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Average or Outlier? Introductory Statistics Adjunct Instructors' Beliefs, Practices, and Experiences

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Abstract

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Keywords

adjunct instructors, undergraduate statistics education, statistics education, thematic analysis, in-depth interviews, case study

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In recent years, the adjunct faculty phenomenon has grown steadily. This research focused on adjunct instructors teaching introductory statistics courses. The purpose of the study was to give a voice to adjunct instructors by allowing them to describe their experiences teaching statistics. We conducted a qualitative study with 15 adjunct instructors of introductory statistics through semi-structured interviews. The participants came from several fields: psychology, nursing, and business, among others. Thematic analysis was used to find themes of statistical anxiety, use of technology in the classroom, lack of curriculum flexibility, and connection to the host institution. Our findings can inform institutions and interdisciplinary departments hosting introductory statistics courses. Similarly, educational statisticians can gain knowledge on the practices and barriers of adjunct instructors.

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Introduction

The role of adjunct faculty is a phenomenon that has grown steadily in recent years in academia (New Faculty Majority, n.d.; Wallis, 2018). According to the website New Faculty Majority, in the United States 75.5% of college faculty are not in tenure-track (TT) positions; this translates to roughly 1.3 million out of 1.8 million faculty positions that are adjunct. In 2017, 47% of faculty in degree-granting institutions were part-time adjunct positions while tenure-track positions have declined over the course of the last three decades (Wallis, 2018). In 1980, the percentage of tenure-track faculty was 55%, but this declined and by 2003 was 41% (Mason, 2009). In contrast, adjunct faculty have experienced a steady growth (Wallis, 2018).

A similar increasing trend can be seen in the enrolment of introductory statistics courses which comes with its own set of issues. Recently, introductory statistics courses have also become an option for students seeking to complete the quantitative requirement for undergraduate college students (Soler, 2010). Soler (2010), who used his own institution as case study, emphasized that the instructors teaching statistics have often taken few statistics courses, mostly on probability, and do not necessarily have a background in statistics. This is reminiscent of the “lone statistician,” which is a common problem in statistical consulting. This phenomenon is represented by faculty who are considered by their department as the experts in statistics due to their quantitative skills, but do not necessarily have a degree in statistics (Vance, 2015). Content areas such as psychology, criminal justice, health sciences, and business have an introductory course in their curriculum that can be taught by instructors who do not consider themselves statisticians, or an adjunct whose background can very well be statistics, mathematics, or another field (Schwab-McCoy, 2019). In mathematics, adjunct instructors have taught 90% of the mathematics sections (Rahman et al., 2020). Introductory

statistics courses shape the student's statistical literacy and how they consume data and information throughout their lives (Engel, 2017). Yet, there has not been any in-depth research on adjuncts teaching introductory courses in statistics.

Literature Review

Adjunct instructors are often offered seasonal contracts. Independent of the adjunct's performance, they are often denied retirement and health care benefits, raises, and promotions. Adjunct faculty may hold doctorates, master's degrees, or bachelor's degrees, depending on the hiring policies of the host institution where they teach. Graduate students in Ph.D. programs who struggle with little to no departmental support often find themselves teaching in adjunct positions at local (or nowadays online) institutions (Crannell, 1998). Although adjunct faculty are an important part of higher education (Maxey & Kezar, 2016), their motivation to teach, and identities are often subject of study (Snook et al., 2019). Despite playing an important role in student learning, adjunct faculty are also overlooked when it comes to professional development. The need for adjunct faculty is not discipline-specific; nearly all areas in higher education rely on adjunct instructors to teach courses. Similarly, research on adjunct instructors is multifaceted.

Research on adjunct faculty is varied though not extensive. First, we will review past research which has focused on the high percentage of adjuncts currently teaching at the university level, job satisfaction, professional development needs, and institution integration (Cawley, 2018; Edwards et al., 2015; Gray, 2017). Gray's (2017) findings detailed many barriers faced by adjunct instructors in becoming integrated within the institution and the department. Similarly, Rahman et al. (2020) focused on part-time faculty teaching core courses, such as Pre-Calculus, Rahman et al. (2020) interviewed part-time faculty to understand their job satisfaction. Rahman et al. (2020) suggested that for universities to improve STEM education, professional development opportunities for adjuncts also need to be established. Furthermore, in developmental mathematics courses, faculty education level has correlated with course grades indicating that higher grades correlate with faculty having graduate degrees (Fike & Fike, 2007). Furthermore, Cawley (2018) focused on Hispanic serving institutions with developmental mathematics courses. In this study, adjunct instructors and Latinx learners were observed. When interviewed, Latinx learners described their interactions with the adjunct instructor as encouraging and supportive.

