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# Strategies for Teaching Graduate Statistics Courses: A Qualitative Study

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***Abstract:*** *The purpose of this qualitative study was to better understand how faculty approach teaching statistics. This study sought to further understand the instructional strategies professors' use and how faculty try to improve academic success in a statistics course.*

***Key Words:*** Statistics Instruction, Graduate Education, Qualitative

## INTRODUCTION

With many fields requiring students to complete some form of statistics prior to graduation the number of students enrolled in these courses is increasing (Hagen, Awosoga, Kellett, & Dei, 2013). In the current landscape of teaching in higher education, more and more courses and programs are offered through distance education. According to Allen and Seaman (2017), in Fall 2016, almost 30% of students in higher education are taking at least one distance course. With this increase in enrollment, including distance education, comes the need to better understand how faculty approach the instruction of statistics. Schlotter (2013) suggested that students should take fewer statistics courses and that as faculty we should move the statistical topics into discipline courses. As faculty if we do not want that then we need to ensure that we are serving our students and the statistical courses we teach are appropriate and useful (Prium, 2015).

In addition to appropriate and useful courses, statistics faculty face many challenges. One of the biggest challenges that professors' face is the anxiety many students have when they take a statistics course (Onwuegbuzie, 2004). Researchers have found statistical anxiety impacts academic success (Dykeman, 2011). Many faculty try to compensate for this by implementing various instructional strategies.

Instructional strategies are also important in online courses. Kahn, Egbue, Palkie, and Madden (2017) suggest that instructors must do much more than deliver content in ways that are similar to a traditional classroom. These approaches must be carefully considered so that students can be engaged with each other and create a strong classroom learning community from the very beginning of a course. Kahn et al. (2017) suggest that online teaching strategies are applicable across disciplines and if faculty shares their approaches with each other, they can all work together to improve student learning. The literature surrounding instructional strategies, in both face-to-face and online statistics course, is limited.

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The purpose of this study was to better understand the instructional strategies faculty use, in face-to-face and online courses, and how faculty try to improve academic success in a statistics course. This study sought to answer the following research questions; "What instructional strategies do statistics faculty find the most useful?", "What instructional strategies do statistics faculty find less useful?", and "What steps do statistics faculty take to improve academic success in a course focused on statistics?"

## METHODS

A qualitative approach was used. The study was conducted by interviewing instructors and students in graduate statistics courses to understand their perspectives and experiences in teaching and learning advanced statistics. Interviews focused on teaching strategies and the ways interpersonal connections were established.

Participants were identified via involvement in organizations, their university website, or professors known to researchers. The researchers interviewed 16 professors of statistics. The majority of participants were white (78%), females (61%), who had more than eight years as a professor teaching statistics (56%). Participants also included 10 students who have taken at least two research courses. Most students were females (70%) who had taken both online and a face-to-face course.

The interviews were administered via phone and each interview required approximately 45 minutes. Interviews were transcribed and coded by the researchers. The interviews were coded and analysis was conducted using open coding (Corbin & Strauss, 2015). Corbin and Strauss recommended that researchers explore the data for ideas and give those ideas conceptual names; then researchers should follow this open coding with axial coding to look for relationships between themes. We followed this method, moving between the parts and the whole (Dahlberg, Dahlberg, & Nystrom, 2008).

## FINDINGS

Preliminary thematic analysis revealed several themes: engagement, projects, online discussions, video/audio communication, and challenges/struggles.

### ENGAGEMENT

Student engagement is a topic of great concern to faculty, especially those teaching online. Professors reported they were "afraid an online course would be a group of independent learners who learn on their own." They were very concerned about strategies they could use to motivate students to interact. Several professors mentioned the use of synchronous and asynchronous video or audio personal introductions as the course began. Students enjoyed the independence of an online course and at times, they "did not want to be bothered by having to interact with others."

### PROJECTS

When professors were asked about how their instruction has changes they mentioned the role of projects. One professor stated that with the increase in online classes projects allowed him a vehicle to ensure students were applying what they had learned in a "meaningful way." Another professor stated that she utilizes projects as a way to "prepare graduate students to complete a dissertation." In most research courses professors utilized projects as a way to make connections

to applications.

### ONLINE DISCUSSIONS

Professors and students talked a great deal about online discussions, even for their face-to-face classes. Professors said that they think carefully about the design of online discussions and are careful to ask meaningful, probing questions. According to one professor, "some students' responses are thoughtful and show strong critical thinking. Other times, students do only minimal work and show little engagement." Another instructor noted, "I design complex scenarios requiring students to go deep into their data and interpretation. Yet, there aren't many students who rise to the challenge." Students report that instructors grade their discussions by requiring a certain number of posts throughout the discussion period. This approach "feels like just busy work and I just want to get it done. I don't think deeply when it's like that." Overall, discussions are both valued and time-consuming without payoff in terms of learning.

### VIDEO/AUDIO COMMUNICATION

Professors and students talked about the value of video and audio communication. Some professors posted Instructional videos in the online course and, although instructors saw them as a replacement for the traditional lectures, students valued them only if they were fairly short and would function well on their mobile devices. Additionally, students were appreciative of the opportunity to repeat the videos when necessary for their review. Students and professors both reported taking advantage of the learning management system (i.e. Canvas) features that allowed synchronous question and answer sessions that were either video or audio and recorded for review at a later time.

### CHALLENGES/STRUGGLES

Professors commented that there are still a lot of challenges they are working through. They mentioned that a lot of students come into the class with high levels of anxiety compared to other classes they teach. While anxiety was not directly mention by students, faculty commonly mentioned anxiety. Some faculty felt students' anxiety impacted their ability to do well. Some professors have tried to openly talk about anxiety and like the role SPSS plays in the classroom because "there is no longer a fear of formulas" and professors can focus on the application. In online instructions professors mentioned the challenge of connecting with students. While this is a challenge in all research courses the online modality adds another layer.

## SCHOLARLY SIGNIFICANCE

Overall findings reveal instructors are approaching the instruction of statistics differently. Instructors are implementing individualized projects and utilizing technology to aid in instruction. Faculty find discussion can be of value if the prompts require a deeper level of thinking and are well thought out. Faculty feel students begin class with high anxiety levels and low levels of interest in statistics. Because of this, faculty feel they have an uphill battle and must call on some of the instructional strategies mentioned above. Online instructors may consider using discussions as a way to keep students engaged while face-to-face instructors could mirror this deeper level thinking with small group activities. Students taking online statistics courses appreciated having videos available. This use of technology could be integrated in a face-to-face course and would allow students in a face-to-face course to replay videos for a better understanding of concepts.

Instructors also valued the use of individualized projects. Adding individualized project in all statistics course, no matter the course delivery mode, would assist with engagement and prepare students for their dissertation. Instructors do appear to be using strategies that are designed to actively engage students in their learning. It appears that the instructors in our study worked hard to develop meaningful discussion activities. These findings can help statistics instructors plan course lessons that may help ease student anxiety and encourage more learning. Future researchers could expand the scope to examine how students apply the knowledge learned when working towards this degree.

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