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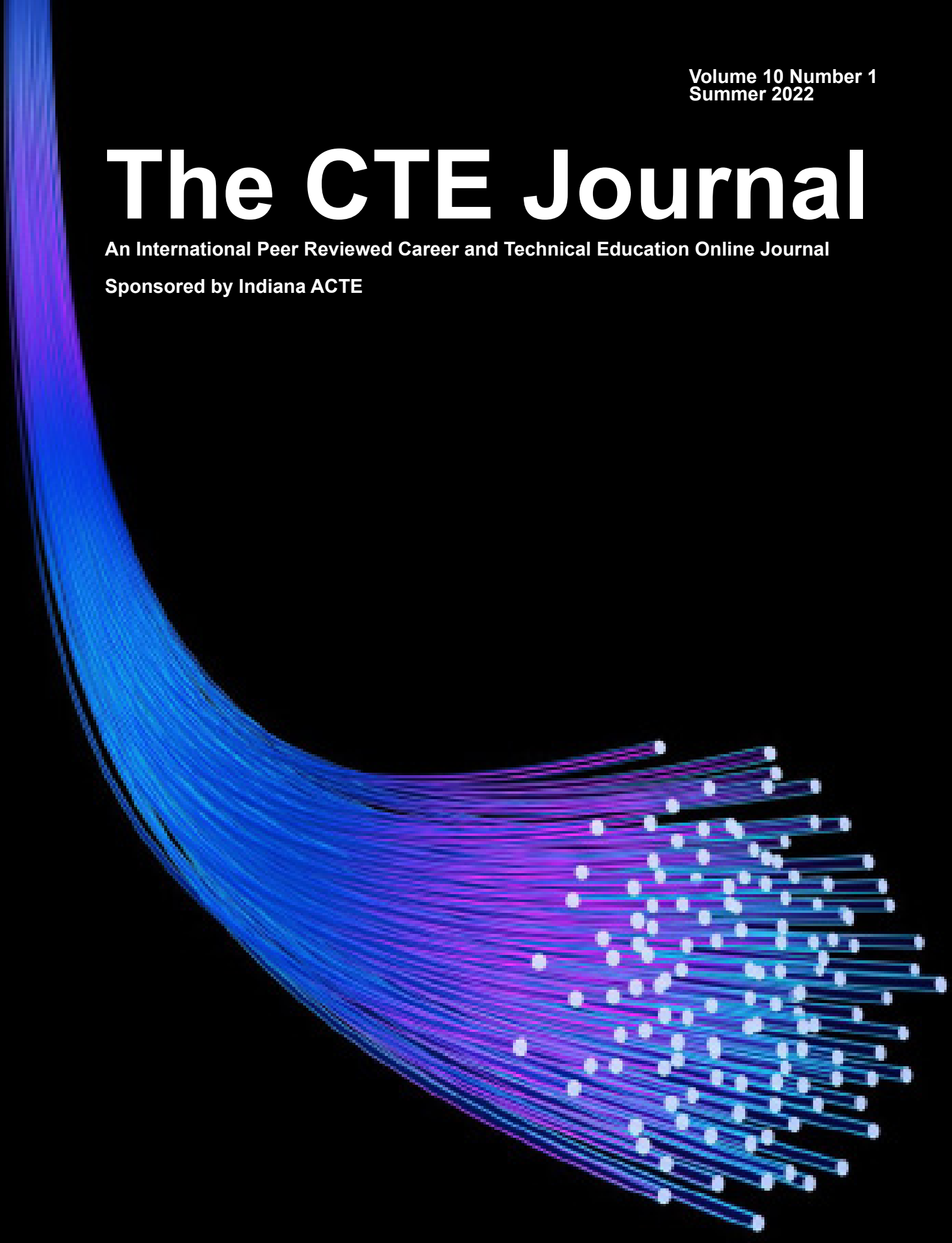

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Computer Support Specialist Career Path Exploration

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Introduction

This article provides factual information for those interested in a career as a computer user support specialist and a computer network support specialist. For those trying to decide if this career is a good fit, specific information such as pay and benefits, career outlook, and responsibilities may be helpful. Details regarding these careers will be presented in the following order: responsibilities, how to become one, pay and benefits, job outlook, and an interview with a small business owner in these occupation areas.

Responsibilities of a Computer Support Specialist

According to the U.S. Department of Labor (2021), a computer network support specialist provides routine maintenance, test network systems, evaluate performance, and resolve network issues. A computer network support specialist configures network security settings and backs up network data (Occupational Information Network, para. 2, 2021). Computer user support specialists troubleshoot computer problems for customers. They are responsible for fielding telephone calls and assisting nontechnical computer users with hardware and software questions (Moncarz, 2001, p.17). Computer user support specialists are responsible for repairing and setting up computer equipment. They also provide training to non-technical customers to work with new equipment. A computer user support specialist can also be responsible for networking support services (Field Engineers, para. 2, 2021). The responsibilities assigned to a computer support specialist vary based on the employer.

How to Become a Computer Support Specialist

The education requirements of a computer support specialist can differ between employers; however, all employers require computer support specialist to have computer expertise (Mckay, para. 5, 2019). The U.S. Department of Labor (2021) denotes the education requirements of a computer support specialists for a large software company typically requires a bachelor's degree. Active listening skills play an important role for computer support specialists to understand peoples' needs and accurately resolve their computer problems. Strong critical thinking capabilities are needed to problem solve computer issues (Mckay, para. 6, 2019).

Pay and Benefits

According to the U.S. Department of Labor (2021), the median annual pay for a computer support specialist is $55,510. Computer network support specialists earn a median annual wage of $65,450. The median annual pay for computer user support specialists is $52,690. According to Salary.com (2021), the average computer user support specialist earned $43,313 annually. The average annual pay for a computer network support specialist is $52,088 (Salary.com, 2021).

Job Outlook

The U.S. Department of Labor (2021) reported 882,300 computer support specialists in 2019 and projects that number to increase by 8% to 949,600 by 2029. In 2019, there were 195,100 computer network support specialists; by 2029 the number is expected to grow to 207,700 or about 6%. Computer user support specialist jobs are expected to increase by 8% over the same time period from 687,200 to 741,900. The Employment Development Department for the State of California (para. 12, 2021) predicts strong job prospects as information technology continues to be adopted in new fields including healthcare and electronic commerce.

Interview with Steven Culp at "Your Very Own Geek" which is a computer consulting and repair business located 33 E Main Street in Anderson, Indiana. Steven can be reached at steven@yourveryowngeek.com

Steven Culp, pictured in Figure 1, is the president of "Your Very Own Geek". He was interviewed by Dr. Edward J. Lazaros on May 18, 2021. The interview along with Steven's responses are listed int eh following sections:

Figure 1: Steven standing in front of his computer consulting and repair business, which is called "Your Very Own Geek".

1. What previous experience prepared you for this position?

"*I worked in the corporate world and managed North and South American networks for BMW. I then came back to local and regional business support for their computers*" (Steven Culp, personal communication, May 18, 2021).

2. What does a typical work day look like for you?

"*Answering phones, texts, e-mails and communicating with clients or potential clients. We engage in computer and cell phone repair. We take care of business networks and residential networks. We deal with security issues that we discover on the networks. We even get to work with U.S. Homeland Security and other government agencies when we deal with security issues*" (Steven Culp, personal communication, May 18, 2021).

Figure 2: Steven using network management software that is used for remote control of computers, reviewing event logs, security patch management, monitoring computer performance.

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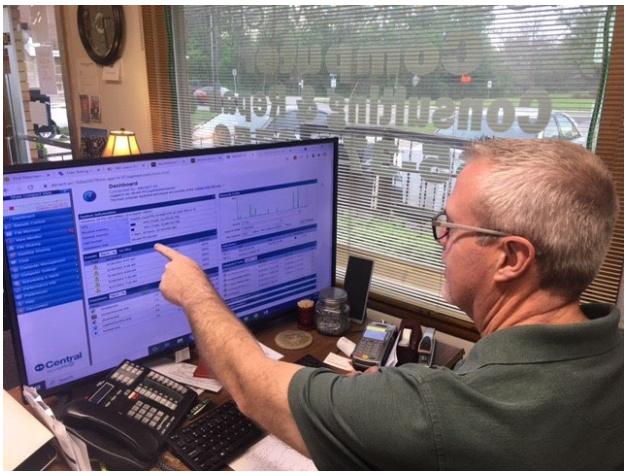


3. What is your favorite part about your daily work?

"*I like the customer interaction. I like solving people's problems and making them happy. I like that we always get to work with new technology, which is always changing*" (Steven Culp, personal communication, May 18, 2021).

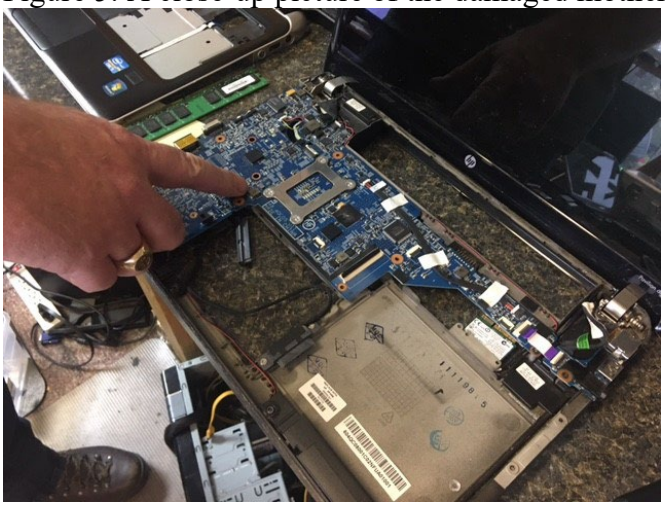
Figure 3: Steven speaking with a customer on the phone.

4. What are the main challenges you encounter with your daily work?

"*Trying to keep up with the new technology is a challenge. We cover a broad expanse, and keeping up with all of it is a challenge. For example, malware, viruses, and adware are always coming out, and we want to stay ahead of them. Trying to educate customers on malware, viruses, and adware is also a challenge*" (Steven Culp, personal communication, May 18, 2021).

Figure 4: Steven examining a damaged motherboard in a laptop computer that is going to be replaced.

Figure 5: A close-up picture of the damaged motherboard in a laptop computer.



5. What kinds of fun technology do you get to use?

"*We deal with network scanners. They identify points of vulnerability on a network so that we can determine what type of security patching that we need to do. They can detect throughput problems so that we know where the bandwidth is going and how it is being distributed*" (Steven Culp, personal communication, May 18, 2021).

6. What advice would you give someone who would like to get into this career?

"*Start small! You can always grow your technological abilities as you go. Don't go in thinking you have to be the best at everything. Get your feet into it and figure out what areas you like. Select jobs where you can get exposed to a lot of different things so that you can touch all of the technology*" (Steven Culp, personal communication, May 18, 2021).

Figure 6: Steven in the showroom of refurbished computer equipment that is for sale.

Conclusion

Computer network support specialists help businesses maintain and upgrade their networks, conversely, computer user support specialists aid customers in diagnosing and resolving computer problems. With a projected increase between 2019 and 2029 these careers look like they may have a bright future.

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Career Pathways in System Administration

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Abstract
A Systems Administrator holds the responsibility of keeping an organization's systems and servers safe from hackers and viruses, while also keeping the network up-to-date and running efficiently. Additionally, a Systems Administrator provides support for an organization's user base. This paper will examine the in-depth specifics of a Systems Administrator and the industry, as well as the job qualifications and responsibilities.

Introduction

In the Information Technology (IT) field, a systems (or server) administrator is primarily responsible for creating and maintaining the computer systems that run the organization's information systems. In the research literature, systems administration is defined as the "design, running, and maintenance of human-computer communities" (Burgess, 2003, p. 1). These systems can range from smaller PC-based (x-86, x64, etc.) computers running MS Windows or Linux, to mainframes running specialized operating systems.

Responsibilities of Systems Administrators

Server (or System) Administrators include a group of individuals that are considered to be technical experts, responsible for large-scale, complex and high-risk environments requiring a vast understanding of general and specific networking information (Forsgren et al. 2016). According to Forsgren (2016), "Sysadmins have relied on direct communication with the servers and networks they are responsible for by using cryptic—but powerful and informative—command-line interfaces." Therefore, an organization's computer servers and networks are under their supervision, making them responsible for maintaining efficiency and safety, in addition to tracking information entering or exiting a secure network. Such responsibilities are done by performing daily tasks of upgrading and maintaining hardware and software, solving technical issues, overseeing activity levels, providing server security, and developing new system structures as needed (Field Engineer, 2021).

Server Administrators can obtain an associate's or bachelor's degree; however a bachelor's is preferred, along with a professional certification. The bachelor's degree can be in any of the following fields: Computer Science, Web Technology, Information Technology, or Network Administration (Bateman, 2013). There are further qualifications that can be beneficial when searching for employment in the field, such as Cisco Certified Network Professional or Cisco Certified Network Associate, Server+, Red Hat RHCE, and Microsoft Certified System Administrator (MCSA) (Bateman, 2013). Depending on the particular job at hand, it is not uncommon for an employer to require a minimum of three to five years of experience to be a qualified applicant (Bateman, 2013). Due to the daily inter-collaboration with various

departments and individuals, further personal attributes are also valuable within the field. For instance, analytical thinking, efficient problem solving and communication skills, multi-tasking abilities, and high quality professionalism (Field Engineer, 2021). In addition, physical fitness is also important due to the need to potentially work outdoors, at heights, or having to relocate equipment (Field Engineer, 2021).

Although Server Administrators can be employed at any job with servers or networks, they need to acquire knowledge in virtualization owing to the evolution of cloud computing (Field Engineer, 2021). According to Field Engineer (2021), the core concepts of PowerShell or DevOps, specifically, are of importance to those pursuing System Administration.

Atlassian (2016) defines DevOps as a "set of practices, tools, and a cultural philosophy that automate and integrate the processes between software development and IT teams." Therefore, it is a software development and operations approach that helps make the development of new products faster and more efficient, while also easily maintaining existing deployments (*Why DevOps is Important? Benefits & Challenges Explained*, 2021). When a system administrator wishes to pursue the role of a DevOps professional, it is often doable and enjoyable due to the overlap of responsibilities and requirements. However, there is a set of crucial skills necessary in order to obtain roles in both such as, cloud computing, coding and scripting shells, continuous integration, configuration management, and forward-thinking deployment strategies (DevopsCurry, 2020).

Cloud administration is a new opportunity for system administrators because it allows businesses to outsource information technology necessities. Which in turn, leads to savings in cost of capital and ensures speed, performance, security and scalability (*What Is Cloud Computing? A Beginner's Guide | Microsoft Azure.* n.d.). Rather than eradicating system administrators, cloud services create new opportunities because companies still need them in order to manage the computer systems within the company. Therefore, cloud system administrators are responsible for managing and facilitating cloud services. The management of cloud services can fall either under the description of a system administrator, or under an entirely separate position (Frank, 2021). The development of cloud administration and similar jobs may allow for future system administrators to focus on more specific skills, leading to more productivity and less stress.

Current and Future Trends in Systems Administration

As previously discussed, DevOps is a practice that will alter the way system administrators operate in the future. DevOps is a combination of application development and IT operations. Where development is made up of software developers and IT operations are made up of system administrators. In turn, DevOps aims to bridge the gap between these two domains by utilizing an inter collaboration approach. By doing so, the communication between development and operations is improved, as well as productivity realization of up to 30% (Hussaini, 2014). In addition, there are higher efficiencies in the releases and there is reduced time to market (Hussaini, 2014). With that being said, many job postings for system administrators include DevOps in the description or list of desired skills. The prevalence of DevOps in the field suggests that future system administrators will work closer with development teams.

Automation is another aspect that seems to be supporting rather than threatening system administration. According to Gulenko et al (2020), Artificial Intelligence for IT Operations (AIOps) is the use of artificial intelligence to handle simple IT management tasks often performed by system administrators. For example, it can be used for automated anomaly detection, root cause analysis, and automated self-stabilizing. Automating some management has become increasingly necessary as businesses expand and the complexity of systems increases. System administrators and other IT professionals often have to resolve repetitive issues, wasting their time and productivity when automation could resolve the issue instead. In addition, some urgent issues can be solved immediately with AIOps rather than waiting on a system administrator to be available.

Despite the numerous advantages, AIOps may increase complexity for the system administrator, who now has to manage the AI as well as the systems themselves. When AI-supported administration fails, the system administrator must recognize the new issue, roll back the AI's attempted fixes, then address the original issue. Gulenko et al (2020) identifies levels to AIOps that provide the system administrator with varying amounts of control. At level 1, the human administrator handles issues and only uses the AI for implementation. At level 2, the AI helps suggest solutions, and the human administrator makes the final decision. At higher levels, the computer can select and implement solutions itself with some input from the human administrator. As AI improves, higher levels of AIOps can be implemented with less concern. However, AI is still faulty and not effective at higher levels (Gulneko et al., 2020). With that being said, AIOps is still being developed and it will still be some time before system administrators will need to manage AI more than they manage systems themselves.

Pay and Benefits

According to the U.S. Bureau of Labor Statistics (2019), system administration is a stable career with a median wage of $84,810 as of 2020. Providing nearly $40,000 above the average median wage. The median annual wages for network and computer systems administrators in the top industries fell within the higher end of $80,000 for finance and insurance, information, management of companies and enterprises, and computer systems and design and related services. Relatedly, educational services wages were ranked at $75,230.

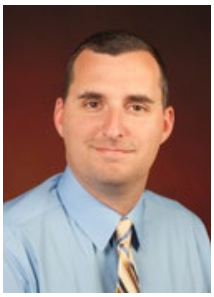
Job Outlook

The technological industry is a continuously growing field with consistent advancements. The U.S. Bureau of Labor Statistics (2019) estimates Server Administration job opportunities will increase a total of five percent from 2018 to 2028, offering an increase of more than 18,000 jobs. According to Hess (2020), that number doesn't include replacement jobs for more than 383,000 current system administrators. It is recommended for individuals to cross-train with an organization on additional aspects of IT such as, database administration, network administration, virtualization, cloud, project management, software development or management (Hess, 2020). Doing so increases the chances of employment outside of System Administration if necessary, as well as make the individual a more valuable and competent professional.

Interview with Chris Cahoe at Ball State University, Muncie, Indiana

Figure 1

Chris Cahoe, Director of UCS, Ball State



Chris Cahoe is the Director of Unified Communications at Ball State University. He assumed this position in 2019. Prior to that, he worked as the Assistant Director of Unified Communications Technology for seven years, and as the Enterprise Network Engineer for 8 years before that. He has a Bachelor of Science in Computer Technology/Computer Systems Technology from Ball State University. He was a Cisco Certified Design Professional, as well as a Cisco Certified Network Professional. Chris Cahoe was interviewed by graduate student researcher Brianna Bowles, B.S., and undergraduate researchers Jayci Wimmer and Dan Chepkwony on January 19, 2022. The following section presents the questions Mr. Cahoe was asked regarding his career and experiences in system administration.

1. What previous experiences prepared you for your current position?

   "I started out working on computers as a hobby and then getting into desktop support, as a high school and a young college kid, while working for what was UCS (University Computing Services) back in the day. We dealt with the random issues of patching and backups. Everything related to modern system administration" (C.Cahoe, personal communication, January 19, 2022).

   "I spent a few days as a student computer room operator, and about a week and a half as a help desk operator. That brief experience helped me throughout my whole career seeing what someone goes through at the help desk and from other perspectives within IT. It's certainly a different perspective over what I do today. Help desk is interesting for the fact that you're talking with customers who may not be comfortable with technology, and you're trying to translate their issues to engineers. They need more details other than," my application's not working." Can you not sign in? Is it not loading data? Help desk is a good middle position to translate from non-techies to techies. It's an interesting spot to be in." (C.Cahoe, personal communication, January 19, 2022).

2. What does a typical workday look like for you?

   "The first responsibility is to review e-mails that might have come in overnight. Do I have any major issues that I have been notified about or any major issues that have come up? We have numerous monitoring systems that we will take a look through, do we see any major issues, do we see any minor issues, did something reboot unexpectedly. Reboots can happen so fast that we might not see an outage notification, so we'll look

specifically for those. And then, from a system administrator, are there any major patches or security issues we've been notified about, that sort of stuff. It's a pretty quick daily check to make sure nothing is wrong and then it's onto projects such as building or upgrading a server or building a new network. That's a pretty typical day." (C.Cahoe, personal communication, January 19, 2022).

"We have 24/7 operators in what would typically be considered a NOC. They have screens up where they're constantly watching for issues after hours. If systems go down, or there is major alerts, they'll submit tickets and direct it to the administrators or the engineers, that say 'Hey, this popped up can you take care of it?' That's the typical day." (C.Cahoe, personal communication, January 19, 2022).

"I would say fifty to sixty percent of my time is just spent coordinating what my staff is doing, answering their questions because sometimes they're working on a project and they'll need me to either provide feedback or I'll have to get approval to purchase something. We can't just say 'Hey boss, I need $5,000.' It's a write up that says why we need that $5,000. What is it going to do? What are we going to gain from it? Will it save us more money down the road? I am still a hands-on administrator even though I'm managing people. I still manage the firewall, I still manage routers, and I still manage servers because I enjoy it. I legitimately enjoy doing that part. It's just I don't get to do as much of it like I used to" (C.Cahoe, personal communication, January 19, 2022).

3. What is your favorite part about your position?

"We have a large variety of systems in our group. We're managing everything from unified communications which you would consider telephones, voicemails, contact center software to routers and switches and general server administration stuff. If you like server administration you can fit into our group. If you like networking, you could fit into our group. We also manage the video security cameras on campus. If you like those types of things, if you like video, if you like photography type stuff, that would hit home with you because you're thinking through 'Where do I place the camera best to get the best lighting and get the best shot,'. Just the variety I guess. The variety of what you could do in systems administration would be pretty incredible" (C.Cahoe, personal communication, January 19, 2022).

4. Are there any incentives, such as compensation, provided in your position?

"Nothing beyond what a typical Ball State employee gets. There's no additional compensation. I am on call 24/7, so I do have a cell phone. I don't know if that's always considered extra compensation because when you're woken up at three in the morning with an emergency, it doesn't feel like extra compensation. If you are considered on call 24/7, then you would have a cell phone. Again, not always considered a good thing" (C.Cahoe, personal communication, January 19, 2022).

5. What challenges do you encounter?

"Well, in my opinion the number one challenge right now is the IT security battle between keeping your system up and keeping users happy, and then protecting it from people who are interested in exploiting you. One of our vendors, Kronos, was essentially attacked with ransomware and was compromised. It took them a long time to get all of their customers back up. I think that really goes for most of IT. You have to keep systems patched. You have to stay on top of firewall entries and auditing. It's a constant battle, we are always under attack. One random person gets a backdoor on their computer. We had an issue last March where one device was compromised and then that was a jump off point for a group to start trying to exploit us. Thankfully, it was caught early. It's just one of those things where it's nonstop, and it's not just Ball State, it's everybody," (C.Cahoe, personal communication, January 19, 2022)

"I know this from my more networking-focused role: when you do maintenance to patch systems, we can't always keep the systems up. There are things we do where we have to take systems down briefly. It becomes a matter of scheduling. So what we've found historically is to notify users: 'Hey, we have to take the system down at this time,' and they're typically more understanding of the work that has to be done. Instead of just randomly upgrading systems and hoping no one notices an outage. You can't do that; we never want to potentially risk an outage during or close to school or work hours. We aim to do them over a break or you do it at two in the morning or six in the morning. What we have, for the most part, is a scheduled maintenance window from 9:00 PM on Saturday until noon on Sunday where a lot of the general patches for systems get done. The thing I've noticed is that [customers] are not always tied to the common work hours. You know something like 7:00 AM to 7:00 PM. For the most part there's always someone doing something. Especially at a place as large as Ball State. Some professor is in a classroom, and they're working on something important. And you don't want to disrupt that if you don't have to. So that's why you wait until these change windows or after hours if it's an emergency. We take it very seriously. We don't like causing issues for people," (C.Cahoe, personal communication, January 19, 2022).