A subset of the research reviewed in the previous paragraph centered on adjunct faculty in developmental mathematics. We will now focus on research specific to adjunct instructors teaching introductory statistics courses to address a gap in the literature (Fike & Fike, 2007; Gray, 2017; Rahman et al., 2020). Current research in the introductory statistics area focuses on improving the training of graduate teaching assistants and the teaching experiences of international students (Christian, 2014; Green & Blankenship, 2014; Kaplan & Roland, 2018). Similarly, Justice (2020) studied the graduate teaching assistants (GTAs) who are tasked with teaching statistics courses. GTAs, due to their inexperience teaching, may focus on the mastery of statistics problems rather than emphasizing conceptual understanding of statistics (Green, 2010).

Purpose and Rationale

Recall, that introductory courses in statistics can be interdisciplinary, and adjunct instructors often navigate the differences between departmental requirements, as well as student expectations and preparation. Further, introductory statistics courses shape student's statistical literacy and how they consume data and information throughout their lives. Yet, there

exists no current research on adjuncts teaching introductory courses in statistics. Findings from this study will provide first-hand accounts of adjunct faculty experiences, providing insight on how to better support adjunct faculty and form best practices for the teaching of statistics.

Research Question

RQ1. How do part-time, non-tenure-track faculty (i.e., adjunct faculty) describe their experiences and practices teaching introductory statistics?

RQ2. What are part-time, non-tenure-track faculty (i.e., adjunct faculty) beliefs when teaching introductory statistics?

Methodology

After obtaining IRB approval, we began data collection via virtual interviews. We utilized the methodological framework of qualitative research, specifically our inquiry approach was case study. Our data collection was performed through detailed, in-depth interviews with multiple individuals ($N = 15$; Creswell & Poth, 2016; Stake, 1995). We identify our cases as adjunct instructors teaching statistics. Participants were recruited using purposeful sampling, which is commonly used in case studies (Creswell & Poth, 2016). To preserve confidentiality, we used color names as pseudonyms for the participants. Finally, we used thematic analysis across the cases as our data analysis technique (Creswell & Poth, 2016). We detail the data analysis process later in the paper (Creswell & Poth, 2016).

Researcher Stance

I, Samantha Estrada, was an adjunct instructor for five years while completing my Ph.D. in Applied Statistics and Research Methods. During this time, I taught introductory statistics in multiple departments, including business statistics and mathematics department statistics. Although the course content overlapped, I noticed subtle changes in my approach to teaching. For example, I understood that business students wanted to be challenged, whereas students taking introductory statistics to fulfil a math requirement needed to build their knowledge of mathematical basics. I then realized how flexible and diverse teaching statistics can be. As an adjunct for many years, I was able to form a community at my host institution. I participated in many teaching workshops, which helped me connect with the institution and fellow instructors while also helping me navigate graduate school. I was interested in whether other adjunct instructors experienced changes in pedagogy as a result of teaching in different departments, in addition to understanding different experiences in teaching statistics.

I, Erica Martinez, was an undergraduate when I became interested in conducting research. At that time, I had just finished a Statistics class and became curious about the challenges students face when taking the course. Having experienced the struggles myself, I wanted to investigate how students could improve their learning experience. As a graduate student and Teaching Assistant for undergraduate Statistics at my institution, I can observe first-hand the difficulties students encounter, including their self-efficacy in completing assignments and seeking help. Through my experience as a Teaching Assistant, I have gained insight into the professor's perspective as well. Having seen both sides of teaching Statistics, I have developed a keen interest in exploring the conceptual and computational difficulties that students encounter, which has fuelled my interest in the present research.

