," describes Chartier. JMP gave her a comprehensive tool that she could use from start to finish, from developing her idea to visualizing and sharing results.

## Sports analytics know-how launches students into the big leagues

While men's basketball is Davidson's premier sport, Chartier has made it a priority from the early days of Cats Stats to support a diverse array of sports, thus broadening opportunities for his students post-graduation. With many students earning internships with professional sports leagues and supporting not only Davidson teams but the NBA, WNBA, NFL and NASCAR throughout the year, Cats Stats students are well prepared for professional careers in sports analytics. "The biggest thing that will happen anytime someone poses a data analytics question is that we'll have no idea how to [address it]. And that's the actual career training: learning not to know," Chartier says. "One of the reasons [Cats Stats alumni] go into good jobs and enjoy what they do is that they've trained and learned how to discover things that are unknown."

### Solution

Students involved in Cats Stats, Davidson's one-of-a-kind sports analytics group, sift through the numbers to offer coaches important insight - from lineup efficiencies and shot prediction to personnel scouting. JMP® provides a user-friendly interface that makes data exploration and visualization easy.

### Results

Davidson's students have honed their analytical skills while simultaneously providing support to the college's athletics program; several students have since gone on to professional sports analytics careers.

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