6. What kinds of technology do you get to use as a System Administrator?

"From general IT monitoring, [redacted] is a primary product and there's different pieces of [redacted] we use. There's some that are more focused on servers and applications and others that are more networking type focused. We have a fairly large virtualization environment, so it's getting into the virtualized hosts, looking at them for their health and monitoring different virtual machines within the hosts and it's checking all of those, monitoring CPU, memory usage, disk storage usage" (C.Cahoe, personal communication, January 19, 2022)

"We use some other tools, like something called [redacted], which is from the network side. We use it to map our network usage across our major links. So we can just pull up a webpage at any time and monitor traffic throughput. We went away from MRTG but the product that we found that was best to replace it is called [redacted]. It's a Solar Winds, Nagios type system. It does more than just graphing, it does SNMP monitoring, ping monitoring, and all that stuff" (C.Cahoe, personal communication, January 19, 2022).

*"So we have monitoring tools: what's up, what's down, what needs to be addressed? We have systems administration tools to manage devices. Whether you're pushing out images, patching, or doing backups. Obviously when you have hundreds of things to do, we try to be efficient with it, so you have all of these different tools that help you manage it faster" (*C.Cahoe, personal communication, January 19, 2022).

"Teams is typically the team communication tool. For minor stuff it's just email, but if there is some ongoing thread that we talk about then it's going to be on Teams" (C.Cahoe, personal communication, January 19, 2022).

"One good thing to touch on is password management tools. We have a password management system where passwords can get stored and that way you have strong passwords that people don't necessarily remember by heart. Also security analysis tools, I won't disclose the tool, but we do have tools that are constantly doing threat assessments across all our systems. It's going out, it's scanning systems, it's alerting if it detects a new vulnerability. If there's a new vulnerability against Java, Apache, etc., the system will recognize that it's vulnerable and let us know." (C.Cahoe, personal communication, January 19, 2022).

7. What advice would you give someone who is interested in pursuing this career path?

"The biggest advice I would say is: learn. Try and figure out what you like, what you enjoy. Yeah-- obviously, in any career-- it doesn't matter what your career is. If you don't enjoy what you're doing, it's going to feel like work, and it's going to suck after a while. If you pick a career and you stay in that career for thirty or forty years, you better enjoy it. So if you like the phone side and the conferencing side, then maybe you should try and gravitate towards a position that focuses more on that. If you like staying in the background and patching servers and doing backups and then just a routine systems administration gig, just try and find that. This really goes for any career. Find that little niche in the field that you enjoy" (C.Cahoe, personal communication, January 19, 2022).

Conclusion

As the demand for IT workers increases, the field of systems administration becomes more attractive to students and potential workers. To compete in this field, a worker needs specialized training which can include a Bachelor's degree in Computer Science or Information Technology as well as some certifications such as Cisco or Microsoft. There are a number of subcategories for systems administration employment including computing server administration and Cloud administration. Additionally, there exists many opportunities to cross-train and expand administration skills to include database administration, network administration and project management.

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Student Reactions to Online Instruction at the SIUC Automotive Technology Program

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Abstract
In light of recent events necessitating the transition to online instruction, exploring ways to improve student perceptions of online instructional delivery is an important preparation for potential re-occurrences of this type of event. A survey was developed and administered to collect data regarding the student online educational experience at the Automotive Technology Program at Southern Illinois University Carbondale (the Program). The survey was designed to gather student exposure to various methods, as well as student perceptions of each method. The sample was generated from the population of students who completed at least one online technical course at the Program. Questions were designed utilizing descriptions of the subject matter, effectiveness, ease of use, appropriate length, and continued usage of each instructional method. Collected data was analyzed and stated in both paragraph and 100% stacked bar chart forms. The study documented student responses to the most applied online instructional methods at the Program. Responses indicated these methods were successful in providing a positive educational experience for the majority of students. Additionally, the study collected suggestions for instructors to implement in future online offerings to enhance learning and improve student experiences at the Program.

Introduction

The Automotive Technology Program at Southern Illinois University Carbondale (SIUC) is a nationally recognized baccalaureate program, providing a combination of theoretical and practical hands-on application in technical courses. These courses have traditionally been taught in a face-to-face format. To reinforce the direct instruction provided in the classroom, students perform diagnostic testing and repair procedures in a service lab. Training of this type enables students to practice actual automotive repair tasks in a supervised environment.

Due to the COVID-19 pandemic and resulting restrictions on social proximity, students in the Program were transitioned to an online teaching format during the spring semester of 2020. Labs were closed and face-to-face instruction ceased for the remainder of the semester. When students returned to class in the fall semester of 2020, the Program reopened classrooms and labs for face-to-face instruction. However, some instruction was performed in a hybrid format with a blend of online and face-to-face instruction. Online instruction was also available to accommodate students under mandatory quarantine. At Thanksgiving break, classrooms and labs were again closed and the remainder of the semester was taught remotely.

In light of the recent necessity of transitioning instruction into an online format, exploring ways to improve and broaden online instructional delivery methods can help prepare the Program for any potential re-occurrences of this type of transition. Discovering student perceptions of their online educational experience will provide information that can assist instructors in developing

improvements in their online delivery. Identifying the instructional methods students had the most positive perception of can guide instructors to add more of these methods. This action should improve student experiences at the Program. Finding ways to improve student perceptions of the applied methodologies is also a desired outcome.

In the interest of improving student experiences at the Program, this study will focus on the following research objectives:

- Document online instructional methods applied at the Program
- Gather student reactions and perceptions of applied online instructional methods
- Assess student responses to suggest best practices in future online offerings

If students did not react positively to a particular method, can the reasons be identified? Can we improve the method to achieve the desired outcome? Instructors at the Program are currently learning and developing the best practices to deliver online instruction. Gathering student feedback can assist in developing classes that will provide the best educational experience for all stakeholders.

Literature Review

One of the most common components of an online course is the Learning Management System (LMS). According to David (2013, pp. 4-5), an LMS is "a software application for the administration, documentation, tracking, reporting, and delivery of education courses or training programs." Instructors can use the LMS to communicate with students, post assignments and grades, store slideshows and articles, host discussions, and essentially any other instructional task that is required. For instructors within the Program, SIUC has an existing LMS in the form of *D2L Brightspace*.

SIUC offers instructional support for D2L Brightspace through the Center for Teaching Excellence (CTE). An Online Bootcamp was offered by CTE in the summer of 2020. Attendees were able to practice developing an online class within a mock course shell. Assignments, announcements, weighted gradebook, and discussion boards were among the practice assignments attendees were able to learn about before using them in actual courses in the fall. SIUC encourages instructors to develop LMS strategies through training opportunities provided by CTE.

Various recommendations regarding online instructional strategies were found to be more suitable to specific applications. However, other suggestions were more generic and found applications relevant to all instructors. Darby (2019) advises putting personal touches into the courses, which lets students know who you are and what you expect of them. Creating a *Welcome to Class* video in the LMS is one way to provide such a personal touch to the course. Other authors provided more specific ideas to build course content that students could more easily understand. Sugar (2015) recommended the organization of content into modules and submodules in a logical manner to provide structure for students and make the course easy to navigate. Morris (2020) suggests the pre-planning step of creating a topical outline, then selecting separate video links for each bullet point.

With the LMS providing a framework for the course, the components of the course need to be designed and uploaded. Items such as assignments, readings, and slideshows are familiar to most instructors who have previously taught in a face-to-face format. Other concepts including pre-

recorded video, remote conferencing, and discussion boards may be new to instructors who have not taught online before. Some instructors at the Program have recorded personal video demonstrations, but to provide the bulk of the lesson virtually, more online content is required.

Before the pandemic, many instructors were not familiar with the concepts of synchronous and asynchronous instruction. These terms became more frequently mentioned during meetings and discussions. The concepts are easily defined. According to Wintemute (2021), synchronous learning happens in real time. All participants interact in a specific virtual place at a set time. Conversely, asynchronous learning does not require real-time interaction; content is available for students to access and complete on their schedule. As student learning styles vary, each of these methods would have advantages for some students and disadvantages for others.

Synchronous instructional methods commonly include some form of video conferencing. Platforms such as *Zoom* and *Microsoft Teams* enable students and instructors to interact with active discussions and live lectures. Synchronous instruction can resemble a face-to-face classroom experience in many ways. For example, questions can be fielded in real time and feedback can be immediately provided. Instructors who are more comfortable with traditional lecture than creating pre-recorded videos can appreciate this method of online instruction. However, the rigid schedule of synchronous instruction can create conflicts. Some students may have prior engagements or responsibilities that preclude them from attending synchronous classes at scheduled times.

Asynchronous instructional activities include self-guided lesson modules, pre-recorded videos, readings, case studies, discussion boards, and other content not tied to a live presence. These methods are more accommodating to students with existing schedules and those requiring a more flexible format. Asynchronous modules are completed at the students own pace, providing additional accommodations to learning styles. However, students who appreciate interaction may find themselves isolated in an asynchronous learning environment (Wintemute, 2021).

When delivering instructional materials in a virtual environment, motivating students and keeping them engaged in the learning activities remains an important goal. Multiple studies were found which explored the optimal instructional video length in regards to student attention span. According to Morris (2020), online content or lecture videos in excess of 12 minutes in length are commonly skipped over or simply not watched by students. The suggestion is made to keep online content broken up into short, focused segments of between 6-12 minutes in length. Lynch (2019) agrees, stating as video lectures are a passive activity, students simply tire of listening to excessive lecture in one sitting. By practicing a scenario after watching a six-minute video, students are more likely to remain engaged, and watch additional videos. Discovering student perceptions of appropriate content length could prove beneficial in improving online instruction at the Program.

In addition to self-developed video lectures and live-video lectures, instructors can add content to the course with externally sourced components. These resources can impact more students' learning styles and diversify the course. Instructional videos can be obtained from various training resources as well as popular video sites such as YouTube. While not as personalized, these videos can provide a more professional level of production and variety to motivate and enhance student learning. While many resources are available, it is suggested to select only

content videos that appropriately reinforce the lessons of the course. Jackman and Roberts (2014) exposed students to carefully selected YouTube videos based upon suggestions of the instructor's manuals or from professional videos covering key course concepts. Their results found overwhelmingly positive student perceptions of the videos in their study. By adding external video resources, instructors can build additional curriculum, but they should add value to the course and provide positive student experiences.

Traditional assignments such as textbook chapters, case studies, and assigned readings are easily convertible to an online format. These items are typically uploaded into the LMS along with a drop box for completed work. While similar in nature, online delivery affords the opportunity for assignments to be administered in a variety of new ways. Discussion boards can provide a venue for interaction while short, online quizzes can provide immediate feedback for formative assessment. While traditional assignments are familiar to most instructors, extra effort can ensure these instruments remain effective teaching tools in an online format. Face-to-face learning allows informal interaction which can be deficient in an online setting. To combat mis-communication when assigning work, Stanford Teaching Commons (n.d.) suggests being meticulous with instructions while avoiding elaborate and overly complicated assignments. Allocating extra time to clarify, remind, and communicate with students can mitigate problems and improve understanding.

Remote instruction inevitably includes some form of online assessment. Instructors still need to assess the students' achievement of the learning objectives of the course. At the Program, quizzes and tests were traditionally administered in a face-to-face setting under the supervision of an instructor. In an online application, this is not possible. Instructors can harbor inhibition about online testing due to the fact students can access reference material in a multitude of ways. This is sometimes regarded as academic dishonesty, or cheating, by instructors. Proctoring software and lockdown browsers attempt to keep students from accessing outside material, but are typically not without concerns of their own. Hubler (2020) reveals damaging effects to students regarding privacy and connectivity problems with online proctoring software. Determining best practices in online testing is critical to online instruction. Some instructors are writing questions based on applied knowledge rather than rote memorization. Others are increasing question difficulty while allowing open-notes during the exam. In both cases, determining student perceptions of the practice of online testing will benefit future applications of these strategies.

Methods

An informal questionnaire was sent to all technical instructors in the Program to survey the online methods used/expected to be used in the spring and fall semesters of 2020. Various known online teaching methods, as well as methods discovered through research were listed in the questionnaire. Of the 17 technical instructors surveyed, 12 completed and returned the survey, for an approximate 71% return rate. The results of this survey provided a starting point to develop the student survey. The six most identified methods were: D2L Brightspace, pre-recorded lectures, live video lectures, YouTube videos, assigned readings, and online testing.

Approval was received for a SurveyMonkey account through the SIUC Office of Information Technology and the Provost Office. The SurveyMonkey platform was used to design and administer the 50-question student survey. The survey was organized into eight sections:

Demographics, D2L Brightspace, Previously Recorded Lectures/Demonstrations (Asynchronous), Live Video Lectures/Demonstrations (Synchronous), Non-Instructor Videos/YouTube/External Videos, Assigned Readings (Articles/Chapters/Case Studies), Online Testing/Assessments, and Final Thoughts.

The intent of the study was to confirm applied online instructional methods at the Program and capture student perceptions of their experiences with these methods. To achieve this goal, a variety of select-response question styles were designed utilizing scaled, dichotomous, and multiple-choice response options. Question content included descriptions of the subject matter, effectiveness, ease of use, appropriate length, and continued usage of each instructional method. At the end of each section, supply-response text boxes were provided for additional student comments.

Survey design enabled students to only answer questions regarding methods of which they participated. For each section, students were asked if they were exposed to that particular teaching method. If they answered yes, they were allowed to continue in the section. If they answered no, they were directed to the next section.

The student survey was then sent to SIUC Office of Sponsored Projects Human Subjects Committee (HSC), along with a completed Application to Conduct Research. HSC determined this project did not meet the regulatory definition of human subjects research and approved the research to continue with no additional regulatory requirements. *HSC Reference Number: Q20004*

The sample was generated from the population of students who have taken a recent online technical course in the Program. Students were identified that registered for a technical course in either or both the spring and fall semesters of 2020. Near the conclusion of the fall 2020 semester, an email link to the SurveyMonkey student survey was sent to 366 former and current automotive students. Of these students, 73 returned a response, an approximate 20% return rate. Regarding academic standing, 36 respondents were seniors, 16 were juniors, 17 were sophomores, and 4 were freshmen. Of the respondents, 65 identified as male, 7 identified as female, and 1 identified as other. The survey revealed 34 students transferred into the program, while 39 students were non-transfers.

> "Non-Traditional Students are defined by SIUC as having any of the following characteristics: are financially independent; have delayed enrollment in college (generally not entering directly from high school); are returning to higher education after stepping out at least once; are working full-time; are attending college part-time; have children; are married, widowed, or divorced; are commuting to college; or are a veteran." (Southern Illinois University Carbondale, 2021)

From the above definition, 12 respondents identified as non-traditional and 61 identified as traditional students.

At the conclusion of the collection phase, returned survey data was reviewed and analyzed within the SurveyMonkey platform. Demographic information of the sample group was identified and documented. Filters were used to isolate students by response in attempts to

discover any existing patterns. Student responses to questions regarding each of the eight survey sections were compared to determine which instructional methods provided the most positive educational experiences. Student reactions to each method were determined to be best communicated by outlining in paragraph form. Student participation in each method was identified in percentages. Student perceptions and attitudes regarding qualities of each method were also stated in percentages.

In addition to the data result paragraphs for each method, charts were developed to display student responses to similar questions across different methods. Through experimentation with chart design, the desired visual display of data was achieved. Charts are color-coded and of the *100% stacked bar* style. This chart style was determined to provide the most consistent interpretation of the data among multiple experimented styles.

Results

D2L Brightspace

All responding students utilized D2L for some portion of their online content. Over 92% of students described D2L as at least somewhat helpful in increasing their knowledge of the subject material. Most students (75%) described D2L as easy to understand and navigate. Only 10% of students found D2L difficult to use. In easing the transition to online learning from face-to-face, over 87% of students described D2L as at least somewhat effective in this role. Over 91% of students believe D2L should continue to be used in cases where online learning is necessary. Student supplied comments regarding D2L agreed with the select response data. Multiple students suggested having all instructors organize content in a consistent fashion. Inconsistencies in D2L organization from class to class created confusion among some learners.

Previously Recorded Lectures/Demonstrations (Asynchronous)

Over 90% of responding students experienced asynchronous lectures or demonstrations as part of their online instruction. Most students (77%) thought the length of each recorded activity was "about right". However, around 23% of students thought these activities were too long, while none thought they were too short. When asked for the appropriate length of these activities, most (80%) stated a length between 15-45 minutes was desired. No student desired a recorded activity in excess of 60 minutes. Approximately 37% of students found difficulty remaining engaged and attentive to the recorded activities while just over 29% regarded it easy to remain engaged. Of the students who stated difficulty in remaining engaged, over half additionally stated the recorded activities were too long. Of the students who responded the length of the recorded activities was too long, over 86% of these found difficulty in remaining engaged in the activity. Students were very supportive of these recorded activities when asked about increasing their knowledge of the subject material. Over 93% of students stated the recorded activities were at least somewhat effective in accomplishing this goal. While approximately 17% of students recommended to use less recorded activities in class, the remainder wanted the same amount or more. Student supplied comments regarding asynchronous activities provided a variety of feedback. While the majority of comments were positive, some statements regarding excessive length and preference for face-to-face instruction were noted. Many student comments appreciated the ability to replay lectures multiple times.

Live Video Lectures/Demonstrations (Synchronous)
Just over 57% of respondent students experienced synchronous lectures and demonstrations as part of their online instructional experience. At almost 88%, the overwhelming majority of these students thought the length of the learning activity was "about the right length". When asked of the appropriate length of each activity, almost 95% of respondents stated a length of between 15-60 minutes. Approximately 21% of students found difficulty remaining engaged and attentive to the live activities while just over 43% regarded it easy to remain engaged. Students were also very supportive of the live activities when asked about increasing their knowledge of the subject material. Over 90% of students stated the recorded activities were at least somewhat effective in accomplishing this goal. While approximately 18% of students recommended to use less recorded activities in class, the remainder wanted the same amount or more. Student supplied comments stated a desire for face-to-face instruction over online, but comments specifically regarding live activities were generally not as positive as asynchronous activities. Most negative comments referred to difficulty in paying attention.

Non-Instructor Videos/YouTube/External Videos
Approximately 82% of responding students were subjected to externally supplied videos as part of their online instruction. Almost 86% of students thought the length of these videos was "about the right length". When asked of the appropriate length of each activity, all students responded with an answer of less than 60 minutes. Of these respondents, 81% requested a length of 30 minutes of less. Approximately 60% of students regarded these activities as easy or very easy to remain attentive and engaged, while only 7% stated difficulty. Students were similarly supportive of the external videos regarding increasing their knowledge of the subject material. Approximately 95% of students stated these activities were effective. Only 14% of students recommended using less recorded activities in class, with the remainder wanting the same amount or more. All responding students identified the external video resources as being aligned with their expectations of the course, with 84% stating mostly or extremely aligned. Student supplied comments stated appreciation for the external video resources. Instructors were praised for diligence in selecting external videos which were relevant and accurate. Comments included the opinion that instructors should create the majority of the content of the course.

Assigned Readings (Articles/Chapters/Case Studies)
Exactly 90% of students indicated they experienced reading assignments as part of their online instruction. Approximately 84% of responding students stated these assignments were mostly aligned with their expectations of the course. Most students (86%) stated the instructor provided a complementary assignment such as a quiz or writing summary, while approximately 14% replied this was not common practice in their course. The majority of students (74%) responded a time spent of approximately 30-60 minutes on each assignment, with a range of responses from less than 30 minutes to more than 120 minutes. Over 53% of students stated the reading assignments were very or extremely effective in increasing their knowledge of the subject material. However, approximately 12% stated these were only minimally or not effective at all. Over 29% of students suggested instructors use less of these types of assignments in their courses, with only approximately 16% of students suggested more. The remainder thought the same amount of readings was appropriate. Student supplied responses were mixed, ranging from appreciation and perceived importance to aversion and statements of misalignment with expectations.

Online Testing/Assessments

Approximately 97% of the responding students experienced online testing in their course offerings. Students were exposed to a variety of allowances and supporting aides within this methodology. Over 81% of students indicated an open note/open book allowance, while only 22% stated they were allowed to work in groups. Approximately 71% indicated a specific day and time for the scheduled exam, and 64% stated a time limit for the exam. Immediate feedback of the exam results was indicated by 66% of respondents, while only 24% indicated they were allowed multiple attempts. Approximately 42% of students indicated the instructor supplied a study guide specifically for the online exam. When asked if online testing discourages students from learning the material beforehand, 51% of students disagreed. Only 29% of students agreed with this statement, while the remainder had mixed feelings. Regardless, the wide majority of students (90%) stated online testing methods should continue to be used in online course offerings at the Program. Student supplied responses indicated strong opinions both approving and opposing online testing. A few negative responses went as far as calling online testing "a joke" that encourages copying answers from fellow classmates. However, more responses indicated the exercise of looking up answers during the exam to be a helpful learning activity. Students placed less importance on memorizing answers, and referenced how most external situations requires the use of reference material, making online testing more aligned with real-world tasks.

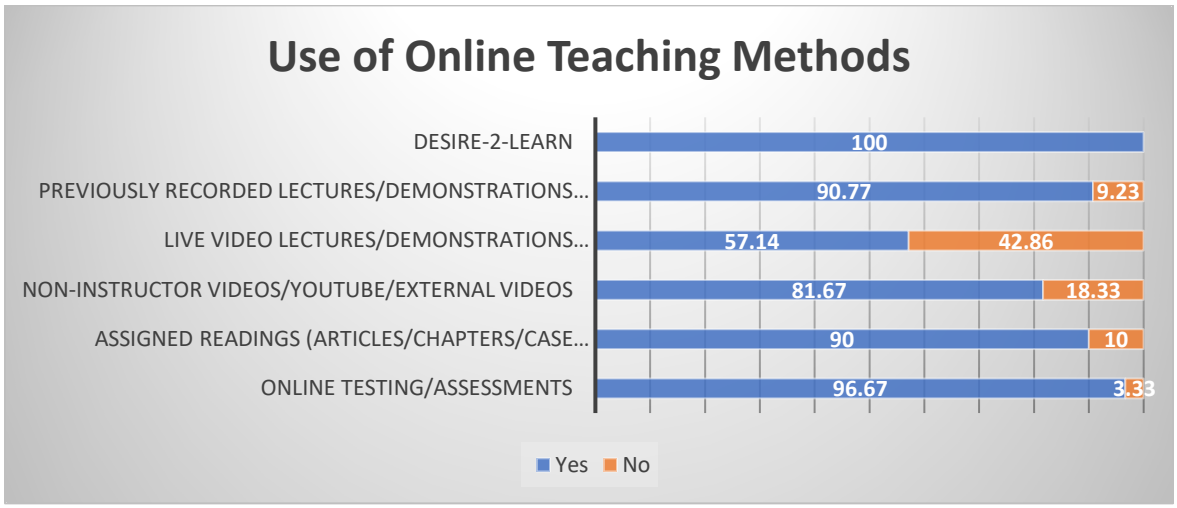
Final Thoughts

Five additional questions were asked regarding overall online instructional experience at the Program. When asked for total time spent learning, studying, and completing assignments, over 65% of students responded between 10-20 hours each week. Only 12% spent more than 25 hours per week, while 14% spend less than 10 hours. Students were asked their preference among synchronous and asynchronous methodologies. Responses were moderately spread, with a 10% preference for synchronous methods. Only 30% preferred just one method or the other, and the remainder sought a blend of the two methods. Students were asked about the importance of virtual office hours. Of these, 66% stated they were needed, while 34% stated they preferred an alternate method. Students were asked if technical courses could effectively be taught in an online format. Over 92% of respondents stated online portions should be limited to 50% or less, with 31% stating these courses should only be taught face-to-face. Only 5% of students stated a majority online delivery is an effective instructional strategy. Additionally, students were asked their preferred instructional delivery strategy for both automotive technical and core classes. Over 98% of respondents requested face-to-face instruction for their technical classes. Almost 75% of students requested online core classes, while 24% preferred face-to-face delivery. Only one student stated a preference for online technical classes.