Data Collection

We recruited participants in three different means: reddit.com (subreddits pertaining to academia and statistics), the Consortium for the Advancement of Undergraduate Statistics Education (CAUSE) listserv, and via purposeful sampling (Creswell & Poth, 2016; Patton, 2015). We conducted the interviews via Zoom due to both the COVID-19 pandemic and the location of the participants. We recorded the interviews, these typically lasted between 30 to 45 minutes. Erica transcribed the interviews, assigned the pseudonyms while transcribing she also made notes of similar themes among the interviews. In this step, the data was de-identified in case the interviewee mentioned a location or an institution. Each participant's identifying information was protected by changing identifiers to pseudonyms in the transcripts. The next step was to conduct member-checking. To enhance trustworthiness, participants were asked to provide feedback on their transcripts and findings via email. Only two of the participants, adjuncts Gold and White, had feedback on their transcripts. Participants views are presented in their own words to strengthen the credibility of the research (Patton, 2015).

Participants

Of the fifteen participants, all had taught or were currently teaching introductory-level statistics; several of them had taught graduate courses (Sangria, Brown, Khaki, and Beige). The departments ranged from mathematics, biostatistics, business, and psychology, as we can see in Table 1. The participants were from different universities all over the United States, and three of them had taught in foreign institutions (Sangria, Beige, and Black). Eleven of the fifteen participants were graduate students who were teaching a class to gain some experience as they pursued their degrees. The backgrounds of the participants are presented in Table 1.

Table 1

Study Participants Pseudonyms, Department and Status While Teaching as an Adjunct Instructor

Participant	Department	Status
Orange	Psychological Statistics	Graduate Student
Red	Business Statistics	Graduate Student/(currently) Data
	Statistics/Mathematics	Analyst
Blue	Biostatistics/Nursing	Graduate Student
Purple	Business Statistics	Graduate Student
Gray	Biostatistics	Graduate Student
Brown	Geography/Geostatistics	Master's completed, Ph.D. Student.
Green	Mathematics	Graduate Student
Yellow	Biological Statistics	Graduate Student
Pink	Biological Statistics	Professor
Sangria	Statistics/Data Science	Graduate Student
White	Psychology	Graduate Student
Gold	Common Core Course	Ph.D. Adjunct instructor part-time
Khaki	Sociology	Ph.D. Adjunct instructor part-time
Beige	Mathematics	Ph.D. Adjunct instructor full-time
Black	Mathematics	Masters/Adjunct full-time

Note. The adjunct instructors were assigned a color as a pseudonym.

Data Analysis

Data analysis was conducted utilizing the qualitative software QSR NVIVO (2022). Thematic analysis is useful for summarizing information from considerably rich datasets in addition to being considered a “robust” and “accessible” method (Braun & Clarke, 2022, p. 4; Nowell et al., 2017). We took notes during the interview process to complement the information in the interviewee’s transcript. For example, when an interview was finished, we would save a document with details from the interview (type of university if the participant had disclosed it, type of statistics course taught, class sizes among other pieces of information, for example, one of the adjuncts shared a screenshot of their learning management system (LMS) we saved this along with the notes). However, most of this information was unevenly collected, given participants did not always volunteer the information; for this reason, the data analysis the transcript information was predominantly used to perform the thematic analysis.

The first step in conducting thematic analysis was to become familiar with the data (Freeman & Sullivan, 2019). After becoming familiar with the data, the codebook was created inductively (Braun & Clarke, 2022; Lochmiller, 2021). We used reflexive reading to revisit the transcripts and when interpreting the findings (Yao, 2019). Next, the first cycle of coding began by utilizing attribute coding. Attribute coding is a “conceptual phrase representing a topic of inquiry to a segment of data” (Saldaña, 2021, p. 97). This process allowed us to create labels with the initial codes before I began the second cycle of coding, which consisted of identifying similarly coded data. The process involved searching for patterns to be able to form themes from them (Fereday & Muir-Cochrane, 2006). Roughly twelve initial codes were created. Examples of code labels are “technology,” “statistical anxiety,” and “mentorship” (Braun & Clarke, 2022). The next step was to identify the codes that fit with the themes of interest: handling statistical anxiety, making use of technology, or experiences of mentorship as an adjunct instructor, among others. We created a graphic abstract to detail this process as suggested by Lochmiller (2021). Figure 1 shows how the codes created the themes described in the results section.

Figure 1

Illustration of Themes and Their Codes and Subcodes.

EXPERIENCES WITH STATISTICAL ANXIETY

- Personal Experiences with Statistical/Mathematical Anxiety
- Handling statistical anxiety as an instructor

USE OF TECHNOLOGY IN THE CLASSROOM

- Technology
 - Stats Software
 - Simulations to teach statistics.

CURRICULUM FLEXIBILITY

- Lack of Curriculum Flexibility ↔ Developed Curriculum
- Course Structure

CONNECTION TO INSTITUTION AND MENTORSHIP

- Mentorship ↔ Institution On Boarding Process
- Compensation

During this process, we found we created duplicate codes. An example of this occurred with codes for “technology” and “simulation.” To better organize these pieces of data we created subcodes, for example, a subcode of “simulations” in the “technology” code (see Figure 1). Finally, we reviewed the themes by going back to the original dataset and re-reading the transcripts.

Results

We anticipated a pattern where adjunct instructors would not necessarily have a background in statistics but were teaching statistics due to their quantitative skills and availability (Schwab-McCoy, 2019; Vance, 2015). This was the case for Adjuncts Orange, Purple, Pink, and Khaki. An unexpected characteristic of the adjuncts interviewed was that several of them worked for institutions where they were part of a larger course structure: the adjunct was the instructor of record for one or multiple sections, but the larger section had a different faculty member in charge. This was the case for Sangria, Gold, and Pink. Many adjuncts received materials such as Power Point presentations and labs and implemented them. This was the case for the Adjuncts Yellow, Red, Brown, Blue, Gold and Orange. The adjuncts in this model reported having little input on topics, textbooks, and software. In fact, only Adjunct White described having the opportunity to re-design the course to what the adjunct considered a more “modern” approach.

We will present our results in the structure laid out by our graphical abstract in Figure 1.

Theme: Experiences with Statistical Anxiety

Statistical anxiety, like mathematical anxiety, is well known among statistics (and mathematics) instructors and has long been studied in the field of statistics education (Frey-Clark et al., 2019; Vigil-Colet et al., 2008). Thus, it was not surprising that adjunct instructors of statistics experienced the phenomenon firsthand. For example, Adjunct White discussed that while there is a large amount of research regarding statistical anxiety, there is not enough information on how to handle it in the classroom: “We know that statistics anxiety is real [...] there’s enough assessments that have shown it, like on a repeated basis, I would say that what isn’t there in the literature to me is good recommendations for what to do.”

Instructors varied in how they related their experiences regarding statistical anxiety. A few of them shared their experiences as students while a couple of them shared their experiences on how they handle anxiety in the classroom. Adjuncts Blue and Pink shared their own experiences while Adjunct Khaki shared their approach to handling anxiety.

Adjunct Blue shared a story about how her sister’s experiences shaped her teaching philosophy:

I have a twin sister [...] it was really interesting going through high school with her. Because I was in kind of the high-level math classes, and she was in kind of the low-level math classes and we were in the same school, same school system, same school and our teachers attitudes towards our work and like attitudes towards teaching math in general were clearly so different, you know? I had really great math teachers in all throughout school [...] she has like awful handwriting and like the correct answer would be you know 19 and she would have a number that was like “is it a nine or is it a four?” and they’d [the teachers] be like “oh it’s 14” and they’d like “mark it wrong,” like, give them [the students] the benefit of the doubt or ask [...] if you can’t tell [...] why would

you always read it as the wrong one? They did that, and she had a lot of people who were like really kind of aggressive high school teachers in a way that I did not.

Adjunct Blue wonders if her students had experiences like those of her sister:

If their experience was anything like my sister, in my experience, they would have had like the crummiest teachers [...] they were mean to her, like calling you know, stupid [...] like not quite [stupid] but like it. No wonder that they are afraid of math when you have people who are, you know, being mean to you and you get the answer wrong.

Adjunct Pink shared her experiences with dealing with statistical anxiety. However, students seemed more concerned with the mathematical aspect of the course:

A lot of students think it's going to be like a hardcore math class, and they come in very worried and stressed that they don't have the math chops to keep up. And really, if you know how to add and, you know, multiply, you're going to be just fine. So, I think having a smooth introduction to a math class is really powerful for underrepresented groups or people who have been told they're bad at math. I was told I was bad at math and here I am, I'm like a statistician. So, I like undoing that damage that somebody else did.

Adjunct Khaki discussed how he dealt with statistical anxiety, perceived as mathematical anxiety by the students:

In a lot of different ways and not just you know I said I've seen it in young generations, but I've seen it also in older generations, especially as I talked to female students in graduate courses but also in undergraduate courses. The phenomenon of having had negative and sometimes traumatic experiences in math.