Data Charts

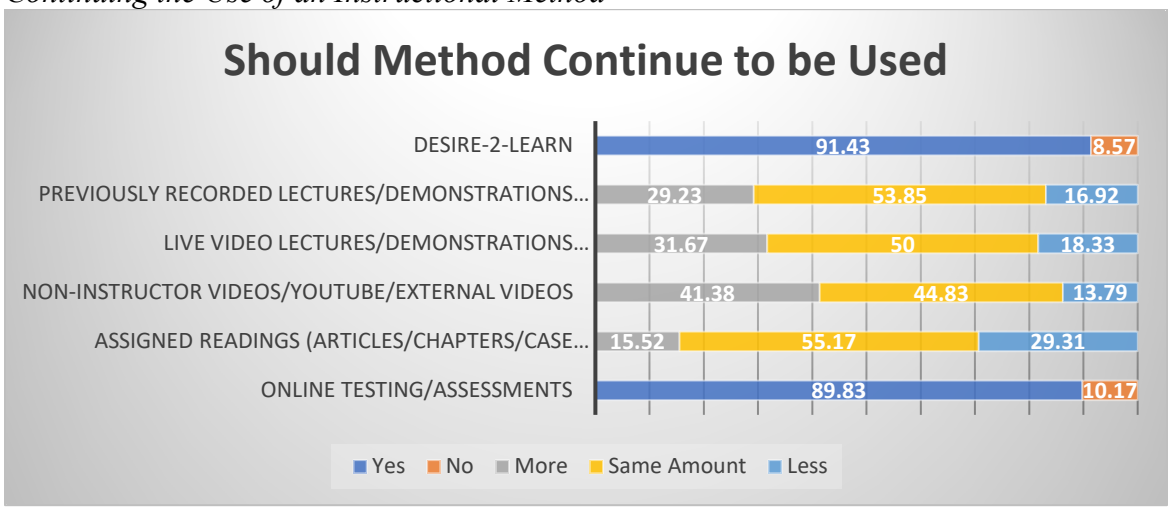
When a particular question was asked across multiple survey sections, the responses were grouped together to provide additional analysis and comparison of the responses. When appropriate and practical, methods were grouped under a question pertaining to that method. The following figures display student responses to particular questions across the different instructional methods.

Figure 1
Student Exposure to Instructional Methods



Note. Percentage of students who experienced a particular instructional method at some point in their online courses.

Figure 2
Continuing the Use of an Instructional Method



Note. Students were asked whether a particular instructional method should continue to be used in online course offerings. Differences in select responses should be noted due to appropriateness of a particular method to be offered in an increased or decreased capacity.

Figure 3
Ease of Student Participation

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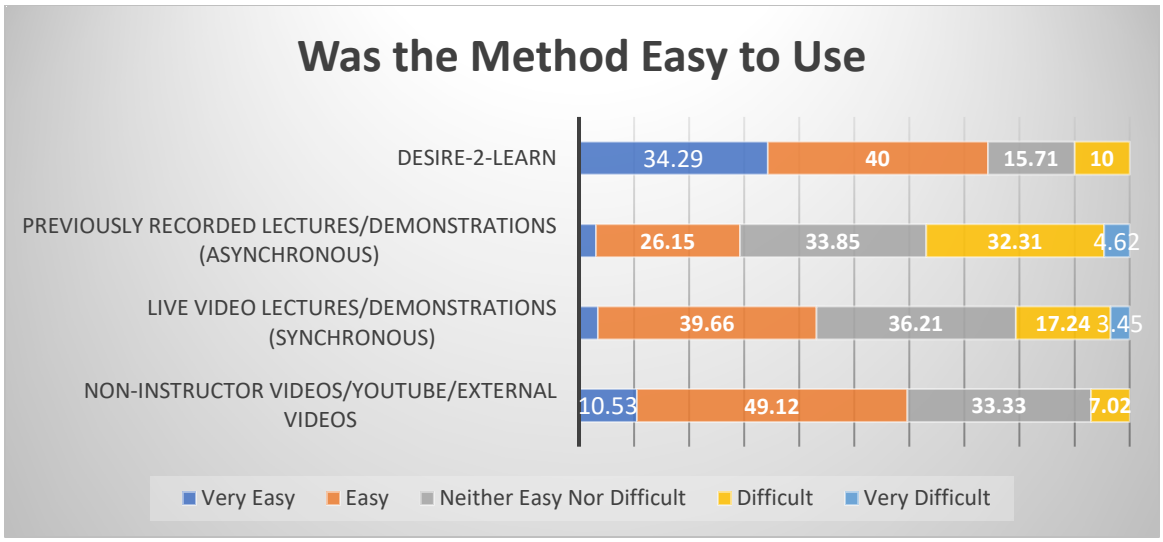
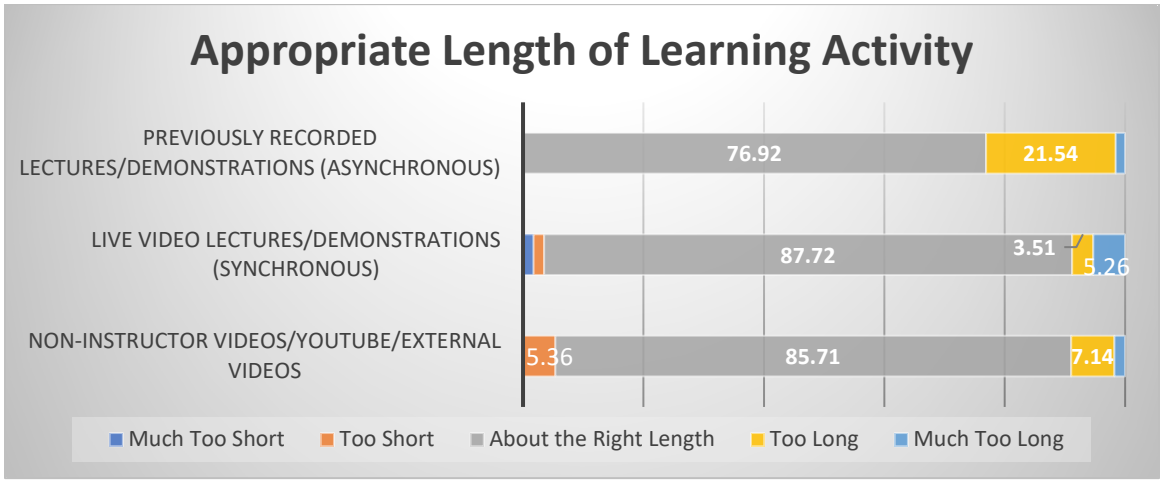


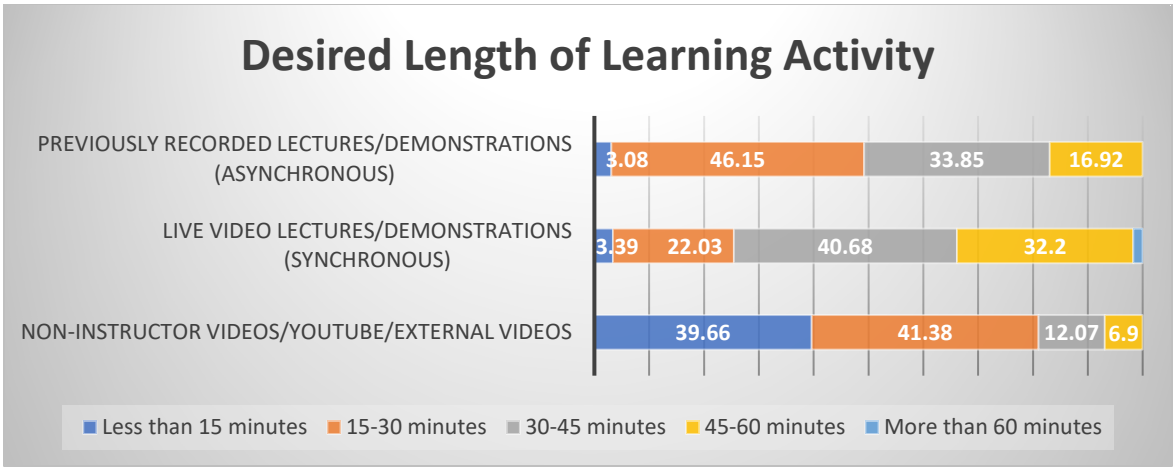
Note. Students were asked to rate the ease in which the learning activities within the instructional method were to participate. Questions included verbiage related to understanding, navigating, engaging, and remaining attentive to the activities.

Figure 4
Appropriateness of Activity Length



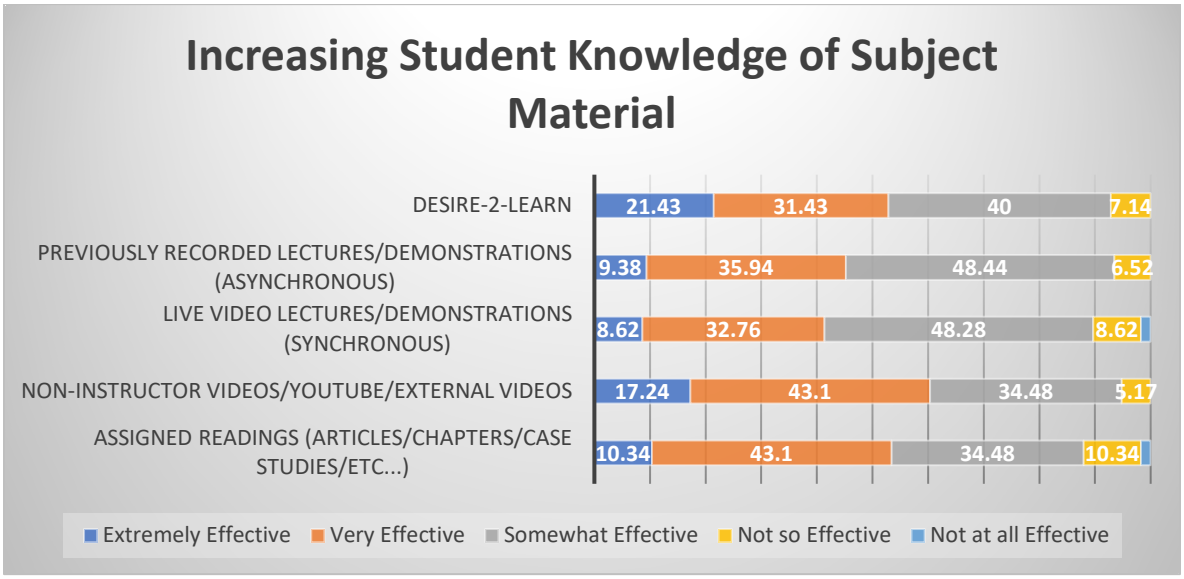
Note. Student responses regarding the perceived length of each learning activity within a particular instructional method. Methods not represented in this figure were not asked this question.

Figure 5
Desired Learning Activity Length



Note. Student responses regarding their desired length of each learning activity within a particular instructional method. Methods not represented in this figure were not asked this question.

Figure 6
Increasing Student Knowledge



Note. Student perceptions of the effectiveness of a particular instructional method to increasing their knowledge of the subject material.

Discussion

This study successfully documented student responses to the most applied online instructional methods at the SIUC Automotive Program during the spring and fall semesters of 2020. Responses regarding length, ease of use, and effectiveness indicated these methods were successful in providing a positive educational experience for the majority of students in the Program.

Students seemed quite receptive of the D2L Brightspace LMS. Student suggestions for improvement supported Sugar's (2015) research regarding logical organization of content. Instructors are encouraged to attend CTE provided D2L training to create a more consolidated course organization and improve student experiences.

Both synchronous and asynchronous methods were generally well received by the students. However, most students found difficulty remaining engaged to learning activities in excess of 45 minutes. These results agree with Lynch (2019). Instructors are encouraged to design and select learning activities at a length between 15-45 minutes to maximize positive student perceptions and improve instructional effectiveness.

Student responses regarded externally sourced video content among the most effective and easiest to use of all methods experienced. These results aligned with Jackman and Roberts' (2014) findings. Instructors are encouraged to supplement online content with external videos carefully selected for accuracy and alignment with course concepts.

Responses indicated fewer students were exposed to synchronous delivery methods than any other method. However, many students indicated an appreciation and desire to participate in synchronous instruction. Instructors are encouraged to continue to utilize a variety of online instructional methods to motivate and address as many student learning styles as possible.

Student responses indicated an overwhelming preference for face-to-face instruction in technical automotive courses. Due to this discovery, online delivery of technical courses at the Program is suggested to be used in situations of necessity only.

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Describing the professional development needs and retention of novice business education teachers in the state of Pennsylvania

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Abstract
Professional development (PD) and retention of teachers are very important to the teaching profession. The purpose of the study was to describe the perceptions of novice business education (BE) teachers in the state of Pennsylvania over three different categories, including their PD needs, likelihood to remain in their current position, and likelihood to remain at their current school district. The first category examined was guided using *Borich's Needs Assessment Model* framework, while the second and third categories were developed after an exhaustive review of the literature and examining what has not yet been described using *Borich's Needs Assessment Model* framework and this population of participants. The results indicated that novice Pennsylvania BE teachers perceived teaching business skills, the integration of technology, getting students to think critically, and assessment and student evaluation, as the most important areas of PD.

Introduction

The professional development (PD) needs and retention of teachers are two important factors within the field of education and especially in the field of business education (BE). New teachers to the field of education, referred to as novice teachers, are those teachers who are completing their first few years of teaching (Caspersen & Raaen, 2014). Novice teachers experience a litany of challenges as they begin their teaching career, which can affect their PD needs and whether they choose to remain in the profession (Clark, 2012) while acclimating to the demands of a new teaching career.

Nationally, teacher PD has gained much attention over the years, including how to effectively define and implement in-service training opportunities (Darling-Hammond et al., 2017; Learn, 2009). Teachers differ on what constitutes effective PD (Desmome & Garet, 2015; Kennedy, 2016; Stewart, 2014) and how to ensure that teacher PD is targeted and focused on their own needs for teaching. Kennedy (2016) also included recommendations for ongoing PD during a teacher's first two years, including suggesting that, "I [Kennedy] would urge researchers to monitoring student learning for 1 or 2 years beyond the close of the PD itself" (p. 974). Effective PD for teachers during their formative years of teaching may be a strong reason as to why teachers choose to remain in the profession or leave teaching altogether (Eberhard, et al., 2000;

Sargent, 2003). Additionally, teacher PD can assist with teacher retention during a teacher's formative years for those teachers who may not feel fully prepared for the demands of a new teaching job (Garcia & Weiss, 2019; Rodgers & Skelton, 2014).

Novice BE teachers are also required to maintain PD hours and this, in turn, can affect the retainment. In the state of Pennsylvania, novice BE teachers must complete certain requirements for their license once they enter the workforce. To earn a Level II PA teaching certification a teacher must earn 24 post baccalaureate credits and 6 must relate to their certification area or improve their professional practice (Pennsylvania Department of Education, 2021). In addition, many states require teachers to meet a certain amount of PD within a set period.

Purpose and Research Questions

The purpose of the study was to describe the perceptions of novice BE teachers in the state of Pennsylvania over three different categories, including their PD needs, likelihood to remain in their current position, and likelihood to remain at their current school district. Data were also collected regarding the participants' demographic backgrounds. The first category as part of the purpose of the study was guided using the Borich's Needs Assessment Model framework, while the second and third categories were developed after an exhaustive review of the literature and examining what has not yet been described using the *Borich's Needs Assessment Model* framework and this population of participants. Also collected were the demographic data of participants. The following research questions were developed to guide the purpose of the study.

1. What were the demographic characteristics of the convenience sample of novice Pennsylvania business education teachers?
2. What were the perceived professional development needs of the convenience sample of novice Pennsylvania business education teachers?
3. What is the perceived likelihood that novice Pennsylvania business education teachers from the convenience sample will remain at their current school and in the teaching profession?
4. What are the perceived reasons that novice Pennsylvania business education teachers from the convenience sample expressed as influencing their reasons to stay or remain in the teaching profession?

Review of the Literature

Professional development is continued education that professionals participate in after entering their professional careers (Antley, 2020). PD programs are meant to reinforce areas related to one's profession or introduce new concepts. In addition, PD can help an individual advance their career. Many fields such as education require professionals to complete in-service education and training in order to maintain their licensure or certification (Antley, 2020). PD in education typically refers to classes, workshops, seminars and conferences (Mizell, 2010). PD for the teaching profession has been integral in the development and refinement of skills, knowledge, and attitudes of educators (Aldosemani, 2019).

There are many benefits to developing professionally such as gaining and reinforcing knowledge while increasing one's expertise. An increase in knowledge also leads to increased self confidence in one's ability (Antley, 2020). In addition to the benefits provided to individuals, schools are recognizing the importance PD can have on school improvement. PD can provide

teachers with the knowledge to increase student engagement, learning and achievement (Borko et al., 2010).

In many school districts, administrators are often the ones involved in designing in school PD. Cannon et al. (2010) found that Idaho Career Technical Education (CTE) secondary principals perceived that the PD priorities for CTE teachers were to motivate students to learn, teach students to think critically and creatively, grant writing and funding opportunities, design and develop digital-age learning assessments, and teach learning disabled students. The majority of CTE PD research has focused on teaching and learning and program management. Kitchel et al. (2009) examined business and marketing teachers in Idaho. This study found the top topics of importance for the teachers as:

1. were grant writing and funding opportunities;
2. understanding federal, state, and local funding;
3. establishing and organizing co-op/internships;
4. developing an effective public relations program; and
5. developing curriculum-based school-to-work/career activities.

There was some overlap between the Cannon et al. (2010) and Kitchel et al. (2009) studies, but also differences in what the principals and the business and marketing teachers perceived were important PD topics. There have been times when there may be a disconnect between what administrators perceived as important and what teachers believe to be important (Kitchel et al., 2009; Cannon et al., 2010). Therefore, a team effort between administration and teachers is the best approach when developing PD goals (Cannon et al., 2010; Mizell, 2010).

Retention

The United States is facing a teacher shortage and a teacher retention problem. García and Weiss (2019) found that 13.8% of public teachers were leaving their school or the teaching professional altogether. There was a drop in the number of individuals completing a teacher preparation program of 27.4% from the 2008-09 school year to the 2015-16 school year (Weiss, 2019). The National Center for Education Statistics (2016) cited in a study of teachers from 2011-12 and 2012-13 that 8% left the teaching profession. To increase retention rates, it is important to determine what factors are important in a novice teacher's decision-making process. PD is one component that can assist educators in developing skills important for being an effective educator. Making it more likely to remain in the teaching profession (Huang & Cho, 2010).

Conceptual Framework

Scholarship on PD has shown the importance of well-designed needs assessment for effective in-service learning activities leading to continuous professional improvement (Guskey, 2000). Research by Borich (1980) on *needs assessment* served as the conceptual framework for this study. The *Borich's needs assessment* model seeks to uncover an individual's competency and proficiency in a certain area. A topic might seem important to an educator, but they might be proficient in that area and not need additional PD (Waters & Haskell, 1989). This model has been found to be an efficient way to include teachers and stakeholders in an engaging needs assessment process (Cannon et al., 2013).

The Borich (1980) model utilizes a descriptive survey which evaluates teachers' perceptions of "perceived level of importance" and "perceived level of competence" of constructs and practices related to specific disciplines of teaching (Cannon et al., 2013). Data is collected and analyzed comparing the "importance" with the "competence" results. A *mean weighted discrepancy score* (*MWDS*) is calculated and ranked. Items having the highest *MWDS* are deemed to be PD needs with the highest priority (Cannon et al., 2013). Borich's (1980) model has been used by numerous CTE and BE researchers as a method to determine PD needs over the past quarter century (Garton & Chung, 1996, 1997; Edwards & Briers, 1999; Joerger, 2002; Layfield & Dobbins, 2002; Cannon et al., 2010; Kitchel et al., 2010; Kitchel et al., 2010; Cannon et al., 2011; Cannon et al., 2012, Hendon et al., 2019).

Research Design and Methodology

The instrument for this study was developed from one used for previous research exploring the PD needs of CTE teachers (Duncan et al., 2006; Cannon et al., 2010). The instrument was in the form of an online questionnaire. It was revised to fit the scope and research questions of the study, and it also went through validity and reliability testing. A diverse panel of experts that included current BE teacher educators and researchers reviewed the questionnaire and provided feedback. A pilot test with current BE teachers who were not a part of the target population also completed the questionnaire and provided feedback. Reliability coefficients in the form of *Cronbach alphas* were calculated for each subscale of the questionnaire and also an overall score. Overall, the Cronbach Alpha score was .777. According to the guidance of internal reliability and scales on a questionnaire as delineated by Gliem and Gliem (2003), each scale had a rating of "Excellent" or "Good", indicating sufficient levels of internal consistency. Data from the questionnaire were analyzed using descriptive statistics and qualitatively for themes.

A convenience sampling technique was used (Creswell, 2012), and the survey was distributed to participants using Qualtrics as well as implementing suggestions for best practices for online data collection as espoused by Dillman et al. (2014). It should be noted that a convenience sampling technique produces non-randomized results, which can in turn affect generalizability outside of the sample. The convenience sample would also greatly impact research questions numbers one and three as part of the results. A prenotice was sent to participants, and two rounds of data collection occurred during the months of May and June. To encourage participation, three $25 Amazon.com gift cards were offered through a random drawing of participants who completed the questionnaire. Overall, 27 teachers fully completed the questionnaire.

Twenty-five statements were included on the questionnaire regarding PD needs including program operation and management, usage of instructional strategies, and maintaining a BE program. Participants selected their "Level of Importance" and "Level of Competence" for each statement. Each scale ranged from 1 to 5, with "1" indicating low agreement with a particular statement, "3" indicating a medium agreement with each particular statement, and a "5" indicating strong agreement with that particular statement.

PD needs were determined through the calculation of *Mean weighted discrepancy scores* (*MWDS*). Previous research focused on CTE PD have used the *MWDS* to prioritize needs (Cannon et al. 2011; Cannon et al., 2012; Duncan et al., 2006; Garton & Chung, 1996; Kitchel et al., 2009; Kitchel et al., 2010; Layfield & Dobbins, 2002). The researchers used the data for

perceived "Level of Importance" and "Level of Competence" to calculate the *MWDS* for each item. The scores were then ranked with items having the highest MWDS being the most pressing PD needs. Institutional review board approval was required and obtained for this study.