Adjunct Khaki continued, "you have to fight against that! [...] You have to convince the students that they've been lied to." Like Adjunct Pink, Adjunct Khaki believes knowledge of basic operations can help a student get through introductory statistics.

I will tell the students. You were lied to. And the way you were lied to is one day, you are struggling reading, and someone told you "Just practice you're reading more." And then the next day you were struggling in math, and someone said, "unfortunately not everyone is good at math." And that's stuck in your head, this idea that math is somehow "innate." In reading [and in] writing it is somehow based on an investment, and math [it] is not. [Math] it's also an investment. And so, I try to tell students: "If you put the work in, you will master this." It has nothing to do with whether you are good at this or not. It has a lot to do with your interests.

Theme: Use of Technology in the Classroom

The Guidelines for Assessment and Instruction in Statistics Education (GAISE) promote the use of technology for the teaching of introductory statistics; thus, we were interested in the use of technology in the classroom by the adjunct instructors. The topic of sampling distributions has often been recognized as one of the most difficult topics in the

introductory statistics course (Albert, 2002; Lipson, 2002; Sotos et al., 2007). Adjuncts White, Sangria, and Gold all advocated for the use of Stat Key to teach sampling distributions through simulations to students. TinkerPlots and STAT Crunch were also mentioned. Adjunct Purple discussed how she was not required to teach using technology. However, Adjunct Purple's experience in business influenced her pedagogy and thought it was important for her students to learn Excel. Adjunct Green used a combination of Minitab and Excel. However, an interesting finding was the recurring theme of simulations in introductory statistics to teach sampling distributions. It is important to note that this only became a pattern after recruiting through the CAUSE mailing list. It is important to note the CAUSE organization focuses on the teaching practices of statistics thus members of the mailing list may be more familiar with the current practices of teaching statistics (e.g., utilizing simulations in the classroom). Adjunct Beige discussed the flexibility of being able to assign each student a different sample via simulations. This allowed the adjunct to avoid cheating (as students all will have different results) and highlight the concept of sampling distributions.

While many of the adjuncts discussed the inability to change the curriculum, Adjunct White was an outlier in this regard. Adjunct White was displeased with the curriculum in an introductory statistics course for the health sciences, saying utilizing simulations does not go far enough. The adjunct outlined his reasons:

I would call myself like a “radical” in terms of what I think the intro curriculum should be I don't think these simulations basically go far enough; you know? I think that the classical school of statistics needs to be moved on [...] the simulation curricula are better at developing students understanding of a sampling distribution and what it represents [...] one of the goals of switching to simulation was to relieve the like algebraic burden and instead spend time placing the logic of just like statistical testing at the core so I think there's some evidence that that actually does work you know even what actually is a sampling distribution. I don't touch central limit theorem.

Adjuncts Sangria and Gold discussed the usefulness of using simulations in teaching statistics:

Yeah, we are using simulations. This course is very simulation based. And so, we use both simulations, and then we, we also look at error. And that's really my approach because I really like the baseline stuff so I'm really much into simulations [...] simulation is, to me, is a very good intuitive way to really know what is going on.

Adjunct Gold stated:

We just define it broadly [sic]. It's a distribution of a statistic. And then we estimate them using simulation, and then after we go through half the course of simulation and then we switch over to the more empirical normal distribution and so forth.

Adjunct Khaki had a counterpoint, exploring the idea that it might not be used in the social and behavioral sciences because the most popular analyses in these areas are usually based on samples:

Yeah. I think maybe something like Stat Key, which makes that easy, is obviously a tool, that is something, that has been increased, and that is the advantage of some of these software [...] because there's no other way to do that very easily. You can't do an Excel; you can't do an SPSS. There's no way to really automate that.

Adjunct Pink agreed that "the way we teach it at [my institution] is just not helpful. I have since decided that the best way to teach sampling distributions is through a simulation, where we all like collect data and then we put it together we get the means we graph those and like go really slowly and actually do it all together." Adjunct Pink added, "I'm not in charge of the curriculum," stating this was the reason it was not possible for her to include simulations when working as an adjunct instructor. The flexibility (and lack thereof) was another major theme in these interviews.

Theme: Curriculum Flexibility

The flexibility of being an adjunct instructor had two major subthemes: flexibility in terms of the topics being taught (curriculum) and the lack of flexibility in course delivery. All but one adjunct instructor (Adjunct White) was able to restructure their course. As previously mentioned by Adjunct Pink, several adjuncts were dissatisfied about how the introductory statistics course was structured. Adjunct White had strong words regarding the curricula of the introductory statistics course:

What I see in intro stats, it's like it's archaic it'd be like you know an introduction to medicine course covering leeches [...] I get that they used to do this but like nobody does this anymore like this is so outdated [...] there's no need to there's all kinds of other stuff you can do or like chi-square tests why would you ever do that? Do a regression tree like that just makes me way more sense.

Adjuncts Gold, Grey, Pink, Blue and Sangria described being part of a larger "machine." Adjuncts Blue and Gray shared that they were working as adjunct instructors as a graduate student, and they worked mostly under a senior lecturer. Adjunct Pink described having a similar experience, though she has already completed her degree and continues to work as an adjunct. Adjunct Gold described how each part of the course is thought out. Gold describes how large student enrollment plays a role as to why the courses are well structured and there is a lack of flexibility in the curriculum:

There is there's a lot of structure to it. There are large enrollments. There's many, many, many sections. They share office hours. There's a strict structure to it. And so, if you teach that, you kind of just follow the curriculum. You don't have to actually, you can modify it a little bit, but generally everyone follows the same curriculum because it's easier that way. [...] people share exams, but, yeah, you're largely just kind of hook up with the other instructors and share materials. And if it's the online course, everything is set up for you. There are online notes. Y'u can create your own exams create your own labs and homework if you wish. But all that is set up for yo' for the large enrollment courses.

Khaki offers an alternative explanation for the lack of flexibility in the curriculum discussion. The adjunct describes how this is not necessarily an issue in community colleges or graduate programs:

In the community college, you definitely have a lot more flexibility. And in graduate programs, too, because they trust you, they're hiring you for your expertise. It's graduate students. And so, there's the assumption that people will communicate better, and if there are challenges, those will come up.

Adjunct Beige discussed the lack of flexibility not only in terms of topics, but in terms of software. The adjunct also added:

I understand the reasoning that for community colleges they would like you to cover a wide range of topics without any real explanations. [At 4-year college] they are never able to cover all together the chi-square, ANOVA, inference for regression. We cannot do that during [one] semester.

Gold discusses how a more permanent position might be key to experimenting with teaching strategies:

I mean, if it was a permanent position, like a full-time position, I probably just have more time to experiment. I like to experiment with different grading schemes, different activities in class [...] I think if I have more time, I would just have more updated materials, and I would just have more chance to experiment with different styles of teaching, different types of assignments because I do like to do that.

Adjunct Black discusses how the approach to teaching is different in universities outside the United States. Adjunct Black shared how outside of the United States, teachers work together, hold regular meetings to create class content, discuss teaching and how to address course issues. She confesses, "it was great that we become even friends with some [instructors...]" Yes, it was very nice to work in teams." Adjunct Black raises an important point often discussed in the literature which is adjunct's connection to the institution (Gray, 2017).

Theme: Connection to Institution and Mentorship

In this research, many of the adjuncts interviewed expressed the lack of connectedness to the institution like Gray's (2017) work. For example, Adjunct Gold stated:

I think the whole idea of connectedness not just the students, but to the faculty and the community overall, I feel like there's probably a disconnect. I go to the Department picnics. I don't think I see any other adjuncts there ever. I don't know if they're getting invited. I don't know how they're treated in other institutions, if they're treated as part of the community, or if they're just like contractors.

Adjunct Red added:

I would say that as an adjunct that is probably the hardest. I think you have an office; you know you're not like, you're part of the team but not really, you know? You're almost like a substitute for the semester.

This same feeling was shared by Adjunct Beige: "I guess because they [are] always just coming and leaving. When we teach on campus we're just coming and leaving." Adjunct Khaki stresses the need for institution connection:

Especially in community college, isolation is probably the biggest problem. That all faculty, not just adjuncts, but "full timers" too, especially in large community colleges. I've had the privilege of also working in a big four-year institution as a full-time faculty member. And that's definitely much more collegial and closer knit. So, I'm going to say at the end of the day, no, that's not a good thing. That independence comes with disconnection, and especially teaching statistics. I think you need support. You need to be connected. You need someone to talk to about it, to bounce ideas off. If not, you get very stale in you' teaching and you never really break through and teach in a way that helps a broader range of students.