Results and Findings

The results of the study included demographic information of the participants, the ranking of perceived PD, and the likelihood of remaining in the teaching profession. All results are summarized below.

Research Question #1: ***What were the demographic characteristics of the convenience sample of novice Pennsylvania business education teachers?***

Overall, 16 females and 11 males completed the questionnaire, with a total of 27 participants. Participant demographic information also included age, years of teaching experience, highest degree level attainment, number of students at each school, number of business education teachers in each school, grade level(s) taught, and background of the school. Participants had an average age of 37 (*SD* = 11) and had 2.93 years of teaching experience (*SD* = 1.75). Eight participants held a bachelor's degree and 19 held a master's degree; the average number of students at each school was 1,307.89 (*SD* = 743.34). The average number of business teachers at each school was 3.63 (*SD* = 2.34). Fifteen participants worked in a community categorized as "rural", seven in a community categorized as an "urban cluster", and five in a community categorized as an "urbanized area". Most of the participants (N=19) were teaching at the high school level, seven taught at the middle school and high school levels, and one taught at elementary and middle school levels.

Research Question #2: ***What were the perceived professional development needs of the convenience sample of novice Pennsylvania business education teachers?***

Data analysis and results for Research Question 2 can be found in Table 2. Participants ranked 25 different statements which were analyzed for the teachers' perceived levels of importance and perceived levels of competence on a Lykert type scale of 1-5. Participants identified *Teaching skills and concepts in your area of business* (*M* = 4.81 *SD* = 0.48), *Integrating current advances in technology into the curriculum* (M = 4.74; *SD* = 0.66), *Teaching students to think critically and creatively* (M = 4.7, *SD* = 0.54) as the three most important perceived business education teaching and learning constructs. The results also indicated that participants perceived *Conducting needs assessments and surveys to determine the courses that should be taught* (*M* = 4.00, *SD* =0.96), *Developing an effective public relations program* (*M* =3.74, *SD* =0.94), and *Planning and conducting student field trips* (*M* =3.63, *SD* =1.08) as their least important areas of business teaching and learning.

Participants identified *Using computers/technology in classroom teaching* (*M* = 4.48, *SD* = 0.75) and *Organizing and supervising computer instruction* (*M* = 4.48 , *SD* = 0.7) as their most competent areas of business education teaching and learning. These were followed by *Teaching skills and concepts in your area of business* (*M* = 4.41, *SD* = 0.75), *Using multimedia equipment in classroom teaching as their second choice* (*M* = 4.41, *SD* = 0.75), and *Assessing and evaluating student performance* (*M* = 4.37, *SD* = 0.63). The results also indicated that participants perceived *Evaluating the local Business program* (*M* =3.67, *SD* = 0.96), *Teaching*

learning disabled students (*M* = 3.63, *SD* = 0.93), and *Developing an effective public relations program* (*M* =3.48, *SD* = 0.89) as their least competent areas.

Perceived PD needs of novice Pennsylvania Business teachers was determined by calculating *Mean Weighted Discrepancy Scores* (*MWDS*). The highest *MWDS* scores were considered the items as the most important PD needs. Items with the highest *MWDS* were as follows:

1. "Integrating current advances in technology into the curriculum" (*MWDS* = 3.69);
2. "Teaching learning disabled students" (*MWDS* = 3.62);
3. "Teaching gifted and talented students" (*MWDS* = 3.43);
4. "Teaching students to think critically and creatively" (*MWDS* = 2.61); and
5. "Integrating life skills into the curriculum" (*MWDS* = 2.59).

The items with the lowest MWDS, and therefore the least important perceived PD needs were as follows:

1. "Planning and conducting student field trips" (*MWDS* = -0.81);
2. "Organizing and supervising computer instruction" (*MWDS* = 0.17);
3. "Developing relations with fellow teachers and administrators" (*MWDS* = 0.32);
4. "Locating and selecting student references and materials" (*MWDS* = 0.46); and
5. "Conducting parent/teacher conferences" (*MWDS* = 0.46).

Research Question #3: ***What is the perceived likelihood that novice Pennsylvania business education teachers from the convenience sample will remain at their current school and in the teaching profession?***

Participants rated the likelihood that they would return to their current teaching position and also to remain in the profession, which included written responses specifically stating why they would stay or leave the profession. Participants rated the question of likelihood to return to teaching for the next school year as "Extremely likely" (N=23), "Somewhat likely" (N=3), and "Somewhat unlikely" (N=1). Participants were also asked the likelihood that they would return to their current teaching position and school as "Extremely likely" (N=22), "Somewhat likely" (N=4), and "Somewhat unlikely" (N=1).

Research Question #4 ***What are the perceived reasons that novice Pennsylvania business education teachers from the convenience sample expressed as influencing their reasons to stay or remain in the teaching profession?***

The last part of the questionnaire was open-ended and asked participants to describe reasons to remain in the teaching profession. A qualitative analysis was performed and researchers counted the number of times the following themes appeared through open-ended questions:

1. a love of teaching (44%);
2. administrative support or lack of administrative support (30%);
3. varied job responsibilities including the number of courses and types of courses taught (19%);
4. salary expectations (11%);
5. the environment and culture of the school (11%); and
6. support from other colleagues (9%).

Table 1
Importance and competence ratings from each statement on the questionnaire

	Importance		Competence		
Statement from questionnaire	M	*SD*	M	*SD*	MWDS
Integrating current advances in technology into the curriculum.	4.74	0.66	3.96	0.85	3.69
Teaching learning disabled students.	4.44	0.75	3.63	0.93	3.62
Teaching gifted and talented students.	4.63	0.56	3.89	1.01	3.43
Teaching students to think critically and creatively.	4.7	0.54	4.15	0.72	2.61
Integrating life skills into the curriculum.	4.67	0.73	4.11	0.97	2.59
Evaluating the local Business program.	4.22	0.8	3.67	0.96	2.34
Establishing and organizing work-based learning.	4.44	0.75	3.96	1.06	2.14

Teaching skills and concepts in your area of business.	4.81	0.48	4.41	0.75	1.96
Teaching students problem-solving and decision-making skills.	4.67	0.68	4.3	0.72	1.73
Providing career exploration activities in your business area.	4.59	0.75	4.22	0.93	1.7
Developing performance based assessment instruments.	4.56	0.64	4.19	0.68	1.69
Determining the content that should be taught in specific courses	4.44	0.75	4.07	0.87	1.64
Managing student behavior problems.	4.56	0.64	4.22	0.93	1.52
Motivating students to learn	4.56	0.64	4.22	0.85	1.52
Assessing and evaluating student performance.	4.59	0.75	4.37	0.63	1.02

Developing an effective public relations program.	3.74	0.94	3.48	0.89	0.97
Conducting needs assessments and surveys to determine the courses that should be taught.	4.00	0.96	3.78	1.01	0.89
Using computers/technology in classroom teaching.	4.67	0.83	4.48	0.75	0.86
Embedding national and state business education standards into the business education curriculum.	4.3	1.03	4.11	0.89	0.8
Using multimedia equipment in classroom teaching.	4.52	0.64	4.41	0.75	0.5
Conducting parent/teacher conferences.	4.15	0.82	4.04	0.94	0.46
Locating and selecting student references and materials.	4.15	0.86	4.04	0.85	0.46

Developing relations with fellow teachers and administrators.	4.33	0.96	4.26	0.76	0.32
Organizing and supervising computer instruction.	4.52	0.8	4.48	0.7	0.17
Planning and conducting student field trips.	3.63	1.08	3.85	1.03	-0.81

Note: MWDS is an acronym for "Mean Weighted Discrepancy Scores"

Limitations

Because of the nature of the convenience sample of 27 novice Pennsylvania BE teachers, the findings of the study are limited. Generalizations should not be made beyond this group. However, the results of the study provide baseline data about the field of Business Educators and the variables of PD and retention.

Conclusions, Discussion, & Recommendations

The Borich's Needs Assessment model measures the gap between "what is" and "what could be" (Borich, 1980). The results of the research study concluded which PD needs, as indicated by statements on the questionnaire, that novice BE teachers perceived to be the most important and most competent. By having participants select statements and ranking them according to their own perceptions of important items and the perceived level of competency for these items, it can be concluded that novice Pennsylvania BE teachers have certain PD needs that are applicable to them.

The results of the study indicated that novice Pennsylvania BE teachers who completed this study's survey instrument perceived that integrating current advances in technology into the curriculum as the most pressing PD need. These teachers perceived that PD related to teaching students with special needs was also a high priority need. Specifically, teaching learning disabled students and teaching gifted and talented students. Teaching students soft skills such as critical and creative thinking and integrating these and other life skills into the curriculum rounded out the top five of PD needs as perceived by the novice Pennsylvania BE teachers who were a part of this study's convenience sample.

Previous PD needs assessment research related to the Business discipline found somewhat similar results. Scholars from Idaho determined the following perceived PD priorities for Business teachers in that state:

1. developing applications through programming languages;
2. developing performance based assessment instruments;
3. integrating science standards into the CTE curriculum;
4. embedding graduation standards into the CTE curriculum; and
5. teaching problem-solving & decision-making skills (Kitchel, et al. 2010).

Similarities can be seen between integrating of current technological advances into the curriculum (this study) and developing applications through programming languages (Kitchel et al., 2010). Also, teaching soft skills of critical/creative thinking (this study) is similar to teaching problem solving and decision-making skills (Kitchel et al., 2010). A consistent theme of utilizing technology and teaching life skills has emerged in BE over the past decade. With the need to utilize online, distance, and remote delivery of instruction due to Covid 19 mandates, it is clear that PD related to integrating technology into curricula and learning environments will continue to be a pressing priority. The use of technology in the curriculum and to deliver instruction will provide teachers opportunities to prepare a diverse group of students with skills to be used for successful college experiences, entry into the workforce, and to lead a productive and happy life.

Business Education programs have evolved to serve a diverse population of students. The need to create engaging learning environments for students with unique and individual learning needs is clear. Findings from this research demonstrated the need to provide quality PD opportunities to novice Pennsylvania BE teachers. Many Business teachers have students with learning disabilities in classes along with students who have been identified as gifted and talented. Teaching students with diverse learning styles and needs presents a challenge that PD can provide teachers with the tools to overcome.

Participants reported numerous reasons for returning to teaching. These included levels of stress, support of the administration, love of learning and teaching, salary, variance in the school day, and love of the teaching profession. Some reasons that participants cited as influencing their decision to return to their current teaching position included support from co-workers and administration, work-safety issues, issues with student behavior, loving the job and opportunities, ability to coach, and work-life balance. These findings can also be used by stakeholders tasked with creating and implementing engaging PD for BE teachers in Pennsylvania. Specifically, those who design and develop PD for novice BE teachers should consider reasons for staying in teaching as a component in the planning for in-service training activities.

Several recommendations arise from the findings and conclusions of this research. These include designing appropriate and effective PD opportunities for novice Pennsylvania BE teachers, continuing to determine novice Pennsylvania BE teachers' areas of perceived lower competence, and tracking baseline data regarding novice BE teachers' likelihood to remain at their current school and in the teaching profession. It is recommended that school districts and Pennsylvania BE consultants design PD that addresses these areas, and that BE teacher preparation programs create learning environments which integrate these components for pre-service BE teachers' learning opportunities. This also follows the recommendations indicated by Desimone and Garet (2015) ensuring that PD is content focused. Novice BE teachers may perceive PD activities more

valuable if PD opportunities are targeted and unique for the discipline. This in turn can lead to more effective training and continued professional growth. Long term, this focused PD can lead to higher retention rates. Higher retention rates will mean more teachers with the valuable experience necessary for student learning and achievement.

From the findings, these novice Pennsylvania BE teachers' most pressing PD needs were revising curriculum to utilize the latest technological advances, teaching a diverse array of student backgrounds and exceptionalities, teaching students critical and creative thinking skills, and providing students opportunities to develop life skills. These findings were similar to previous research identifying PD needs for Business teachers and other CTE teachers. Kitchel et al. (2010) found the following in-service training needs for Idaho Business teachers; teaching students critical and creative thinking skills, the creation of "digital-age" assessments of learning, and student motivation to learn. Cannon et al. (2012) found the PD needs for secondary CTE teachers as teaching critical and creative thinking, motivating students to learn, designing learning experiences and assessments utilizing current technology.

As a result of the study, educational stakeholders can plan and implement effective PD opportunities that directly impact novice Pennsylvania BE teachers. This recommendation reflects the suggested guidance of targeted PD as espoused by (Darling-Hammond et al., 2017). Targeted PD can benefit novice teachers and allow them to have a voice in the types of PD that they participate in according to their needs. Pennsylvania educational leaders should use the findings as a component for the planning of PD activities specifically catered to beginning Business teachers. Training activities designed to meet the needs of this population of Pennsylvania teachers should be a component of retention programs.

Recommendations for future research

This study sought to understand the PD needs of novice Pennsylvania BE teachers based on common PD topics. However, some districts take the viewpoint that PD should be based on student needs. Additional areas of research may include asking business educators if they are aware of their student needs and what PD is necessary. This would be a different method than the Borich (1980) *Needs Assessment* and could be used as another tool to validate the identification of PD needs. Researchers should also explore ways to include the needs of business and industry in the identification of Business teachers training needs.

As with other studies which utilized the Borich (1980) *Needs Assessment* instrument, it is recommended that BE researchers continue to replicate research which has added to the scholarship of PD needs assessment. The replication process will continue to improve the instrument and strengthen the validity and reliability of this PD needs assessment model.

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Advancing the Design Thinking Mindset in Secondary and Post-Secondary Business Education

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Abstract
Little is known about the use of design thinking in business education. This descriptive, quantitative study was situated in a theoretical framework of social constructivism and experiential learning, and sought to discover to what extent secondary and post-secondary business educators are implementing design thinking. Secondary teachers are embedding design thinking into information technology and entrepreneurship courses, and post-secondary instructors are embedding design thinking into management, general business, and information technology courses. Lack of knowledge is the main reason business educators do not use design thinking. Business educators confirmed that reflection is essential to the design thinking process**,** and class discussion was the instructional approach most used to foster reflection. It is likely that business school faculty have not been exposed to designers in either their corporate careers or their own business school education, and need to learn the design thinking mindset, tools, and pedagogies in order to implement them into business courses.

Keywords: design thinking, business education, experiential learning, social constructivism, instructional approaches, Stanford Design Thinking Framework

Introduction

Numerous studies have identified a new set of skills that are needed to prepare 21st century learners to thrive in an ever-changing world. Topping the list of skills needed for today's advancement of innovation in science and technology in a globalized society include critical thinking, communication, and creativity (Roslaniec, 2018). Educational systems need to transform curriculum that will prepare students to develop curiosity and resilience, have self-regulation, respect the ideas and values of others, and persevere when confronted with failure and rejection (OECD, 2018, p. 2). One of the most "fundamental human cognitive processes" (Rahman, 2019, p.64) is the skill of problem-solving. It is a critical and essential life skill for every job in every industry (CareerBuilder, 2021). Problem-solving is a complex process that includes observation and critical thinking skills, and each of these skills relies on additional skill development. A strategic approach educators can adopt to develop the problem-solving skills of 21st-century learners is a design thinking mindset.

Design thinking is a human-centered approach that draws on students to engage in innovative and creative problem-solving. Efeoglu et al. (2013) defined design thinking as "a human-centered problem solving method that mostly leads to radical innovative solution in terms of the feasibility, desirability and viability of products or services" (p. 241). Brown (2008) considers innovation to be the core of design thinking. Gibbons (2016) asserted that a design thinking approach to problem-solving may lead to innovation and a competitive advantage.

Review of the Literature

Design Thinking in Secondary and Post-Secondary Education

The traditional approaches to teaching problem-solving to students at the K-12 level seem to be ineffective in developing the 21st-century skills of creativity and innovation (Luka, 2014). At the middle level, research findings indicated when design thinking was used, students were able to utilize their imagination, develop creative confidence, and develop a prototyping mindset (M. Carroll, 2014; Carrol et al., 2010). Design thinking was also found to elevate students' choice and voice (Durkin, 2021). In contrast, Panke (2019) concluded that it is possible for students to experience potential negative outcomes such as anxiety, frustration, and a lack of confidence in their creativity.

Many secondary schools are also faced with the challenges of effectively developing entrepreneurship, creativity, and innovation under the current educational system (Androutsos & Brinia, 2019). The findings of recent studies indicated that design thinking has a positive impact on the learning of secondary students. Aflatoony et al. (2018) was focused on evaluating design thinking skills of secondary students and found that problem-solving, human-centeredness, and collaboration skills all increased. Hennessey and Mueller (2020) investigated how educators perceive design thinking integrating into their classrooms and found that educators had a positive attitude towards the design thinking framework.

At the post-secondary level, design thinking is wide-spread in many academic disciplines such as the Science, Technology, Engineering & Mathematics (STEM) strand (Mentzer et al., 2015); engineering (Plattner et al., 2011), medical education (Gottlieb et al., 2017), and art education (Watson, 2015). However, design thinking has evolved into a "pedagogical phenomenon…due to its widespread relevance across many disciplines" (Beligatamulla et al., 2019, p. 91) and is now also used in disciplines like computer science and software engineering (Sohaib et al., 2019; Valentim et al., 2017), software development (Parizi et al., 2022), and information technology education (Henriksen et al., 2017; Lin et al., 2020; Su & Xu, 2020). In information technology education design thinking has been credited with developing 21st century skills, especially creativity (Henriksen et al., 2017).

Business education has been slow to adopt design thinking, even though Dunne and Martin (2006) explained the need for it, saying, "today's business people don't need to understand designers better, they need to become designers" (p. 513). While Matthews and Wrigley (2017) found that design thinking was growing in higher education, Pande and Bharathi (2020) found a lack of published studies connecting design thinking to management education. The Rotman School of Management at the University of Toronto, Canada, integrates design thinking into business education because they believed their business students were not equipped with

problem-solving skills (Çeviker-Çınar et al., 2017; Matthews & Wrigley, 2017). Although one of the newer business sub-disciplines, entrepreneurship education has been on the forefront of implementing design thinking into business education. The Lean Startup movement (Ries, 2011), a method to develop startups and inspired by Toyota's lean manufacturing processes, is credited with expanding principles of design thinking into the world of entrepreneurs.

Design Thinking Models

While there are many variations of design thinking models (Parizi et al., 2022; Watson, 2015) one of the most well-known design thinking models for problem-solving is the Stanford Design Thinking Framework, and this was used to conceptualize the present research study. The Stanford Design Thinking Framework is a research-based methodology for creative problem-solving and is used by Fortune 500 companies such as Apple, Google, Samsung, and General Electric as a viable problem-solving model (Dam & Siang, 2020). Tu et al. (2018) conducted a study using the Stanford Design Thinking Framework to determine the effectiveness of this model. The findings indicated this framework, implemented as a creativity teaching strategy, has the potential to promote student participation, improve teaching, support student learning, and deepen discussion skills.

A review of existing literature was conducted to learn the instructional approaches and resources used in each stage of design thinking. The five stages that define the Stanford Design Thinking Framework are Empathize, Define, Ideate, Prototype, and Test. The key to the Empathize stage is that it begins with people and requires connecting with the needs of the end user. This approach focuses on understanding a problem from a new perspective, which can aid in empathizing with the people affected by the problem (Gallagher & Thordarson, 2020). Potential tools to accomplish the first stage could include empathy maps, artifacts from interviews, and personas. "The most powerful means for students to develop empathy is through direct, in person, observation and interviews of the target population in the context of their lives or work" (Glen, et al., 2015, p. 186).

In the Define stage of design thinking, the insights of the information collected in the empathy stage are analyzed to provide clarity and focus to the problem. Approaches used in this stage could include affinity mapping or story and journey mapping. Ultimately this stage leads to a point of view statement that guides the remaining stages of this design thinking model (Gallagher & Thordarson, 2020). In the Ideation stage, brainstorming is performed to generate ideas. To facilitate this stage, activities like wacky introductions, 30 circles, two buckets, and crazy 8's, can be used to generate ideas (Gallagher & Thordarson, 2020). Based on the results of the Ideate stage, the design thinking model moves into the fourth stage, Prototype.

The Prototype stage moves ideas into action and is often one of the most challenging primarily because an idea might or might not work as defined in the ideate stage (Gallagher & Thordarson, 2020). Prototyping in design thinking should be "as fast and cheap as possible" (Glen, et al., 2015, p. 182) as its purpose is to create representations of ideas in order to learn and get feedback from customers on them (Glen et al., 2015). When a prototype fails, which is encouraged, it then requires a visit back to the ideate stage to generate new ideas. Examples of prototypes could include brochures, storyboards, diagrams, models, roleplay, or anything that encourages users to interact and give feedback (Del Pino Galvan, 2012). Prototypes are encouraged to be relevant,

tangible, and developed in rough draft form (Gallagher & Thordarson, 2020). Demonstrating a prototype of a new or improved product, service or process by creating a video or a slide presentation also works, as the concept of "show don't tell" (Doorley, et al., 2018, p. 56) is a critical way of letting users experience the prototype.

The final stage of the Stanford Design Thinking Framework is Test. In this phase, the users provide feedback on how well the prototype addresses the problem. The test stage is critical, offering the feedback needed to determine if the problem has been solved for the end-user and if so, the process moves into implementation. If the test phase indicates the problem has not been solved, it is necessary to return to any of the design thinking stages. The design thinking process is not linear. As often as necessary the prototype, test, feedback stages can be repeated until a solution is implemented.

Theoretical Framework

This study is situated in a broad theoretical framework of experiential learning, social constructivist learning theory, and reflection. Dewey's (1933) ideas about learning laid the foundation for integrating experiences into curriculum. Dewey believed that learning came through experience, that experiences build on each other, that learning is situational, and teachers are responsible for creating the learning experiences for their students. Dewey advocated for learning through real-world problem-solving approaches. Kolb's (1984) experiential learning model builds on Dewey's ideas and is a conceptual model that describes learning as "the process whereby knowledge is created through the transformation of experience" (p. 26). The experiential learning cycle is based on Kolb's ideas that learning is a process, ideas are continually reimagined through experiences, learning involves both people and the environment they are in, and the process of learning happens through experiences and reflection on those experiences.

Constructivism

The dominant modern educational approach to designing instruction is based on the theory of constructivism (Bruner, 1966; Dewey, 1929; Piaget, 1952; Vygotsky, 1978), and constructivism informs experiential learning theory. Constructivism states that individuals construct new knowledge from their experiences by interacting with other people and the environment (Fosnot, 1996; Gagnon & Collay, 2001; Grennon-Brooks & Brooks, 1999). In contrast to behaviorism (Skinner, 1938), where the instructor is the expert in the classroom and repetition is the desired way to learn, constructivism focuses on constructing meaning, not memorizing facts. Instruction becomes student-centered instead of teacher-centered, and instructors are responsible for organizing learning activities for students. Instructors who use constructivism to teach pose problems that are relevant to students' lives or professions, allow learners to work together to solve problems, help build on prior knowledge, create authentic, real-world and hands-on learning experiences, and have students reflect on their learning (Grennon-Brooks & Brooks, 1999).

Specific to management education, Pande and Bharathi (2020) mapped constructivism learning theory with design thinking using the activities of a design thinking workshop in an information technology business management program at a business school in India. The authors found close linkages between constructivist tenets and activities performed in design thinking; for example,

creating new knowledge (Vygotsky, 1978) was performed through the prototyping phase, and experiential learning (Kolb, 1984) was performed through the testing phase.

Reflection

A critical element of experiential learning theory and social constructivism is reflection, which is "intentional consideration of an experience in light of particular learning objectives" (Hatcher & Bringle, 1997, p. 153). Research has shown that reflection is a proven method for helping to increase depth of understanding in an experiential course (Ions & Sutcliffe, 2020; Lang & McNaught, 2013; Maurer et al., 2021; Perusso et al., 2019; Robertson et al., 2021). Dewey (1933) defined reflection as, "active, persistent and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends" (p. 118). Reflection is a metacognitive skill, and this skill requires students to think about how they think, creating self-directed learners and building critical thinking skills (Krathwohl, 2002; Martinez, 2006).

Purpose of the Study

Although design thinking has been researched and integrated into many academic disciplines, much less is known about the use of design thinking in business education. The purpose of the study was to understand more about the use of design thinking in American secondary and post-secondary business education. Two research questions grew out of existing literature: To what extent are business educators implementing design thinking in their courses? What instructional techniques and/or approaches are being used to teach design thinking?

There are several audiences for which the findings from this study are useful. Business educators will be able to see how and why other business educators in the United States are using, or not using, design thinking. They will also learn which instructional approaches are being used during each mode of design thinking. Administrators will learn how and why to support their teaching staffs' use of design thinking. Employers will learn how design thinking is being implemented in secondary and post-secondary business courses, and which business sub-disciplines are most likely to use design thinking.

Research Design and Methodology

This section describes the research design and methodology, sample, instrument, and data collection and analyzation procedures. The research design for this study was a non-experimental, descriptive study, and the methodology was quantitative using survey research. Institutional Review Board (IRB) approval was obtained from all three of the researchers' universities.

The sample was all business educators in United States' secondary and post-secondary business programs. The sampling frame was current members of the National Association of Business Education as of July 2021. The sample size was 1,694 and 149 people responded, for a 9% response rate. Participants were sought by emailing the NBEA membership a short cover letter and link to the survey in August 2021, followed by one reminder email three weeks later. Participants were asked not to take the survey a second time if they had already taken it. The instrument was pretested with five secondary and post-secondary business educators who were not members of NBEA, and these participants were asked to confirm question clarity and the

amount of time it took to complete the survey. Feedback from the pre-test respondents was used to make changes to the survey.

The Qualtrics electronic survey tool was used to collect data, and both Qualtrics and Microsoft Excel were used to analyze the data. The purpose of both research questions was descriptive, meaning it asked *what* or *which* questions (Gall, Gall & Borg, 2007), so the statistical analysis followed those statistics appropriate for a descriptive research design. In a descriptive study, variables are defined and measured. For the scaled questions, a Likert scale with a scale of 1-5 was used with 1=strongly agree, 2=agree, 3=neither agree or disagree, 4=disagree, and 5=strongly disagree. Cronbach's (1951) alpha was calculated for the scaled questions and was found to be 0.92, which is an excellent internal consistency for descriptive survey research. Descriptive statistics including means, frequency distributions and percentages were developed from the data.

Discussion

Results

Results were analyzed for each research question. The first question asked: To what extent are business educators implementing design thinking in their courses?

Business educators at all grade levels were asked whether they used design thinking in at least one business and/or marketing course. At the secondary level, there were 94 respondents and 67% used design thinking in at least one course, and at the post-secondary level, there were 55 respondents and 58% used design thinking in at least one course. Of the four levels of post-secondary educators sampled, a majority of educators of bachelor's degrees (68.4%), and master's degrees (66.7%), use design thinking, while design thinking is being used by fewer educators of associates degrees (50%), and trade/vocational educators (46.2%).

The sample was also asked why they do not use design thinking in their business and/or marketing courses and the overwhelming majority (61%) for both secondary and postsecondary business educators was that they have a lack of knowledge about design thinking (see Figure 1). Fewer educators responded that they had a lack of time, lack of administrator support, lack of resources, or that it is not a priority.

Figure 1

Main Reason to Not Use Design Thinking

Reasons	Secondary		Post-Secondary	
	n	%	n	%
Lack of knowledge about design thinking	19	61%	14	61%
Lack of time to develop curriculum	5	16%	3	13%
Lack of administrator support	2	6%	1	4%

Lack of resources about design thinking	2	6%	0	0%
Other	2	6%	3	13%
It is not a priority for me	1	3%	2	9%

The sample of business educators was asked in which sub-disciplines they teach design thinking (see Figure 2 and Figure 3). At the secondary level, the top two sub-disciplines where design thinking was used was information technology (27%) and entrepreneurship (25%). At the post-secondary level, the top sub-discipline was management (20%), followed by a tie between general business (13%) and information technology (13%).

Figure 2

Secondary Courses Using Design Thinking

Course Category	Uses Design Thinking	
	n	%
Information Technology	30	27%
Entrepreneurship	27	25%
Marketing	18	16%
General Business	17	15%
Personal Finance	6	5%
Other	5	5%
Management	3	3%
Accounting	2	2%
Business Communication	1	1%
Career Development	1	1%
Business Teacher Education	0	0%

Figure 3

Post-secondary Courses Using Design Thinking

Course Category	Uses Design Thinking	
	n	%
Management	9	20%
General Business	6	13%
Information Technology	6	13%
Business Teacher Education	5	11%
Other	5	11%
Business Communication	4	9%
Entrepreneurship	4	9%
Marketing	3	7%
Personal Finance	2	4%
Accounting	1	2%
Career Development	1	2%

Instructional Approaches

Results were analyzed for the second research question: What instructional techniques and/or approaches are being used by secondary and post-secondary business educators to teach design thinking? Given a list of instructional approaches from a review of the literature, the sample was asked which instructional approaches are being used at each stage of the design thinking process. Results are summarized for each stage of the Stanford Design Thinking Framework, which was the design thinking model upon which this study was designed.

The top instructional approach used to help students empathize was group discussions both at the secondary (18%) and post-secondary (21%) levels. For the define stage, forming a problem statement was the top instructional approach used by both secondary (52%) and post-secondary business educators (56%). For ideation, at both the secondary (13%) and post-secondary (12%) levels, brainstorming was the top instructional strategy used. However, there was a wide variety of ideation approaches used, such as group discussions (also used at the empathy stage) and storyboarding. Results for the prototyping stage were that at both the secondary (16%) and post-secondary level (19%), demonstration (e.g. video or presentation) was the top instructional approach used during the prototype stage. Finally, making a presentation to the class was the top instructional approach used by both secondary (20%), and post-secondary (30%) business educators to test prototypes.

Reflection

Although reflection is not one of the stages of the Stanford Design Thinking Framework, reflection is a design thinking stage in other design thinking models (Lawson, 2006). Because reflection is critical to experiential learning (Kolb, 1984; Schon, 1987), it was important to discover whether business educators believed reflection was an important component of design thinking. Educators at both the secondary (97%) and post-secondary (100%) overwhelmingly agreed that reflection is essential to the design thinking process. Respondents at both academic levels also reported that the top instructional approach used to help students reflect on their design thinking project was class discussions, with the secondary level using class discussion 42% of the time and the post-secondary level using class discussion 30% of the time.

Findings

There are three findings that are based on the study's results. The first finding is that both secondary and postsecondary educators are using design thinking in a variety of business sub-disciplines. Secondary educators are embedding design thinking into information technology and entrepreneurship courses, and post-secondary educators are embedding design thinking into management, general business, and information technology courses. There is some research showing that the sub-disciplines of management, business and entrepreneurship have implemented design thinking as a teaching strategy (Dunne & Martin, 2006; Mumford, et al., 2016; Schlenker & Chantelot, 2014). Entrepreneurship education has embraced design thinking as a way to encourage student focus on creativity, innovation, and problem-solving which are skills and mindsets applicable to entrepreneurs (Linton & Klinton, 2019). Zupan et al. (2014) found that design thinking is a successful methodology for teaching entrepreneurship and improving Millennial students' entrepreneurial skills.

The second finding is that although reflection is not one of the stages of the Stanford design thinking process, business educators confirm that reflection is essential to the design thinking process**.** Moreover, class discussion was the instructional approach most used to foster reflection. Research has shown that discussions are a useful method of facilitating student learning. For example, some research indicates that discussion improves students' critical thinking skills (Dallimore et al., 2008; Noblitt et al., 2010). Discussion builds oral communication skills. Brink and Costigan (2015) described oral communication as either listening, conversing, or presenting, and found that employers most valued listening, conversing, and presenting, respectively, while business schools most valued presenting, conversing, and listening, respectively.

Class discussions promote oral communication skills. Business and marketing employers place a high value on oral communication skills, and it is one of the most sought skills of business graduates. Yet, many employers believe new hires have inadequate oral communication skills (Alshare, 2011; Stevens, 2005). Employers acknowledge that oral communication skills such as team discussions and face-to-face communication are important and common ways to communicate (Grant, 2004) although in more recent years electronic communication skills such as phone and email (Coffelt et al., 2016) have become more commonplace, and thus highly valued by employers. Coffelt et al. (2016) found that employers valued all oral communication skills, and perceived interpersonal communication skills such as asking questions and having

difficult conversations to be more important than presenting, listening, and team/group communication skills.

The third finding is that lack of knowledge about design thinking is the main reason business educators do not use it. It is likely that business school faculty have not been exposed to designers in either their corporate careers or their own business school education, and need to learn the design thinking mindset, tools, and pedagogies in order to implement them into business courses. Sarooghi et al., (2019) suggested business faculty could co-teach with faculty from design schools, and attend design conferences that could increase their knowledge. Additionally, teachers at all levels may need help gaining confidence and expertise in facilitating effective design thinking experiences. Lor (2017) recommended teacher training and development to help them gain the confidence and expertise needed to facilitate effective design thinking experiences.

Conclusion and Future Directions

Design thinking is a human-centered approach that draws on students to engage in innovative and creative problem-solving. Although design thinking has been researched in many academic disciplines, less is known about the use of design thinking in business education. Yet, a design thinking approach to problem-solving can promote innovation, differentiation, and a competitive advantage (Gibbons, 2016). Business and industry seek employees willing to help promote innovation and change (Wrigley & Straker, 2017). Although there have been calls for business people to have design skills (Dunne & Martin, 2006), and some sub-disciplines such as entrepreneurship have embraced design thinking, for the most part, business education has been slow to adopt design thinking.

The present study was situated in a theoretical framework of social constructivism and experiential learning and sought to discover to what extent secondary and post-secondary business educators are implementing design thinking in their courses, and the instructional techniques and/or approaches used. Findings showed that at the secondary, bachelor's degree, and master's degree levels, design thinking is widely used. Secondary educators are embedding design thinking into information technology and entrepreneurship courses, and post-secondary educators are embedding design thinking into management, general business, and information technology courses. Findings also showed that class discussion was the instructional approach most used to foster reflection, and business educators confirmed that reflection is an essential component in the design thinking processes they are teaching. This is helpful because oral communication skills, which can be fostered in class discussions, are valued by employers (Coffelt et al., 2016; Grant, 2004).

Limitations

As with most research, there are limitations to the study. While educators were asked which instructional approaches they used at each stage of the design process, responses were based on the expert opinions of the educators. The effectiveness of the approaches was not examined, nor were students asked their opinions about the effectiveness of the instructional approaches. Bruton (2010) recommended conducting research to discover how learning takes place when design thinking is used, and research of this kind would help business educators understand why using various instructional approaches furthers learning.

The present study did not ask respondents whether their courses were in person, online, or hybrid. Since data was collected in September-October 2021, most U.S. secondary and post-secondary schools had resumed in-person learning, but had come from a period of time in 2020 and 2021 when schools shifted between online learning and in-person learning. This shift in learning models could have affected the perceptions teachers had about design learning. Additionally, data was collected during the COVID-19 pandemic, and the study's low response rate may have been due to current time constraints of educators, so generalizability to a broader population is limited. Finally, the study was a comprehensive look at design thinking in business education from middle through graduate school. It did not seek to compare secondary and post-secondary business education but instead, find out more about both of them.

Future Directions

Limitations present opportunities for future research. Research on using design thinking in online environments exists (Lloyd, 2013) but is very limited. Future research about how design thinking is effectively implemented in online and hybrid learning environments would be helpful to both the secondary and post-secondary levels of business education. Further research should also be conducted that studies whether design thinking should be applied differently to students at different academic levels.

Business education emphasizes preparing people with the knowledge, skills and aptitudes needed for college and career (Chamorro & Frankiewicz, 2019; Lynch, 2000). While the present study helps secondary business educators understand the instructional approaches educators are using to implement design thinking, it did not focus on whether design thinking prepares students for business careers. There is some evidence that corporations such as Apple, Google, and Microsoft are practicing design thinking in venues like department meetings, boot camps, and employee meetings (Mickahail, 2015) and there is also some evidence that corporations such as GM are using design thinking as a problem-solving tool (Beckman, 2017; Liedtka, 2014). While Dunne and Martin (2006) believes the business world wants managers to be designers, more needs to be understood about whether design thinking is an important skill desired by employers who hire business graduates, which industries most desire design thinking, and which jobs require knowledge of or experience with design thinking.

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Salary Compression and Inversion Within an AACSB Accredited College of Business

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Introduction

This case study focused on identifying instances of salary compression and inversion in faculty salaries at an AACSB accredited College of Business at a Midwestern University. Salary data was collected for the Departments of Accounting, Economics, Information Systems and Operations Management (ISOM), Finance and Insurance, Management, and Marketing. Four guiding questions were proposed to narrow the focus of the study to instances of salary compression and inversion: across the departments in the College of Business, which included the following: 1. Is there evidence of objective, identifiable salary compression and/or inversion amongst Assistant Professors within each of the departments in the College of Business, 2. Is there evidence of objective, identifiable salary compression and/or inversion amongst Associate Professors within each of the departments in the College of Business, 3. Is there evidence of objective, identifiable salary compression and/or inversion amongst Professors within each of the departments in the College of Business, 4. How prevalent is salary compression and inversion between ranks of Assistant, Associate, and Professor within the Departments of Accounting, Economics, ISOM, Finance and Insurance, Management, and Marketing.

Literature Review

When faculty at senior ranks are earning salaries that are near to or lower than faculty at junior ranks within their institution, salary compression exists. Salary compression often occurs when new faculty members are hired at higher starting salaries; yet, experienced faculty members receive no adjustment (AAUP, 2018, p. 6). The new faculty members benefit from what is called inversion. According to Jennings and McLaughlin (1997), "Inversion occurs when salary compression is carried an additional step so that the compensation of some junior faculty exceeds those of faculty members who are more senior in terms of experience and/or qualifications" (p. 345).

There are many problems with salary compression and inversion. According to the AAUP (2018) "Salary compression can lead to ethical and moral dilemmas. It can also cause faculty to leave due to stagnation of their salary" (p. 6). In addition to ethical, moral, and resignation implications, salary compression can influence purchasing power for professors. According to Cosgrove and Frank (2014), "Practical effects of salary compression are that it substantially lowers the purchasing power for professors during their working years and in their retirement funds since their 403b accounts would have less dollar contributions" (p. 102). When salary inversion results in salary compression for experienced faculty, it may also have an effect on morale. Salaries provide faculty with a sense of value, since it translates into purchasing power. Purchasing power can be construed as a status symbol. Faculty determine their own worth when compared to others with regard to compensation. Salary inversion may affect a faculty member's perceived status along with his/her capacity for satisfying self-actualization, safety,

social, physiological, and self-esteem needs (Glassman & Mcafee, 2005, p. 331). Glassman and Mcafee (2005) stated very clearly how salary inversion is perceived, "Most workers would see salary inversion as unfair based on equity theory and discrepancy theory since a new hire's inputs (credentials, job skills, productivity) are less and the outcomes (salary and perks) are more" (Glassman & Mcafee, 2005, pp. 25-26). Salary inversion may also have an effect on the perceived value of rank within an institution. According to Stratham (2000), "Rank serves as an important proxy for performance because it reflects, in part, aspects of a faculty member's work that are very difficult to quantify" (p. 237).

One might ask why salary compression and inversion occurs, one possible answer is external market conditions as described by Snyder, McLaughlin, and Montgomery (1992), "While salary compression is an internal problem to a given campus, it can be driven by external market conditions. Salary compression results from hiring new faculty at salaries in excess of those paid to existing faculty at the same or higher ranks or by administering raises that cause a given faculty member's salary to exceed the salary of faculty at the same and higher ranks" (p.114). Salary inversion may occur when a dean needs to quickly fill a position with little effort. In such an instance, salary inversion can be advantageous (Glassman & Mcafee, 2005, p. 328). These same researchers indicate "One could also argue that the costs of pay inversion are small. The dean may believe, perhaps correctly, that despite low morale, current faculty will still make personal sacrifices and work hard out of a sense of responsibility to the students and commitment to the profession" (Glassman & Mcafee, 2005, p. 329).

Methodology

Convenience sampling was used in gathering the sample for the study. The salary data collected from the sample of faculty within the College of Business were restricted to only tenure-line Assistant Professors, Associate Professors, and Professors at an AACSB accredited College of Business at a Midwestern university. Data was omitted for individuals serving in administrative roles such as a dean, associate dean, department chairperson, or chief entrepreneurship officer. SPSS was used to separate the salary data by year in order to tally the number of individuals in the study. The sample included a total of 66 faculty in 2018-19, a total of 69 faculty in 2017-18, and a total of 59 faculty in 2016-17. All tenure-line faculty were included in this study.

This case study focuses on identifying and addressing instances of salary compression and inversion in tenure-line faculty salaries at an AACSB accredited College of Business at a Midwestern university within the Departments of Accounting, Economics, Finance and Insurance, ISOM, Management, and Marketing. The University Institutional Review Board approved this study as "Exempt." Salary data was obtained from the Human Resources Office at the University. Once the data was obtained, a model containing all three years of salary information from the 2016-17 academic year to 2018-19 was created for Assistant Professors, Associate Professors, and Professors. This model allowed for juxtaposing annual salary data between these tenure-line faculty in each department. Primarily, the data collected was analyzed using IBM SPSS Statistics 25.0 software as it allowed for enhanced data segregation and statistical analyses required for this case study.

Results

Figure 1 shows the overall combined annual salary means for faculty at the ranks of Assistant, Associate, and Professor from 2016 to 2018. One piece of information consistent across each academic year is that the salary for Assistant Professors is much higher than Associate Professors. The frequency distribution table shown in *Figure 1* was used to compare salary data between all tenure-line faculty in the College of Business from 2016 to 2018. Data collected between the ranks of Assistant, Associate, and Professor predominately show that those at the Associate Professor rank have been earning much less on average than Assistant Professors. Delving into salary data from the 2016-17 academic year, Assistant Professors (*M* = $120,791.37, *SD* = $29,558.40) made over $13,000.00 more on average than Associate Professors (*M* = $107,074.90, *SD* = $24,888.72) and around $18,000.00 less than Professors (*M* = $139,513.47, *SD* = $22,638.96). This result coincides with findings reported by AAUP (2018), and would indicate salary inversion is present because Assistant Professors are coming in and earning a much greater salary than Associate Professors, who are assumed to have experience already in their positions to earn the rank.

The trend of Assistant Professors earning higher wages than Associate Professors continued through the 2017-18 academic year. Additionally, there was a decrease in mean annual salary across all ranks. For this year, Assistant Professors (*M* = $109,236.17, *SD* = *$*32,110.83) made $3,542.23 more than Associate Professors (*M* = $105,693.94, *SD* = $31,805.47) and roughly $20,000.00 less than Professors (*M* = 129,391.04, *SD* = *$*30,523.26). Assistant Professors and Professors took a fairly large decrease in annual salary between 2016-17 and 2017-18. The most recent data from 2018-19 shows an increase in annual salary compared to the 2017-18 figures, but Associate Professors (*M* = $109,210.05, *SD* = *$*32,178.61) are still making less when compared to Assistant Professor (*M* =115,937.26, *SD* = $31,669.04). The increase in annual wages from the 2017-18 to 2018-19 academic years were also pretty meager for Associate Professors; in comparison they only saw a raise of $3,516.11, while Assistant Professors received an increase of $6,701.09 and Professors (*M* = $129,354.85, *SD* = $32,164.61) received an increase of $36.19 in mean salary for the 2018-19 academic year.

It was expected that faculty at the Professor rank would have the highest salaries since the position often comes with many internal salary structures to stimulate pay increases by the University and to maintain equity in pay, but it was surprising to find that Assistant Professors are earning exactly $6,727.21 more in 2018-19 than Associate Professors. Assuming all things to be equitable, one would expect to find the opposite where Assistant Professors are earning less than Associate Professors, who in turn are earning less than Professors. This difference would be assuming pay determination is influenced by scholarly activities, demand, experience, years at the university, and productivity, meaning Associate Professors and Professors would earn higher salaries in comparison to Assistant Professors. This instance of salary inversion could be due to external influences such as the market environment playing a role. The influences of the external influences are generally a large part issues like salary compression and inversion; salary equity issues arise as a direct result of market conditions affecting market-based pay to new hires, costs of living, years of experience, and research experience (Cosgrove & Frank, 2014; Lamb & Moates, 1999; Snyder, McLaughlin, & Montgomery, 1992; Twigg, Valentine, & Elias, 2002)

Figure 1
Overall Salary for Tenure-Line Faculty in the College of Business, 2016-17 to 2018-19

Academic Year	Rank of Professor		Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error
2018-19	Assistant	Annual Salary	29	64989.00	164109.00	115379.2690	31669.04589	-.296	.434
		Valid N (listwise)	29						
	Associate	Annual Salary	18	47684.22	156270.00	109210.0561	32178.61416	-.227	.536
		Valid N (listwise)	18						
	Professor	Annual Salary	19	75000.00	200937.00	129354.8505	32164.61145	.354	.524
		Valid N (listwise)	19						
2017-18	Assistant	Annual Salary	31	63996.00	161015.00	109236.1716	32110.83284	-.046	.421
		Valid N (listwise)	31						
	Associate	Annual Salary	19	46525.09	152886.00	105693.9468	31805.47703	-.176	.524
		Valid N (listwise)	19						
	Professor	Annual Salary	19	67230.19	197897.00	129391.0411	30523.26902	.194	.524
		Valid N (listwise)	19						
2016-17	Assistant	Annual Salary	24	60902.00	157011.00	120791.3750	29558.40356	-.707	.472
		Valid N (listwise)	24						
	Associate	Annual Salary	19	59275.00	147857.00	107074.9053	24888.72139	-.022	.524
		Valid N (listwise)	19						
	Professor	Annual Salary	16	109143.79	194935.00	139513.4731	22638.96587	.835	.564
		Valid N (listwise)	16						

To further accentuate the issue of salary compression and inversion, *Figure 2* breaks down annual salary data by rank and department over the course of the 2016 to 2018 academic years to identify where instances of salary compression and inversion occur. Additionally, a 3-way ANOVA was conducted to compare the estimated mean salary across all departments and ranks for each year, these are presented in *Figures 4* to *6*. Scatterplots are presented in *Figures 7* to *9*; these figures were created for each of the years to further analyze salary compression at each of the ranks.