Mentorship

Among the adjuncts, Yellow, Orange, Gray, and Brown were graduate students or had been adjuncts while they were graduate students. There was a discussion about feeling supported by full time faculty. Similarly, Adjuncts Beige, Purple, Yellow and Pink mentioned having access to a mentorship support system already available in the institution. Both adjuncts were part of a larger course set up within their own institutions. However, Adjuncts Sangria and Gold had different experiences. Adjunct Sangria, who was the instructor of record in charge of a section out of multiple sections which was administered by other faculty, described his experience: "You catch some errors, you can email them [faculty in charge], and they will clarify something, but apart from that it's not really like mentorship. It's more of just answering questions if you do you have."

Adjunct Gold discussed:

There's no onboarding process. There's no one teaching you, not just the curriculum support for developing or materials, but also just like, what are the policies? What's the process? If I observe an academic violation, what statements do I need to include in my syllabus, those types of process and policy type stuff?

Compensation

When asked about whether the adjunct instructors were compensated fairly, answers varied, creating a dichotomy. For adjuncts who were graduate students while working, they believed the compensation was fair. In comparison, adjuncts who had a second job believed that it was not. Adjunct Gold mentioned the amount had not changed in several years, and Adjunct Sangria was the only adjunct to discuss the stress that comes with semester-by-semester contracts.

Discussion

In this study, we interviewed fifteen adjunct instructors all with various backgrounds such as business, health sciences, nursing, and sociology, among other fields. Research on statistical anxiety is prolific. The adjuncts interviewed in this study had accounts of experiencing it first-hand. Statistical anxiety is a topic often discussed in statistics education (Chew & Dillon, 2014; Frey-Clark et al., 2019; Schwab-McCoy, 2019; Vigil-Colet et al., 2008). Adjuncts shared plenty of stories of students sharing their fear of mathematics with them. Research of both mathematical and statistical anxiety clearly separate the two constructs, and so do instructors, this is not a dichotomy students make in their minds. Adjunct Khaki, Pink and Blue shared how they experienced statistical anxiety and how this had shaped her teaching philosophy. Further, Adjunct White discussed that the issue of statistical anxiety is widely known and common in the classroom. However, there are few, if any, guidelines on how to handle it. Thus, we believe the account of the adjuncts in this study on handling statistical anxiety can serve as a reference to future researchers, but more importantly, it can serve to statistics instructors to know how pervasive statistical anxiety can be in the classroom. This can help instructors prepare both mentally and materials that can help overcome statistical anxiety. Overall, adjuncts encountered statistical anxiety in the classroom, and many referred to their own experiences on the topic to help students succeed.

It has often been discussed that introductory statistics courses in fields like psychology or business are often taught by quantitative experts that do not necessarily have a background in statistics (Schwab-McCoy, 2019; Soler, 2010). This was the case for Adjuncts Pink, Khaki, Orange and Purple. Adjuncts with quantitative expertise were asked to teach introductory courses in a specific field, as was the case for Adjuncts Pink and Khaki. This is reminiscent of Vance's (2015) "lone statistician" issue in statistical consulting. Whether this is a problem in the teaching of introductory statistics or not would require further study. Future research may focus on broadening the scope of this research into a survey, ideally with a larger sample size. Perhaps investigating through a larger scale sampling, initially with a quantitative approach where university departments could be surveyed in search for the "lone statistician." The next step could involve a qualitative framework, perhaps a case study, narrowing down unit of interest to the "lone statistician" specifically.

Similarly, research on statistics education has often declared sampling distributions a difficult topic to understand (Albert, 2002). Indeed, we found that among the adjuncts we interviewed, sampling distributions was one of the topics the adjuncts found difficult to teach (Lipson, 2002; Sotos et al., 2007). Many of the adjuncts supported the idea of utilizing computer software to teach this difficult topic, many of them endorsing the use of Stat Key.

A common theme from the adjuncts interviewed was the lack of curriculum flexibility. All but one of the adjuncts interviewed mentioned the inability to create their own course materials. It is important to keep in mind that the development of a course is difficult work, and in many cases, is beyond the scope of an adjunct instructor's duties. However, many of those interviewed were dissatisfied with the inability to transform their own course. As Adjunct Khaki mentioned, adjuncts are often hired because of their "expertise," but it appears that in practice the curriculum is not determined by this expertise.