Figure 2

Salary Distribution in the College of Business, by Department, 2016-17 to 2018-19

Descriptive Statistics

Department	Rank of Professor	Academic Year		Minimum	Maximum	Mean	Std. Deviation
Accounting	Assistant	2018-19	Annual Salary	138578.00	164109.00	155708.6000	9881.60297
			Valid N (listwise)				
		2017-18	Annual Salary	136713.00	161015.00	152584.3333	8257.59826
			Valid N (listwise)				
		2016-17	Annual Salary	135415.00	157011.00	150975.7143	7162.04579
			Valid N (listwise)				
Economics	Assistant	2018-19	Annual Salary	89938.00	91932.00	90935.0000	1409.97092
			Valid N (listwise)				
		2017-18	Annual Salary	88000.00	102214.00	93531.6667	7612.78361
			Valid N (listwise)				
		2016-17	Annual Salary	89386.00	100171.00	94778.5000	7626.14664
			Valid N (listwise)				
	Associate	2018-19	Annual Salary	47684.22	108456.00	78070.1100	42972.13774
			Valid N (listwise)				
		2017-18	Annual Salary	46525.09	106482.00	71072.5733	31419.64551
			Valid N (listwise)				
		2016-17	Annual Salary	59275.00	104225.00	80043.0000	22668.63851
			Valid N (listwise)				
	Professor	2018-19	Annual Salary	75000.00	153983.00	120772.8257	23713.78958
			Valid N (listwise)				
		2017-18	Annual Salary	67230.19	151641.00	118080.9143	25455.46723
			Valid N (listwise)				
		2016-17	Annual Salary	117721.40	149622.00	129448.1300	14115.98062
			Valid N (listwise)				
ISOM	Assistant	2018-19	Annual Salary	67513.07	118604.00	82394.9500	24367.72246
			Valid N (listwise)				
		2017-18	Annual Salary	65562.07	136899.00	93513.0533	30516.02430
			Valid N (listwise)				
		2016-17	Annual Salary	104147.00	135742.00	118296.3333	16053.35997
			Valid N (listwise)				
	Associate	2018-19	Annual Salary	74785.52	128681.00	101271.6100	20866.26350
			Valid N (listwise)				
		2017-18	Annual Salary	83872.00	126182.00	102009.3567	17453.03991
			Valid N (listwise)				
		2016-17	Annual Salary	82923.00	144634.00	107091.8771	22604.53426
			Valid N (listwise)				
	Professor	2018-19	Annual Salary	88911.11	118065.00	108877.4575	13435.53868
			Valid N (listwise)				
		2017-18	Annual Salary	85899.11	115706.00	106392.7075	13779.14470
			Valid N (listwise)				
		2016-17	Annual Salary	109143.79	113765.00	111454.3950	3267.68893
			Valid N (listwise)				
Finance & Insurance	Assistant	2018-19	Annual Salary	65227.00	150112.00	126584.7500	40964.93762
			Valid N (listwise)				
		2017-18	Annual Salary	64361.00	146112.00	105236.5000	57806.68647
			Valid N (listwise)				
		2016-17	Annual Salary	60902.00	146746.00	103815.5000	47884.71938
			Valid N (listwise)				
	Associate	2018-19	Annual Salary	142879.00	156270.00	150545.0000	6903.28407
			Valid N (listwise)				
		2017-18	Annual Salary	140513.00	152886.00	147698.3333	6423.84514
			Valid N (listwise)				
		2016-17	Annual Salary	78088.00	147857.00	121304.6667	37751.86544
			Valid N (listwise)				
	Professor	2018-19	Annual Salary	142415.00	156654.00	150448.0000	7293.19731
			Valid N (listwise)				
		2017-18	Annual Salary	133149.00	152471.00	143891.0000	8937.54027
			Valid N (listwise)				
		2016-17	Annual Salary	131584.00	150064.00	142065.0000	7518.27474
			Valid N (listwise)				
Marketing	Assistant	2018-19	Annual Salary	64989.00	126817.00	113283.8333	23906.59134
			Valid N (listwise)				
		2017-18	Annual Salary	63996.00	125000.00	106572.2500	28606.36284
			Valid N (listwise)				
		2016-17	Annual Salary	63296.00	119277.00	98883.3333	30929.01098
			Valid N (listwise)				
	Associate	2018-19	Annual Salary	72095.00	141741.00	107104.6140	31262.43493
			Valid N (listwise)				
		2017-18	Annual Salary	71220.00	140000.00	100372.0117	29903.94400
			Valid N (listwise)				
		2016-17	Annual Salary	91078.00	123133.00	108956.7500	13619.49273
			Valid N (listwise)				
	Professor	2018-19	Annual Salary	83981.00	200937.00	151408.3333	60497.50561
			Valid N (listwise)				
		2017-18	Annual Salary	166275.00	197897.00	182086.0000	22360.13063
			Valid N (listwise)				
		2016-17	Annual Salary	163341.00	194935.00	179138.0000	22340.33164
			Valid N (listwise)				
Management	Assistant	2018-19	Annual Salary	69524.00	124572.00	108745.5000	22220.42580
			Valid N (listwise)				
		2017-18	Annual Salary	67350.00	121945.00	99238.0000	24644.15281
			Valid N (listwise)				
		2016-17	Annual Salary	115449.00	120234.00	117161.0000	1837.50075
			Valid N (listwise)				

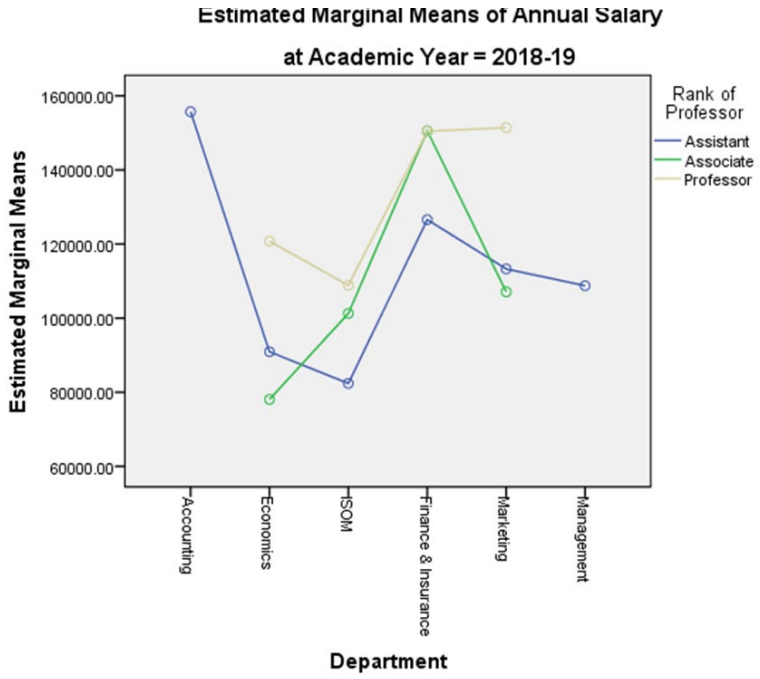
Note. There was only one Associate Professor and one Professor in the Accounting Department and Management Department, therefore their data was not included in Figure 2.

Accounting

The Accounting Department had one faculty member at the rank of Associate Professor and one at the rank of Professors. Looking at the data, 2016-17 and 2017-18 had some vacancies in these positions indicating that the department went some years without anyone filling the rank of Associate Professor or Professor. Due to this situation, most of the data could not provide for comparisons made between mean annual salaries in this department in order to avoid overstating the issue of salary compression and inversion. Comparing Assistant Professors in the Accounting Department across other departments in the College, this group did have the highest mean salary for their rank across all the Departments, as seen in both *Figure 2* and *Figure* 3. The most recent data from 2018-19, shown in *Figure 2,* indicates Assistants (M = $155,708.60, SD = $9881.60) earned on average over $155,000.00 for this year. The high salary trend for the Accounting Department can also be seen in the 2016-17 academic year, where Assistant Professors (M = $150,975.71, SD = $9881.60) were some of the top earners compared to Assistant Professors in other Departments.

Assistant Professors were the largest group in the Accounting Department since there was only one Associate Professor and only one Professor; inferences on salary compression and inversion between other ranks in the Accounting Department would compromise data integrity and may not be reliable. The Associate Professor is making exactly $15,855.94 less than Assistant Professor this salary year. What can be said is the lowest salary for an Assistant Professor for the 2018-19 year was $138,578.00; this condition is within a narrow margin of what the only Associate Professor is earning. The only Professor in the Department has consistently earned the most, as expected, but it is ideal to note the in recent years the gap between the top paid Assistant Professor and Professor has narrowed.

Figure 3
Tenure-Line Faculty Salary in the College of Business, by Department, 2018-19



Economics

As seen in the estimated means plot in *Figure 4,* the Economics Department has an identifiable case of salary inversion where Assistant Professors are earning more in wages than Associate Professors. The corresponding estimated means plots for 2017-18 and 2016-17 presented in *Figure 4* and *Figure 6* respectively show that salary inversion has occurred between these two ranks for over the last three years. The most recent data for 2018-19 shows Associate Professors (*M* = $78,070.11, *SD* = $42,972.13) on average are earning approximately less than $12,800.00 than Assistant Professors (*M* = $90,935.00, *SD* = $1409.97). Further data from the frequency table in *Figure* 2 shows the least paid Associate Professor in the Department is earning a salary of $47,684.22 while the Professor is making $108,456.00. For the two Assistant Professors in the Department, the lowest is earning $89,938.00 while the highest paid earns $91,932.00. One Associate Professor is making more on average than both Assistant Professors, which one would expect to be the case, but the other Associate Professor is making over $42,000.00 less than the least paid Assistant Professor. The impact of how steep gaps in salary caused by salary inversion can effectively drag down earnings in a department is revealed, as well as brings into question how a tenured Associate Professor is earning so little in comparison to faculty further down on tenure-track within the Department.

Data suggests that the Economics Department has the highest number of Professors out of any other Department in the College of Business, and they have remained the highest earners on average in the Economics Department throughout each of the academic years that salary data was collected. In comparison to both Assistant Professors and Associate Professors this year, Professors (*M* =$120,772.82, *SD* = $23,713.78) retained the most earning power in the Department. One surprising discovery that was seen in the 2018-19 data was that even the lowest wages amongst the Assistant Professor group were higher than the lowest seen in the Professors group. Compared to the least paid Assistant Professor who makes $89,938.00 yearly, the lowest paid individual in the Professor rank earns $75,000. As seen in *Figure 2,* data from 2016-17 shows the least paid Professor in the department was earning $117,721.00 and then after the department hired a new Professor in 2017-18 the salary dropped to $67,230.19 in 2017-18.

Figure 4
Average Tenure-Line Faculty Salary in the College of Business, 2018-19

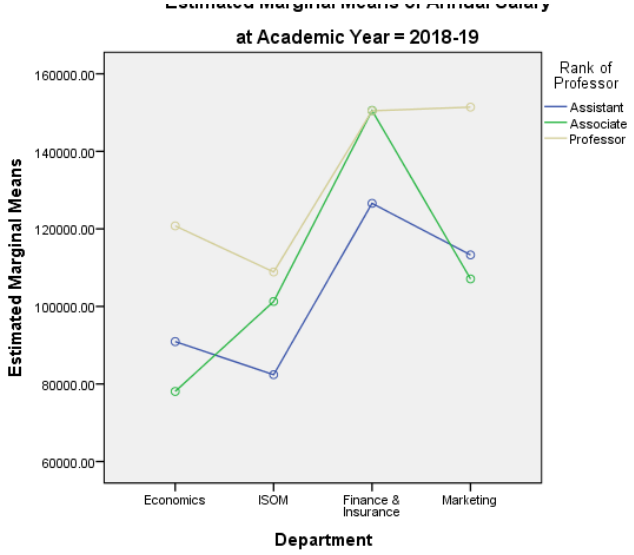


Figure 5
Average Tenure-Line Faculty Salary in the College of Business, 2017-18

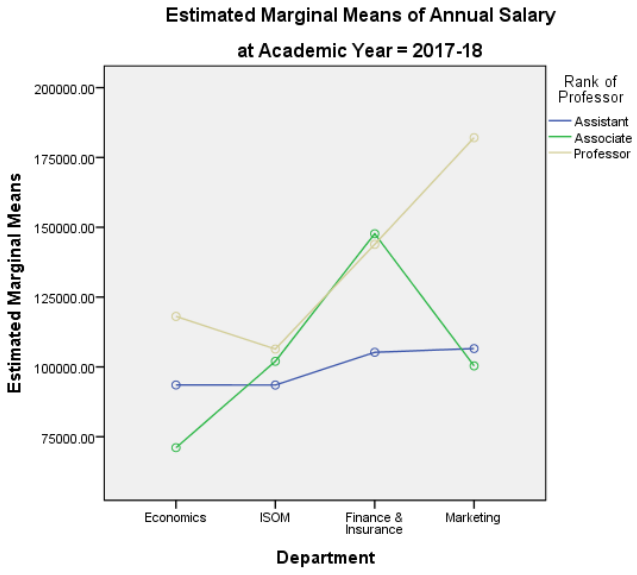
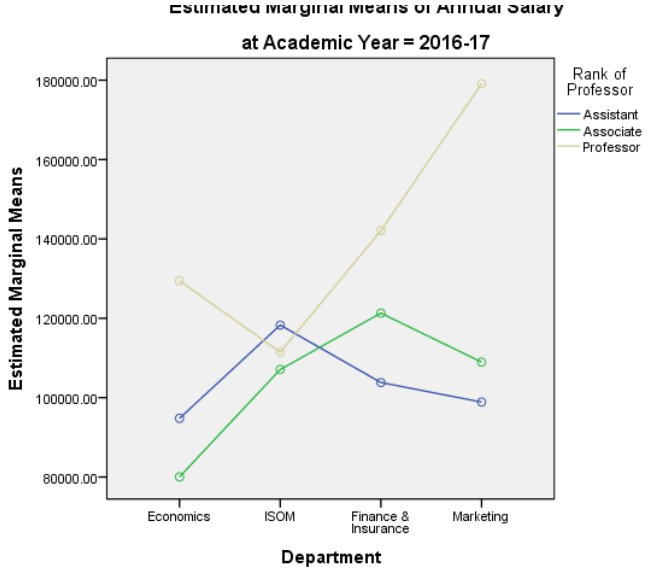


Figure 6
Average Tenure-Line Faculty Salary in the College of Business, 2016-17



ISOM

In 2016-17 the Department that stuck out with the most identifiable case of salary compression and inversion aside from Economics was ISOM. The negative slope for this Department in *Figure 9* is a red-flag indicator of salary inversion in this Department. The negative slope represents that on average Assistant Professors in this Department are receiving much higher pay than both Associate Professors and Professors, who are suffering from salary compression when compared to Assistant Professors who are benefiting from salary inversion. Looking at 2016-17 estimated means plot data in *Figure 6*, Assistant Professors had the highest salaries in the ISOM Department followed by Professors and Associate Professors. As indicated by the salary data presented in the frequency table in *Figure 2*, Assistant Professors (M = \$118,296.33, SD = \$16,053.35) were earning approximately \$11,204.46 more than Associate Professors (M = \$107,091.87, SD = \$22,604.53) and \$6841.94 more than Professors (M = \$111,454.39, SD = \$3267.68) during the 2016-17 academic year. Assuming higher pay is influenced by internal salary structures, scholarly activities, publishing, experience, and productivity, then Assistant Professors would not be expected to make more than tenure-line Associate Professors and Professors. The 2017-18 academic year saw drops in salary across the board for ISOM faculty. During the 2017-18 academic year there was a shift in earning amongst these ranks, where Assistants (M = \$93,513, SD = \$30,516.02) began to receive less salary than Associates (M = \$102,009.35, SD = \$17,453.03) and Professors (M = \$106,392.75, SD = \$13,779.14). This is most likely due to some newly assigned faculty who have been temporarily classified internally within the College as Non-AACSB to prevent accreditation issues; however, the University Resources Office at the University has no such official designation.

A similar trend was also seen in the most recent 2018-19 salary data, in which Assistant Professors (M = \$82,394.95, SD = \$24,367.72) continued to see a decrease in annual salary. Associate Professors (M = \$101,271.61, SD = \$20,866.26) saw a bit of compression in their pay compared to the annual salary they received in the previous year. There was an approximate loss

of $737 in pay for Associate Professors this year. On the other hand, Professors (*M* = *$*108,877.45, *SD* = *$*13,435.53) realized an increase.

Figure 7
Scatterplot of Average Tenure-Line Faculty Salary in the College of Business, 2018-19

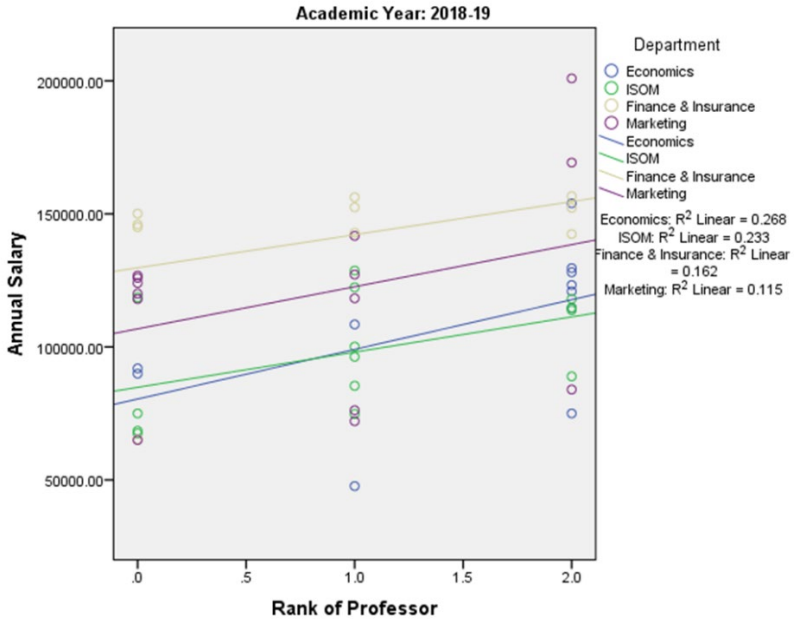


Figure 8
Scatterplot of Average Tenure-Line Faculty Salary in the College of Business, 2017-18

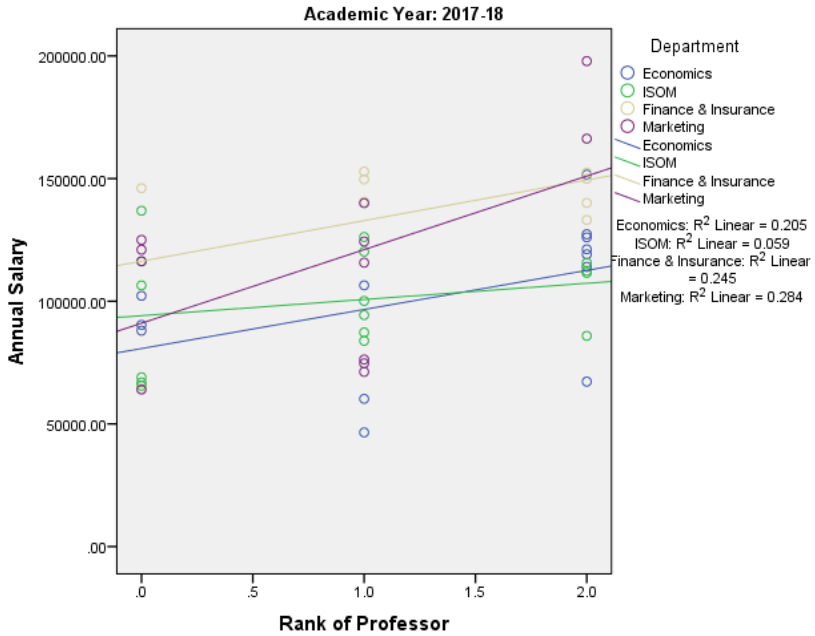
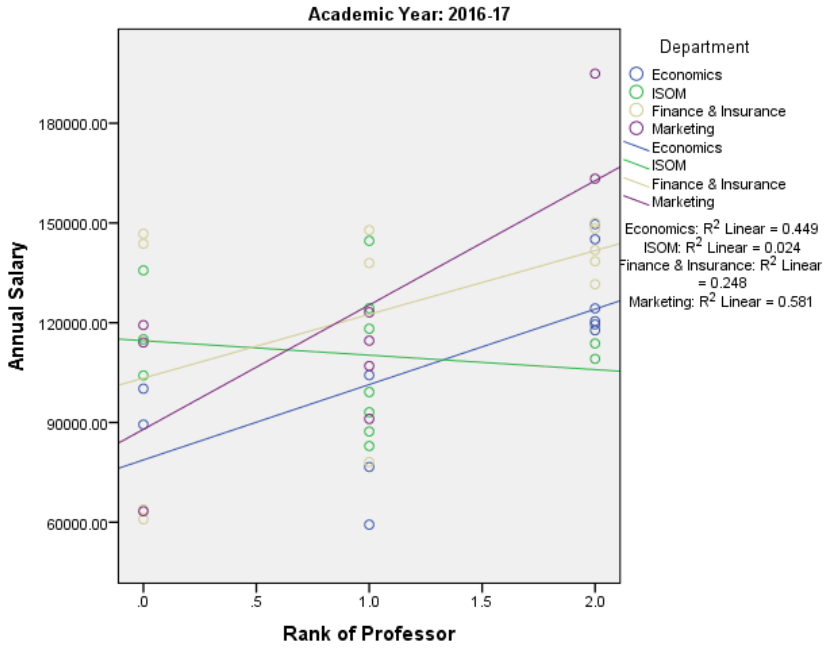


Figure 9
Scatterplot of Average Tenure-Line Faculty Salary in the College of Business, 2016-17



Finance and Insurance

The data for the Finance and Insurance Department had a unique spread. The scatterplots in *Figures 7* to *9* map out salary over the last three years would suggest that the Finance and Insurance Department have one of the more varied linear spread amongst faculty's annual salary than other departments, but there are a few identifiable instances of salary inversion between Associate Professors and Professors. During the 2016-17 academic year, Assistant Professors made less than Associate Professors who made less than Professors, which is what one might expect after seeing the estimated means plots and scatterplots. Salary information from the frequency table in *Figure 2* shows that during the 2017-18 academic year there was a large increase in salary. In 2016-17, Associate Professors were making $121,304.66 on average, while in 2017-18 the average salary of Associate Professors in the department jumped to $147,698.33. This increase in salary put them over the annual salary of Professors who in 2016-17 were making $142,065.00, and in 2017-18 saw a much smaller pay increase in comparison to Associate Professors, putting them at $143,891.00 annually.

Looking at the estimated means plot for 2017-18 and 2018-19 presented in *Figures 4* and *5*, one can see that the average salary for Associate Professors supersedes the salary for Professors. There was an adjustment sometime between this academic year and 2018-19 that compressed the salaries of Associate Professors so that they are earning roughly the same to Professors, but some may earn more on average. The rise in annual salary for the Department of Finance and Insurance would suggest salary inversion between the Associate Professors and Professors existed during the 2017-18 academic year, as Associate Professors on average earned $3,807.33 more than Professors. Salary data from 2018-19 show pay increases across the board for all tenure-line faculty, but also suggests that there is still salary compression and inversion between

these two ranks; for this year Associate Professors on average earned $150,545.00 while Professors in the Department earned $150,448.00, so the gap in pay between the ranks has decreased to about $97.00.

Marketing

In the Marketing Department, there were identifiable instances of salary compression and inversion primarily between the ranks of Assistant Professor and Associate Professor during the 2017-18 and 2018-19 academic years. Data presented in *Figures 4* and *5* show that during both the 2017-18 and 2018-19 academic years Assistant Professors had a higher mean salary than Associate Professors. In 2016-17 this was different as Associate Professors earned $108,956.75, which was more than the $98,883.33 Assistant Professors were making that year. Over the next year, the Department hired a new Assistant Professor and two Associate Professors, which may partially explain the decrease of Associate Professor's salaries during 2017-18. During that year, Associate Professors averaged $100,372.01, which was a decrease of well over $8,000.00 from the previous year. Assistant Professors at this time saw a substantial increase in pay and averaged about $106,572.25, which was way up from the previous year. This trend in earning between the two ranks has continued into the 2018-19 academic year. The department hired two new Assistant Professors for the 2018-19 year, and their average salary for this year increased to around $113,283.83. In comparison, Associate Professors received $107,104.61 for this year, which was an increase in mean salary from the previous year, but still less than what Assistant Professors are earning. Both ranks received a boost to their average salaries. As one can see, even with more faculty in the rank of Assistant Professor and the loss of an Associate Professor the Assistant Professors are earning more on average than their Associate Professor colleagues.

Professors have remained the top earners in the Department over the three years of data collected. Interestingly, they had a similar fluctuation in salary to Associate Professors where they made more in one year, but the average salary dropped steeply during another academic year after hiring-on new faculty. Professors were making $179,138.00 in 2016-17, $182,086.00 in 2017-18, and then dropped to $151,408.33. Considering the rise in average salary for Assistant Professors and Associate Professors this may be indicative of salary compression in order to address pre-existing salary compression.

Management

The Management Department mostly is comprised of Assistant Professors. Associate Professors and Professors for this Department were underrepresented, and each had a year where the Department went without somebody filling the rank, so comparisons may not be truly representative of truly objective salary compression and inversion in the department. Like the Accounting Department, it is difficult to make estimates between ranks in this Department due to the low sample size in Associate Professors and Professor ranks. Looking at the estimated marginal means chart in *Figure 3* it can be inferred that the Assistant Professors are the fourth highest earners out of this ranking group, but it is hard to infer whether salary compression or inversion is occurring between ranks within the Department without a more robust sample of Associate Professors and Professors. What may be said is that Assistant Professors are the largest group in this Department and accordingly have the highest salary on average for this Department.

Discussion

This case study attempted to identify whether there are identifiable instances of salary compression and inversion at an AACSB accredited College of Business. Salary compression and inversion was found in varying degrees between faculty ranks within some of these Departments in the College of Business. There were some limitations on the study that may affect the generalizability of the results. For one, some of the Departments lacked an adequate sample size for comparisons within the Department. While the data was robust, some of the restrictions on it limited some other options for statistical analyses such as repeated measures. Furthermore, the data was collected for the last three years, which limited the scope of possible salary trends in the study. Some faculty have been temporarily classified internally within the College as Non-AACSB to prevent accreditation issues; however, the University Resources Office at the University has no such official designation; therefore, all tenure-line faculty were included in this study. Finally, data analyses only included salary data for these three years and excluded specific data on new-hires. The findings suggest that for some Departments, identifiable cases of salary compression occurred, and corrective measures may have been taken to address issues of salary compression and inversion between the ranks; for other departments, the problem remains prevalent.

Currently, the Departments with identifiable instances of salary compression and inversion are the Economics Department, the Information Systems and Operations Management Department, Finance and Insurance, and the Marketing Department. For the Economics Department, the issue of salary inversion between Assistant Professors and Associate Professors was an identifiable issue that was happening even during the 2016-17 academic year. Both the Finance and Insurance and Marketing Departments have seen identifiable salary compression since the 2017-18 academic year. Associate Professors earn slightly more on average than Professors in the Finance and Insurance Department, which was due to a large increase in average salary between 2016-17 and 2017-18 academic years. Salary compression and inversion were prevalent between Assistant Professors and Associate Professors in the Marketing Department, while Professors remain the top salary earners. In the ISOM Department, salary compression between the ranks of Professor and Associate in this department appears to still be an issue. While steps have been taken to address the severity of the issue of salary compression there are still some Professors who affected by salary compression and inversion. Salary compression is a difficult issue to tackle as universities need to ensure they are maintaining fair and equal compensation that does not compress faculty salary in order to provide a quick solution. Finally, the Accounting and Management Departments did not have enough faculty at the Associate Professor and Professor ranks to accurately study salary compression and inversion; these Departments are prone to having more variability in salaries resulting from salary compression.

All the aforementioned findings raise an important issue about salary, as compensation is a critical component in hiring that attracts new hires and retention of existing faculty. Salary inversion may be ethical from an employer's view to remain competitive, but it can also manifest unfavorable work conditions among those affected. One must remember that sometimes instances of salary compression are to be expected across Departments because it may be the case that some individuals are overqualified for a position and the executive decision is made to pay them accordingly to match their robust achievements, experience, and skills. Addressing the issue of salary compression is not easy to accomplish. Some researchers like Glassman and

McAfee (2005) recommend that it may fall on the university to adopt a system that clearly defines standards of teaching, research, and service that qualify newer faculty for higher pay. Additionally, it must allow older faculty further down the tenure-line to have more flexibility in meeting these requirements while newer hires have more structure in order to pay their dues.

Conclusion

Analyzing three academic years of data shows there have been identifiable instances of salary compression and inversion amongst various ranks across the Departments in this study. This case study brings to light this issue and further implies how it may impact faculty morale, value, purchasing power, and relative worth to their field. Future research should take measures to ensure cases of salary compression and inversion are not being overstated. The importance of explaining this type of discrepancy and take appropriate measures to address the issue to improve the conditions of those who affected. One such measure could include basing starting salaries on the internal market rather than the external market (Glassman & McAfee, 2005). Regardless, combatting the issue takes effort, communication, time, money, and cooperation of all involved. As such, the process should be done in a pragmatic and systematic manner that ensures equity in faculty salaries.

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An Examination of Advertising and Marketing for Career Academies

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Abstract
In high school settings, the small learning community (SLC) concept often manifests in the form of career academies. Career academies function as SLCs organized around career and technical education (CTE) themes; although, CTE is often misunderstood. This study examined a community outreach campaign that used traditional and nontraditional advertising and marketing outlets to combat negative media attention toward career academies. All media outlets examined were effective at reaching the targeted community, yielding a positive response in calls to action. Continued research is needed to better understand how advertising and marketing can be utilized in public education, specifically with combating negative views toward CTE.

Introduction

Over a six-year period, the Metropolitan Nashville Public Schools (MNPS) system engaged in a district-wide high school redesign initiative based on the small learning community (SLC) model to implement career academies across the district's comprehensive high schools. SLCs are intended to create smaller schools-within-schools to create a learning environment desired by students through small, interdisciplinary teaching and learning teams, curriculum that is rigorous and relevant, and inclusive instructional practices (Armstead et al., 2010). According to Armstead et al. (2010) students favor the model, and in in lower performing, large urban high schools SLCs have a positive impact. In MNPS, collectively, 41 unique career academies emerged across the 12 comprehensive high schools. Career academy themes included veterinary science, alternative energy, engineering, computer programming, and nursing, among other career and technical education (CTE) program areas. An early evolution of the high school redesign initiative was branding the 41 career academies as the *Academies of Nashville*.

As learners in the *Academies of Nashville*, students complete general education courses, electives, and specialized courses in their respective CTE pathways. Career academy teachers attempt to provide rigorous academic preparation for college and careers by incorporating interdisciplinary, real-world examples related to career academy themes to ensure relevance for students. Numerous studies demonstrate positive findings on achievement of students in career academies, including higher grades, decreased dropout rates, increased attendance, and increased graduation rates (Hemelt et al., 2019). In spite of documented benefits of implementing the SLC model, some members of the Nashville community were not supportive of the transition with its CTE focus.

During multiple school board meetings, community gatherings, school events, and digital conversations, the SLC model was chastised as vocational training rather than its intent of preparing students for post-secondary education and careers (Garrison, 2011a & Garrison, 2011b). Online criticism from community members about the Academies of Nashville emerged following media reports on the school system changes. Examples of community criticism include, "the Academies of Nashville system will weaken the intellectual aspect of the school" (Hargrove, 2011a, para. 30), "progress will flounder" (Hargrove, 2011a, para. 30), and "Hillsboro High School is in the process of becoming an 'Academies of Nashville School', which means that it will focus on technical and vocational training instead of college prep" (Hargrove, 2011b, para. 16). Beyond reader comments from online periodicals, community displeasure was also voiced through social media sites, school protests, and student demonstrations (Hargrove, 2011b). Therefore, to address concerns, MNPS devised a strategic communications plan that hinged on a community outreach campaign.

Prior to the *Academies of Nashville* community outreach campaign, MNPS used three pre-existing communication efforts. A Facebook page and Twitter account had been developed, but were seldom used and had little engagement by its followers. Additionally, a blog was developed to showcase student work and accomplishments; however, traffic and engagement with the blog plateaued within months of its creation. While there was an established audience for the social media outlets and the blog, each outlet struggled to reach new people and engage existing followers.

Literature Review

For more than forty years, initiatives have supported the development of communication practices in CTE programs at the secondary and postsecondary educational levels. Rice (1980) identified the need for community outreach in CTE, and Martin (1995) provided guidance for creating CTE marketing plans. Other research has previously demonstrated the need for a public relations action in CTE programs (Akers et al., 2001; Roberts & Dyer, 2004), and many states, including Washington, Arkansas, Maryland (Advance CTE, 2020a), Georgia, North Dakota (Advance CTE, 2020b), Colorado, and Idaho (Advance CTE, 2020c) have collaborated with stakeholders to enhance communications. However, no studies have investigated the application of strategic communication plans by CTE programs.

Enhanced school-choice policies throughout the country have resulted in an increased need to market schools and their programmatic offerings to both students and parents (Jabbar, 2016). According to DiMartino and Jensen (2016), effective use of marketing strategies can help schools appear more desirable in the competitive education marketplace. As Beal and Beal (2016) purported, the marketization of K–12 education has caused increased marketing efforts; however, little research has investigated the impact of school marketing strategies. Further, according to Excel*in*Ed (2021), "Parents and young adults agree that developing "real-world" skills, gaining work experience and completing career-focused coursework will set learners up for success after high school—but there is likely a significant gap between what parents believe schools are providing and what they are actually delivering" (p. 12). Further, "parents and young adults indicated that schools most frequently communicate about honors or advanced coursework and college acceleration opportunities–but they want to learn more about career-focused

educational opportunities, especially work-based learning and CTE" (Excel*in*Ed, 2021, p. 17). "There is an information gap in how parents and young adults evaluate the quality of CTE pathways and the information schools currently provide" (Excel*in*Ed, 2021, p. 21). According to Advance CTE (2020a), adopting a digital approach can help reach local stakeholders and providing a diverse array of opportunities to engage with relevant content is essential.

Colley's (1961) Levels of Understanding model served as the foundation for this current study in advertising and marketing. Colley (1961) reported "all commercial communications that weigh on the ultimate objective of a scale must carry a prospect through four levels of understanding" (p. 25). The term *prospect* is used to describe any member of the audience impacted by the advertising campaign (Colley, 1961). As illustrated in Figure 1, all prospects begin in a state of unawareness and then advance through four levels of understanding: (1) awareness, (2) comprehension, (3) conviction, and (4) action. In level one, awareness, the prospect becomes conscious of the existence of a product, organization, or concept. During level two, comprehension, the prospect grasps the purpose of a product, organization, or concept and understands associated benefits. In level three, conviction, the prospect decides to support the product, organization, or concept. During the final stage, action, the prospect responds to the specific advertisement objective, such as purchasing a product, supporting an organization, or promoting a concept (Colley, 1961).

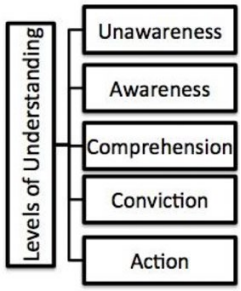

Figure 1. Colley's (1961) Levels of Understanding model.

Deighton (1984) clarified the value of an impression can carry an individual through Colley's (1961) Levels of Understanding. An impression can be made by a click, review, or visual intake of an advertisement. Prior to an impression, an individual may be at the unawareness level of a product, organization, or concept. However, after the individual has experienced an advertisement, calculated as an impression, he or she moves into the awareness level of understanding (Deighton, 1984).

According to Chen and Stallaert (2014), enhancements in information technology have profoundly changed online advertising, especially in the area of measuring the performance and targeting advertisements. Tracking clicks on a particular advertisement is usually marked as the measure of effectiveness, hence cost-per-click is exploited as a pricing standard for online advertising (Chen & Stallaert, 2014). Other measurements may include cost-per-impression (CPI) and click-through-rates (CTR). In CTE, using analytics-informed social media strategies can be beneficial in that these tools are both informative and entertaining (Advance CTE, 2020a).

CPI is the cost incurred for each viewer of an online ad; CPI equals advertising cost divided by total impressions (Chandler, & Munday, 2016). CTR is used as indicator of web users who intend to click when viewing advertisements on websites, representing a ratio of the number of

users that clicked on an ad to the number of times it was shown, and a higher CTR value is important to improving the visibility of an organization (Lakshmanarao et al., 2021). The return on investment (ROI) is one way to measure the efficiency of an investment and compare the efficiency to a number of other investments (Investopedia, 2012).

The most recent National Career and Technical Education Research Agenda (Lambeth, Elliot, & Joerger, 2008) encouraged research on best practices for marketing CTE programs. A search for studies that examined advertising, marketing, and public relations for CTE was conducted in the following journals: The Career and Technical Education Research Journal, the Journal of Agricultural Education, the Journal of Career and Technical Education, and the Journal of Research in Technical Careers. These discipline related journals yielded zero results. To be clear, no empirical evidence of the effectiveness of a local, targeted community outreach campaign regarding CTE exists.

Purpose / Objectives

The purpose of this study was to determine the impact of a community outreach campaign on social media platforms used for promoting career academies. The study was guided by the following research questions:

1. How do different media outlets affect the type and number of audience impressions during a community outreach campaign?
2. What is the return on investment of different media outlets used during a community outreach campaign?
3. How do community outreach campaign calls to action affect social media platforms patronized by an organization?
    a. What is the effect of calls to action on an organization's blog?
    b. What is the effect of calls to action on an organization's Facebook page?
    c. What is the effect of calls to action on an organization's Twitter account?
4. What are the click-through-rates of CTE digital advertising campaigns?

Methods / Procedures

During the *Academies of Nashville* community outreach campaign, both traditional and non-traditional media outlets in Nashville were selected to market the *Academies of Nashville* throughout the community. Media outlets were selected based on content marketing strategy in which content is created and shared using blogs, videos, print and other media to attract and engage a target audience (Pulizzi & Barrett, 2009). Traditional advertising methods selected were newspaper print and digital advertising. The potential audience reach, and cost efficiency were factors in selecting these outlets (Clippenger, 2012). Twenty-five print advertisements ran in *The Tennessean*, the city newspaper, over a four-month period. The digital advertising campaign also ran through *The Tennessean* website during the same period. These traditional advertising outlets were supplemented through non-traditional advertising channels.

Metro Transit Authority (MTA), the local public bus transportation system, bus and bench advertising were selected due to mobility and impression estimates (Advertising Vehicles, 2012). Ten buses and six bus benches displayed *Academies of Nashville* advertisements for two months. Additionally, a thirty-second commercial ran twice during the previews before every movie for three months in movie theaters located in Nashville and a digital campaign was launched on

local ticket sales and movie review websites during the same period. The final non-traditional outlet used was point-of-purchase (POP) television. More than 100 different fifteen-second commercials were broadcast at local gas stations throughout the county.

CTE students wrote statements describing the enhanced abilities they had because of their participation in CTE served as the content for advertisements. For example, one student in a video production CTE program of study wrote, "I can write, produce and direct my own TV show, and I still have a curfew" and another student, a female, in an architecture and construction CTE program of study wrote, "I can design and build a house, and I can do it in heels." These "I Can" statements highlighted different schools and were used in each advertising outlet. According to Lubienski and Lee (2016), the way schools promote themselves to families speaks to how schools engage in the local education market. Therefore, the "I Can" statements were selected for each advertising outlet based on the proximity of the outlet to the physical school location and relevance of the statement to the advertising space or location.

According to the final stage of Colley's (1961) Levels of Understanding model, prospects respond to the specific advertisement objectives. In the present study, each advertising outlet (print ad, bus wraps, bench wraps, movie theater, and POP TV) was associated with a call to action encouraging readers and viewers to visit the *Academies of Nashville* blog and follow the *Academies of Nashville* on Facebook and Twitter, which served as the advertisement objective. According to Colley (1961), monitoring response to advertising allows for advertising campaign results to be measured. Therefore, community responses to the outreach campaign calls to action were utilized for data collection.

Additional data was collected by audit requests and contractual agreements. An audit request was issued to *The Tennessean* to collect subscription numbers, newspaper sales information, and digital campaign analytics for collecting print advertisement data. An audit request was issued to MTA to obtain time framed public impressions for collecting bus and bench wrap advertisement data. An audit request was issued to Regal Cinemas and ScreenVision movie theaters to obtain ticket sales information and digital campaign analytics for collecting movie theater advertisement data. Contractual agreements with local gas stations informed POP TV advertisement data collection.

The Google Analytics service was used to obtain detailed information about visitors to the *Academies of Nashville* blog. Similarly, Facebook's insights feature was utilized to obtain detailed information about visitors to the *Academies of Nashville* Facebook page. Finally, Sprout Social, a social media management tool, was used to obtain detailed information about follower interactions on the *Academies of Nashville* Twitter feed.

All data were analyzed using descriptive statistics.

Results

Research question 1 asked how different media outlets affected the type and number of audience impressions during a community outreach campaign. Table 1 shows the number of impressions obtained by each media outlet, by school, during the community outreach campaign. The Academies of Nashville received 17,762,952 impressions during the campaign.

Table 1
Impression by Outlet by High School.

School	MTA		The Tennessean		Movie Theater		Point-Of-Purchase	Total
	Bus	Bench	Print	Digital	Video	Digital		
HS1	360,000	-	106,484	205,000	-	300,000	380,000	1,351,284
HS2	360,000	-	180,142	205,000	-	300,000	380,000	1,425,142
HS3	360,000	-	183,150	205,000	-	300,000	380,000	1,428,150
HS4	360,000	-	243,434	205,000	-	300,000	380,000	1,488,434
HS5	360,000	407,400	243,434	205,000	244,992	300,000	380,000	2,140,826
HS6	360,000	407,400	332,600	205,000	-	300,000	380,000	1,985,000
HS7	360,000	407,400	80,142	205,000	-	300,000	380,000	1,732,542
HS8	360,000	407,400	-	205,000	244,992	300,000	380,000	1,897,392
HS 9	-	-	362,584	205,000	-	300,000	380,000	1,211,584
HS10	360,000	407,400	100,000	205,000	-	300,000	380,000	1,752,400
HS11	360,000	407,400	163,292	205,000	-	300,000	380,000	1,815,692
HS 12	-	-	166,300	205,000	244,992	300,000	380,000	1,296,292
Total	4,320,000	2,444,400	2,161,562	205,000	734,976	300,000	4,560,000	17,762,952

Note. HS1 = high school 1; HS2 = high school 2…HS12 = high school 12.

Research question 2 asked for the ROI of different media outlets used during a community outreach campaign. The ROI was measured using the cost per impression (CPI) of each outlet as a whole (Table 2). The CPI was calculated using the equation provided previously by Chandler & Munday, (2016), indicating that the CPI is equal to the advertising cost divided by the total number of impressions. The total CPI for the entire outreach campaign was $0.005 per impression.

Table 2
Cost-per-impression by Advertising Outlet.

	MTA		The Tennessean		Movie Theater		Point-Of-Purchase	Total
	Bus	Bench	Print	Digital	Video	Digital		
CPI	0.004	0.004	0.013	0.013	0.017	0.017	--	0.005

Note. Cost-per-impression (CPI) is shown in dollar amount. Point-of-purchase (POP) CPI is not available, as cost for POP advertising was gifted from a community partner and remains unknown to the researchers.

Research question 3a asked for the effect of calls to action on an organization's blog. Data from the community outreach campaign was compared to the next best period (November 2011-February 2012) to show percentage change, as shown in Table 3. When comparing Table 3 to the next best period for the Academies of Nashville blog, every measure improved. There was a 943.84% overall increase in blog visits, a 1,020.28% overall increase in unique visitors to the blog, and an 880.63% overall increase in page views on the blog.

Table 3
Academies of Nashville Blog Analytics.

Month	Page Visits		Unique Visitors		Page Views		Visit Duration	
	#	% growth	#	% growth	#	% growth	#	% growth
Nov. 2011	100	-	73	-	198	-	3:26	-
Sept. 2012	606	506%	525	619%	1,182	497%	1:12	-
Dec. 2011	176	-	143	-	344	-	2:14	-
Oct. 2012	765	335%	684	378%	1,442	319%	1:14	-
Jan. 2012	392	-	272	-	523	-	2:53	-
Nov. 2012	865	121%	708	160%	1,582	202%	1:04	-
Feb. 2012	506	-	408	-	1,205	-	2:23	-
Dec. 2012	1,296	156%	1,126	176%	2,173	80%	0:52	-

Research question 3b asked for the effect of calls to action on an organization's Facebook page. As shown in Table 4, prior to the beginning of the community outreach campaign, the Academies of Nashville Facebook page had 39 likes and limited engagement by its users. By the end of 2012, the Facebook page had 173 likes, an increase of 544%. Additionally, Facebook analytics indicated the Academies of Nashville had a social influence score of 60 and a social engagement score of 20, an increase of 700% and 500%, respectively. A Klout score is a single number that represents the aggregation of multiple pieces of data about social media activities (Rao et al., 2015). Beyond social influence and engagement, a change in audience demographics occurred as well.

Research question 3c asked for the effect of calls to action on an organization's Twitter account. As indicated in Table 5, prior to the beginning of the community outreach campaign the Academies of Nashville Twitter feed had 26 followers and limited engagement by its users. By the end of 2012, the Twitter account had 213 followers, an increase of 919%. Additionally, Twitter analytics indicated that the Academies of Nashville had a social influence score of 63 and a social engagement score of 21, an increase of 585% and 450%, respectively.

Table 4
Academies of Nashville Facebook Page Analytics.

	August 2012	December 2012	Growth

Number of Fans	39	173	544%
Gender			
Impressions			
Male	35	2,837	8,206%
Female	23	5,694	24,857%
Age Impressions			
13-17	1	1,086	108,700%
18-24	5	1,915	38,400%
25-34	13	1,927	14,923%
35-44	18	1,941	10,883%
45-54	15	1,079	7,293%
55+	6	583	9,8`7%
Total Impression	122	27,500	22,640%
Reach	58	8,531	14,808%
Engagement	1%	11%	10%
Social Score			
Influence	10	60	700%
Engagement	5	20	500%

Research question 4 asked for the click-through-rates of CTE digital advertising campaigns. The CTR was calculated using the CTR equation provided by Chandler & Munday, (2016); the total number of clicks divided by the total number of impressions. The CTR for *The Tennessean* was 0.9% and the CTR for movie theaters was 0.04%, as shown in Table 6.

Table 5
Academies of Nashville Twitter Account Analytics.