Regarding connection to the institution, compensation, and mentorship there was a divide between adjunct instructors who were students at the time they were working as adjuncts and those who worked part time as adjuncts but had other employment or were retired. Gray's (2017) work focused on the connection of part-time instructors of developmental mathematics to their host institution. Though the part-time instructors interviewed in Gray's work were aware of institutional efforts to integrate part-time faculty, the interviewees still felt that barriers existed. In this research, many of the adjuncts interviewed expressed the lack of

connectedness to the institution similar to Gray's work. Adjunct Gold and Adjunct Khaki both discussed how the onboarding could be done in a more informative way and how there might be a lack of institution connection. In terms of compensation, those who were still students believed that the compensation was fair, while those who held employment elsewhere did not. Mentorship among graduate students was mix of those that felt mentored and those that did not. Usually, having large sections that had a coordinator in charge of them helped to shape the participant's view of mentorship. Based on adjunct responses, institutions may want to invest in a better onboarding procedures and professional development, as well as working on institution connection with adjuncts.

Limitations

Our study is not without limitations, in this paragraph we will discuss several of them. One of the reasons we purposefully recruited adjunct instructors was because we were interested in the differences in pedagogy. However, from the responses of the interviewees it was rare to change "fields." That is, the adjunct instructors in this study taught in the same departments across their adjunct trajectory. This was a surprising finding as statistics can be interdisciplinary. A potential limitation of the study could be that the adjunct instructor's distribution (e.g., current graduate students vs. adjunct instructors as an additional position) may not accurately reflect the population. Due to our convenience sampling, it was difficult to control for this variable. However, further research may focus on one of the groups, for example only adjunct instructors who are graduate students. Future research may also focus on obtaining a representative sample for each group. Additionally, the adjunct's approaches to teaching seemed very similar, with class size being the clearest factor in determining how the course is taught. This could be a limitation of the study, like the "lone statistician" problem. Finding cases where adjuncts have versatile roles (teaching statistics in different content areas such as business or nursing) may require a wider sampling frame.

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Appendix A

Interview Questions

1. (Demographic) How many years of experience have you had teaching? At what level?
 1. How many years/semesters teaching as an adjunct?
 2. Why did you become an adjunct instructor?
 - a. (Motivation) What motivates you to work as an adjunct at this institution?
 1. Are you aware of any obstacles or barriers keeping part-time faculty affecting their ability to do their best work?
 1. **Probes:** specifically, when teaching statistic and in general
 - b. How many years of experience do you have teaching statistics?
 1. Have you taught other courses besides introductory statistics? Have your experiences been different?
 2. **Probe:** Undergraduate or Graduate courses?
 - c. Department: Mathematics/Statistics, Social Sciences, Health Sciences, Business, Other
 1. Have you switched departments or colleges during your time teaching statistics (as an adjunct)?
 2. Do the strategies for teaching an introductory course in statistics change if the adjunct has switched concentrations/departments?
 - a. If yes, did any strategy or activity not translate between areas?
 - d. Are you aware of any advantages of part-time faculty?
2. (Relationships)
 - a. Do professional development opportunities differ?
 - b. Do mentorship opportunities differ?
 - c. Connection to students
 1. **Probe:** no pay for office hours
 - d. Have you built relationships with other part-time (or full time) faculty?
 - e. In what ways are you able to connect with other faculty or staff within the institution?
 - f. Have you experienced any difficulties in the classroom?
 1. Technology wise or student wise
3. (Teaching)
 - a. What type of teaching training did you receive?
 - b. Emphasis on calculation/understanding concepts?
 - c. What is your preferred technology for teaching statistics?
 1. **Probes:** Excel, SPSS, calculator
 - d. Do you have any data driven activities outside of class?
 - e. Grading? Homework websites?
 - f. Minimize assignments due to adjunct position?
 - g. Anything you would change teaching wise in a more permanent position?

- h. What topics were harder to teach?
 - i. Experiences teaching returning students, or first-generation students?
 - 4. Compensation?
 - 5. Is there anything else you would like to share with me concerning your role as an adjunct instructor of statistics?
- Is there a question I did not ask, a topic I did not cover, but you would have liked to discuss regarding teaching statistics as an adjunct instructor?

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