	August 2012	December 2012	Growth
Number of Followers	26	213	919%
Interactions			
Mentions	20	103	615%
Retweets	9	52	107%
Social Score			
Influence	13	63	585%
Engagement	6	21	450%

Conclusions, Implications, and Recommendations

The present study investigated the impact of a community outreach campaign for CTE. Many public misconceptions of CTE exist with many people viewing CTE as inferior to general *academic* coursework (Kacirek et al., 2010). Due to these misunderstandings there is a further stressed importance in advertising and marketing campaigns that position CTE in a positive fashion. These community outreach campaigns are important for school districts, schools, students, and teachers. In fact, in a review of needs assessments for agricultural education

teachers, of the six major competencies that consistently recurred during the 32-year time period from 1983 to 2015, developing public relations programs was second (DiBenedetto et al., 2018).

Table 6
Click-through-rate by Outlet.

Outlet	Number of Clicks	Number of Impressions	CTR
The Tennessean	1,845	205,000	0.9%
Movie Theaters	120	300,000	0.04%

All forms of advertising used in the present study yielded positive results, demonstrating effectiveness in community outreach. Collectively, the seven media outlets generated 17,762,952 impressions in the Nashville community. The cost-per-impression was $0.005, demonstrating the cost efficiency and potential reach of traditional and nontraditional advertising (Clippenger, 2012; Harper, 2012).

The digital campaign results from *The Tennessean* (0.9%) and movie theaters (0.04%) were effective, given the national digital advertising click-through-rate is 0.03% (Nielsen, 2012). The public transportation bus and bus bench advertising were also effective. These demonstrated an affordable and high impression rate in line with previous advertising ventures (Advertising Vehicles, 2012). The researchers conclude that using the "I Can" statements throughout messaging was helpful at achieving success because this approach used a steady format. Moreover, "preparing for the real world" is a proven message for CTE recruitment" (Advance CTE, 2021, p. 2), and, according to Advance CTE (2020), "consistent and ubiquitous core messages will increase an audience's awareness of the educational and career opportunities CTE can open up to them, and drive action" (p. 6).

Using Klout scores, the researchers conclude that social media outlets used by the *Academies of Nashville* were effective at influencing visitors; however, were not effective at engaging visitors. Klout scores serve as a measurement of influence and engagement (Rao et al., 2015). A high Klout score indicated that posts generated by the *Academies of Nashville* drove action to those around them, democratizing influences. A low engagement score, however, indicated that followers did not seek to have an online conversation about the *Academies of Nashville*. It is recommended that future research investigates precursors of follower engagement with social media.

Beyond the quantitative data provided in the present study, qualitative support for success of the community outreach campaign exists. After the campaign, positive press about the *Academies of Nashville* appeared in the local market, demonstrating greater acceptance and understanding of the high school redesign initiative. Press content contrasted stories and news from previous years (Hargrove, 2011a & Hargrove, 2011b). In the *Nashville Arts Magazine*, Cole (2012) stated, "We are lucky in Nashville to have the Academies of Nashville, small learning communities in most of our public high schools that are aimed at helping students find their spark, whether it is in arts or math or science" (p. 59). Likewise, reports in *The Tennessean* even stated "vocational-education has come a long way since the automotive repair, home economics and cosmetology classes of yore" (McBride, 2012, para. 7).

To provide greater insight to the impact of the outreach campaign, the researchers recommend conducting a community awareness study. Data from a community awareness study would provide enhanced knowledge about community understanding of the *Academies of Nashville* and establish baseline data upon which future studies could be compared.

Findings of this study should be viewed in light of some limitations. First, because the data were collected in 2012, social media outlets used in this study were a limitation. Specifically, though Instagram and Snapchat were in early existence during the campaign, the *Academies of Nashville* did not have a presence on either platform due to their lack of popularity and engagement. The researchers recommend CTE programs implementing a marketing campaign expand social media platforms include outlets most frequently used by the target audience. Second, the data were collected nine years prior to analysis. However, data analyzed were existing administrative data, which is used widely in educational research (Siddiqui, 2019). To address this limitation, the researchers compared forms of media used in this study to those used in 2021. According to HubSpot (2021), the top primary forms of media used in content marketing for 2021 were videos, blogs, and infographics, respectively. The community outreach campaign in this study used videos, blogs, and print advertisements; however, the print advertisements did not incorporate infographics. Therefore, the researchers recommend incorporating infographics into marketing campaigns.

As society demands up to date media and information, schools must frequently provide information about education and educational programs (National School Public Relations Association [NSPRA], 2012). While "prospective parents and students are attracted to the "real world" benefits of CTE" (Advance CTE, 2017, p. 1), much remains unknown about advertising and marketing in CTE. As the present study introduced work on the application and evaluation of advertising and marketing in CTE, continued research efforts are essential to better understand how such these strategies can manifest and be utilized in public education.

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Not Your Parent's Vocational Education: CTE Concentration and Mathematics College Readiness

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Abstract
Career and technical education (CTE) is often perceived to be focused primarily on career readiness, and not necessarily on college readiness. The purpose of this study was to examine the influence of CTE concentration on high school students' college readiness in mathematics. The researchers obtained a convenience sample of ACT Aspire (mathematics) scores for 865 students at a rural high school in Arkansas. The sample included scores for students who participated in three or more CTE courses as well as for students who took fewer than three CTE courses. The results show that neither CTE concentration nor sex appear to have a significant influence on the mathematics readiness of high school students. The researchers argue that this neutral influence may be related to a broader change in the scope of CTE programs.

Keywords: Applied STEM; sex; mathematic achievement; CTE concentrator; college readiness

Introduction

In the past decade, there has been a renewed interest in Career and Technical Education [CTE] (Jacob, 2017), that is reflected in the number of students who enroll, participate, or complete CTE courses and programs. The US Department of Education (2019) revealed that 77% of American students take at least one CTE course. Trends also show more participation across the states. Dougherty (2016) reported 89% of Arkansas students take at least one CTE course while McVicar (2017) reported an increase in Michigan enrollment from 21.4% in 2014 to 22.7% in 2016. In many ways, modern CTE, described as the "new vocationalism" by Dougherty (p.2), is fundamentally different from traditional vocational education. CTE now attracts students with sequenced career courses embedded with college readiness skills. CTE's role in improving student engagement, graduation rates, and career and college readiness has also gained momentum among educators (Kantrov, 2014). Integrating academics into CTE is more popular than ever, with many programs offering core academic credit as CTE and academic instructors collaborate (Richnor, 2014). In spite of these gains, Bottoms (2020) recognizes the need for even closer integration between CTE projects and assignments and college-readiness standards. One area of integration that has become particularly relevant in CTE is mathematics.

Mathematics achievement at the high school level has always been an area of concern for educators and researchers. In a recent study, Cogan, et al, (2019) observed a strong connection between exposure to a rigorous mathematics curriculum, real-world applications of mathematical concepts and the mathematics literacy of high school students. Ironically, the National Center for Education Statistics (NCES, 2019) revealed a stagnation of 12th-grade scores on the National Assessment of Educational Progress in mathematics between 2015 and 2019. In fact, 40% of the scores were at Below Basic performance levels. Moreover, scores decreased among lower-performing students at the 10th and 25th percentiles. Furthermore, when compared to students in 79 other countries, US students ranked 31st in math literacy (Richards, 2020). Efforts to curb this trend have focused on reforms in mathematics instructional methods. This includes improved reasoning and problem-solving skills through activity-based learning (Jonsson & Johan, 2014). Modern CTE courses, therefore, integrate standards-based academic content such as mathematics into cooperative, problem-based, and project-based learning. In this regard, CTE courses can play a role in improving mathematics college readiness. This may explain why the US Department of Education (2019) observed that CTE concentrators were as likely as non-concentrators to complete a four-year degree. Additionally, the department found concentrators to be more likely than their peers to complete an associate's degree and earn a higher annual income after eight years.

Review of Literature

Not Your Parent's CTE

Modern CTE offerings differ from the vocational education of the past. One way is the designation of a CTE participant and a concentrator. In CTE, the term "participant" refers to a student who has earned at least one CTE credit. A "concentrator", on the other hand, is a student earning two or more CTE credits within a program of study (US Department of Education, 2019). Yet, states may require students to take more than the minimum two credits to be a concentrator. For example, in Arkansas, a CTE concentrator is any student who earns three credits in a program of study (Arkansas Department of Education [ADE], 2021). Dougherty (2016) noted that CTE students in Arkansas were offered 62 programs of study; states can decide which programs of study to offer, the courses included, and credits necessary to be a concentrator. Whereas in Oregon, concentrators only have to earn "...one or more CTE credits in a single secondary CTE program" (Arnerson, et al., 2020, p. ii). CTE concentrators have many course options within the programs of study, making CTE more appealing than ever.

Another way modern CTE offerings are different is through programs of study. CTE offers different programs of study so students enroll in courses that relate to their interests and career pathways. The National Assessment of Career and Technical Education's final report to Congress in 2009 found 85% of high school students completed one or more CTE courses, 76% earned at least one CTE credit, and of these, 19% were CTE concentrators who earned at least three credits in one CTE program (US Department of Education, 2014). A few years later, the US Department of Education (2019) reported 77% of students taking at least one CTE credit. While more students are participating and becoming concentrators in CTE, they continue to take advanced academic courses in subjects like mathematics. In fact, Aliaga et al. (2012) found students who took three CTE credits or more also took higher levels of mathematics. This reinforces the idea that CTE and academics can work well together. The US Department of

Education (2014) reported CTE concentrators accounted for 14% of students completing a higher-level mathematics course in ninth grade compared to 24% having completed a lower-level course or no mathematics course at all. As CTE concentrators learn career readiness skills, they are also learning how academics, such as mathematics, relate to different career pathways.

CTE and STEM- Making Connections for Tomorrow's Workforce

As in traditional academic courses, CTE programs incorporate STEM subjects like mathematics, but deliver the content through hands-on, real-world activities (Bozick & Dalton, 2013; Gottfried, et al., 2014). In fact, according to *CTE is your STEM strategy* (2013), STEM should not be viewed as a separate program from CTE because high-quality CTE programs can provide students with a strong foundation for STEM skills and competencies. This connection between CTE and STEM is crucial as over the last decade, graduates with STEM-related training have been projected to be in high demand (Snyder et al., 2016). Additionally, Rothwell (2013) reported the Brookings Institute estimated that by 2011, 20% percent of all jobs required a high level of knowledge in the STEM fields. Half of which require a bachelor's degree but nearly all of which pay well above the national median salary. Furthermore, Yoon Yoon and Strobel (2017) believe STEM programs within CTE will open pipelines to supply America with motivated and prepared students, thus strengthening the US workforce. High school students in STEM related modern CTE programs stand to benefit from this strong connection as they prepare for college and career opportunities.

The Intersection of CTE Concentration, Sex, and Mathematics Performance

Modern CTE courses differ from traditional vocational education because they equally attract both male and female students. Although Plasman et al. (2020) found that nationwide, the gap between male and female student enrollment in CTE courses has remained about the same over the last decade; in states such as California (Reed et al., 2018) and Oregon (Arneson et al.,2020), male students continue to outnumber their female counterparts in CTE courses. However, in Arkansas, Dougherty (2016) found that CTE students were more likely to be female than male. Given these disparities, understanding gender differences in CTE participation requires looking beyond the overall enrollment figures.

Common stereotypes hold that males and females perform better in certain classes may not be entirely unfounded. For example, female students tend to score higher in English and social sciences, while male students score higher in mathematics and science (ACT, 2014). In 2017, the national average ACT score for males in mathematics was 21.2 and 20.4 for females. Male students also outperform female students on all the mathematics subtests (ACT, 2017). In contrast to the national data, the ACT profile report provided by the ADE (2016) shows that 26% of males and 30% of females met mathematics benchmarks.

Beyond this, there is a growing interest in exploring the influence of assessment format on male and female students' mathematics performance. Ghasemi et al. (2019) noted studies that found gender differences are based on the Programme for International Student Assessment (PISA) exam. They argued that no study to date that employed other international mathematics assessment data (e.g., The Trends in International Mathematics and Science Study - TIMSS) supported the difference hypothesis. Ultimately, these types of investigations will lead to better insights into gender and mathematics performance. Overall, regardless of gender, current

literature suggests positive academic and career outcomes for students who choose to participate in CTE. These trends signal that significant changes are taking place in the academic performance of students who choose to enroll, participate, and concentrate in CTE. In the current study, the researchers focus on college readiness at the 10th and 11th grade levels, as this is the point when high school students begin to hone in on college and career preparation (Wyatt, et al., 2014). Furthermore, exploring college readiness at the senior high school level is consistent with prior research on the topic (Bonner & Thomas, 2017).

Research Questions

To guide the investigation, the researchers developed the following research questions:

RQ1 - To what extent does CTE concentration and sex affect mathematics college readiness among Grade 10 students in Arkansas?

RQ2 - To what extent does CTE concentration and sex affect mathematics college readiness among Grade 11 students in Arkansas?

Method

Design and Sampling

A causal-comparative, non-experimental design was used for this study. The researchers obtained a convenience sample of scores for 865 students in Grade 10 (n = 428) and Grade 11 (n = 437) at two Arkansas high schools. The demographic characteristics of the four schools used in this study as published by ADE (2020) are provided in Table 1.

Table 1
Demographic Characteristics of Schools

Demographic		School A	School B
Enrollment		749	949
Low Income		38%	42%
Receive Special Education		12%	10%
Race/Ethnicity			
	Native American	0.5%	0.3%
	Asian	1.1%	1.4%
	African American	0.5%	4.5%
	Hawaiian/Pacific	0.1%	4.6%
	White	93.2%	87.7%
	Two or More Races	0.5%	1.5%

Approximately 10-12% of the students at both schools required special education services (not including language support). The sample included scores for students receiving special education services but excluded scores for students identified as English language learners.

Measures, Procedure and Data Analysis

Data for this study was obtained in the form of scores from the 10th-grade mathematics ACT Aspire and the ACT mathematics subtest. Both assessments are published by ACT Inc. The ACT Aspire is administered to 3rd-10th-grade students in Arkansas (ACT, 2020). It is a norm-referenced test that includes English, Mathematics, Science, Reading and Writing assessments. The mathematics subtest has 60 questions to assess student knowledge and provide insights into student preparedness for the ACT assessment (ACT Aspire, 2016). The ACT is also a norm-referenced test that includes English, Mathematics, Science, Reading and an optional Writing assessment. The mathematics subtest comprises 60 multiple-choice items that cover pre-algebra, quantity, probability, functions, elementary algebra, intermediate algebra, plane geometry, coordinate geometry, statistics, and trigonometry. Scaled scores on the ACT range between 1 and 36 with the benchmark score for the mathematics subtest being 22 (ACT, 2017). By setting benchmarks for subtests, minimum scores help establish achievement levels necessary for student success in first-year college courses.

After receiving Institutional Review Board approval, the records of students' mathematics scores were obtained from the high school administrators. The data were coded, screened, and analyzed using IBM Statistical Packages for the Social Sciences Version 22 (IBM, 2013). To address each research question, the researchers conducted 2 x 2 between- groups factorial ANOVA at a 0.05 level of significance.

Results

Research Question One

To address the first research question, the researchers conducted a 2 x 2 Factorial ANOVA. Researchers examined the assumptions of independence of observations, normality, and homogeneity of variances. No significant outliers were identified in the sample and despite a violation of the assumption of normality, the researchers deemed ANOVA an appropriate method of analysis as it is robust to violations of this assumption under certain conditions (Leech et al., 2011). Table 2 provides a summary of the group means and standard deviations for mathematics achievement of Grade 10 students by CTE concentration and sex.

Table 2
Descriptive Statistics for Mathematics Achievement by CTE Concentration and Sex of Grade 10 Students

Sex	CTE Concentration	*M*	*SD*	*N*
Female	Concentrators	427.45	7.53	117

	Non-Concentrators	427.64	7.96	100
	Total	427.54	7.71	217
Male	Concentrators	426.40	8.12	117
	Non-Concentrators	426.70	8.43	94
	Total	426.54	8.25	211
Total	Concentrators	426.93	7.83	234
	Non-Concentrators	427.19	8.19	194
	Total	427.04	7.99	428

Results of Levene's test revealed no violation of homogeneity of variances on mathematics achievement between the groups $F(3, 424) = 0.912$, $p = .435$. The results of the ANOVA are displayed in Table 3.

Table 3
Factorial ANOVA Results of the Mathematics Achievement of Grade 10 Students

Source	*SS*	*df*	*MS*	*F*	*p*	*ES*
Intercept	77332557.19	1	77332557.19			
Sex	104.86	1	104.86	1.64	.201	<0.01
CTE Concentration	6.30	1	6.30	0.10	.754	<0.01
Sex*CTE Conc.	0.34	1	0.34	0.01	.942	<0.01
Error	27117.81	424	63.96			
Total	78080271.00	428				

The results revealed that the interaction between CTE concentration and sex was not statistically significant, $F(1, 424) = 0.005$, $p = .942$, $ES < 0.01$, with a small effect size. Therefore, the researchers could not reject the interaction null hypothesis. Figure 1 displays the mean mathematics achievement for male and female Grade 10 students by CTE concentration. Analysis of the main effects for CTE concentration and sex revealed no statistically significant effect for either CTE concentration, $F(1, 424) = 0.01$, $p = .754$, $ES <0.01$ or sex, $F(1, 424) = 1.64$, $p = .201$, $ES = 0.004$. In summary, for students in Grade 10, neither CTE concentration or sex (in combination or singularly), had a discernable effect on their mathematics achievement.

Research Question Two

To address the second research question, the researchers also conducted a 2 x 2 factorial between-groups ANOVA. Table 4 provides a summary of the group means and standard deviations for mathematics achievement of Grade 11 students by CTE concentration and sex

Table 4
Descriptive Statistics for Mathematics Achievement by CTE Concentration and Sex of Grade 11 Students

Sex	Program Participation	*M*	*SD*	*N*
Female	Non Concentrators	18.12	3.51	43
	Concentrators	17.63	2.74	176
	Total	17.73	2.91	219
Male	Non-Concentrators	18.27	3.84	33
	Concentrators	19.11	4.03	185
	Total	18.98	4.00	218
Total	Non-Concentrators	18.18	3.64	76
	Concentrators	18.39	3.53	361
	Total	18.35	3.55	437

The researchers checked for homogeneity of variances using Levene's test $F(3, 437) = 8.61$, $p < .001$. Although there was a violation of this assumption, ANOVA is considered robust to this violation (Leech et al., 2011) The results of the ANOVA are displayed in Table 5.

Table 5
Factorial ANOVA Results of the Mathematics Achievement of Grade 11 Students

Source	*SS*	*df*	*MS*	*F*	*P*	*ES*
Intercept	82722.35	1	82722.35			
Sex	104.86	1	41.30	3.38	.067	<0.01
CTE Concentration	1.89	1	1.89	0.16	.694	<0.01
Sex*CTE Conc.	26.99	1	26.99	2.21	.138	.005
Error	5285.80	433	12.21			
Total	152672.00	437				

The analysis revealed that the interaction between sex and CTE concentration was not significant, $F(1, 437) = 2.21$, $p = .138$, $ES = .005$ with a small effect size. Figure 2 shows the means for mathematics achievement as a function of sex and CTE participation level. As with the interaction effect, the researchers found no statistically significant main effect for CTE concentration, $F(1,437) = .155$, $p = .694$, $ES < 0.01$ or sex $F(1, 437) = 3.38$, $p = .067$, $ES < 0.08$. In other words, neither CTE concentration or sex had discernable interaction or main effects on the mathematics achievement of Grade 11 students. In summary, results revealed that although concentrating in CTE classes did not have a significant beneficial effect on mathematics performance for Grade 10 or Grade 11 students, it did not have a detrimental effect for either group. Furthermore, this outcome was the same for male and female students.

Discussion

In this study, the relationship between CTE concentration, sex, and mathematics readiness of 10th and 11th-grade students was examined. Results revealed that neither CTE concentration nor sex had significant interaction effects or main effects on students' mathematics readiness of either group. In discussing these findings, the researchers outline the limitations, implications, and recommendations for further inquiry about the impact of CTE concentration on the current and future academic success of high school students.

Specifically, results show that CTE concentration (four or more classes) neither helped nor hindered mathematics readiness. In essence, the mathematics performance on the ACT Aspire of 10th-grade students who completed four or more CTE courses was not different from their peers who completed fewer CTE courses. The researchers found the same to be true for 11th-grade students taking the ACT mathematics assessment. These findings are in line with Levesque et al. (2011), who found that CTE coursework had a neutral effect on academic achievement. Levesque et al. concluded that the achievement gap between CTE concentrators and other high school students has narrowed due to more students concurrently enrolling in both CTE programs of study and college-preparatory pathways. Partin (2016) reported equally interesting results for CTE students in Arizona where CTE concentrators outperformed the general high school population on the state examination. Partin inferred that this was because academic content was deeply embedded within CTE courses and instruction was aligned with state standards. The research findings however stand in contrast to those of Yettick et al. (2012) and Jacob (2017) that raise questions about the academic rigor of CTE programs and suggest that students in these programs have lower educational aspirations and lack strong academic outcomes.

The researchers found no interaction effect between CTE concentration and sex on students' mathematics performance. The mathematics performance of males and females did not differ whether or not they were CTE concentrators. The findings support Kersey et al. (2019) who found similarities between male and female neural functioning, indicating that mathematical processing develops at the same rate for boys and girls. Gunderson et al., (2011) found math attitudes form as a result of influences and interactions with parents and teachers due to sex expectations and biases.

Limitations

The findings in this study must be considered in light of the following limitations. The researchers employed a causal-comparative strategy, which means findings should not be interpreted as implying causal relationships between gender, CTE concentration, and mathematics achievement. Furthermore, this study did not account for the effect of other factors like parental expectations and intrinsic motivations (Froiland & Davison, 2016) that have been shown to influence high school mathematics performance. Additionally, the sample was limited to scores from students at two schools in Arkansas. This sample restriction could inadvertently affect external validity and the generalizability of the findings. Despite these limitations, the findings serve as an entry-level step to a clearer understanding of the complex relationship between high school curricular pathways and student outcomes.

Implications

The study had two fundamental implications for CTE practitioners. Firstly, it signals a neutral relationship between CTE concentration and students' mathematics college achievement. This would suggest authentic mathematics learning experiences comparable to those in college preparatory mathematics classrooms are taking place in CTE classrooms. Indeed, with regards to mathematics performance, CTE concentration seems to have moved beyond the era of strictly vocational education outcomes. CTE concentration no longer reflects deficits in academic preparation but may actually lead to positive high school outcomes and post-secondary academic and career success.

Secondly, the researchers found no difference between male and female performance on the ACT Aspire or ACT. Like Ghasemi et al. (2019) researchers found very little separation between the sexes concerning mathematics achievement. But even beyond this, the research begins a conversation which has not been previously explored regarding the mathematics achievement of male and female CTE concentrators. Ultimately, this study provides a signal that CTE curricula as a whole is changing in a manner that makes old stereotypes about CTE just that - stereotypes. Invariably, further research is needed to confirm the findings and affirm the implications we have suggested in this paper.

Future Research

It would be worthwhile to direct future research at uncovering other factors that may explain the closing gap in mathematics achievement between CTE concentrators and students in other high school pathways. Studies are also needed that operationalize mathematics achievement with measures other than the ACT and ACT Aspire (e.g., GPA, PISA). In the past, questions have been raised concerning the alignment of ACT-based assessments with Arkansas state standards and standards in other states (e.g., Achieve 2018, Davis-Becker, 2019). One thing is certain though, the mathematics preparation CTE concentrators are now receiving appears to provide them appropriate preparation for their college and career needs. It is no longer just your parent's vocational education.

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