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FROM THE EDITORS

This issue of *Quarterly Review of Business Disciplines* begins with the research of Kevin M. Casey, Jeff Hill, and Joseph Thomas, University of Central Arkansas. They create a narrative discussing how student success was impacted by policies enacted during the Covid-19 pandemic. Louis K. Falk, Kelly Bryan Smith, and Jennifer Lemanski, University of Texas Rio Grande Valley, delve into higher education's recent movement of courses to online or remote. They question whether there should be more flexibility in faculty lines to embrace the new reality of academia. Teddi A. Joyce, Charles A. Lubbers, and Kyle J. Miller, University of South Dakota, investigate mobile dating apps utilized by Generation Z (18-25) and determine that their perception of dating apps may be based on a very limited familiarity of the platforms available.

Hyun Jung Yun, et al. explore young Millennial and Generation Z voters' willingness to voice their political beliefs in divergent public opinion climates during elections. They draw on the *Spiral of Silence* theory and find that young voters in the internet and social media era are not silent any longer creating a *Spiral of Voice*. In our final study, T. Thomas Lahoud, Pace University, investigates ubiquitous data breeches, various biometric measurement options, and focuses on acceptance determinants for users of wearable ECG-based authentication devices by studying the influence of critical endogenous factors.

Margaret A. Goralski, *Quinnipiac University*, Editor-in Chief
Charles A. Lubbers, *University of South Dakota*, Associate Editor

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Manuscript Guidelines/Comments. *QRBD* is a blind peer-reviewed journal that provides publication of articles in all areas of business and the social sciences that affect business. The Journal welcomes the submission of manuscripts that meet the general criteria of significance and business excellence. Manuscripts should address real-world phenomena that highlight research that is interesting and different – innovative papers that begin or continue a line of inquiry that integrate across disciplines, as well as, those that are disciplinary. The Journal is interested in papers that are constructive in nature and suggest how established theories or understandings of issues in business can be positively revised, adapted, or extended through new perspectives and insights. Manuscripts that do not make a theoretical contribution to business studies or that have no relevance to the domain of business should not be sent to *QRBD*. Submissions to *QRBD* must follow the journal's Style Guide for Authors, including length, formatting, and references. Poorly structured or written papers will be returned to the authors promptly. Manuscript length is approximately 16 – 20 single-spaced pages. Acceptance rate is 25-28%.

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COVID-19 STATISTICS: PANDEMIC RESPONSE AND STUDENT SUCCESS IN THE UNIVERSITY STATISTICS CLASSROOM

Kevin M. Casey, University of Central Arkansas

Jeff Hill, University of Central Arkansas

Joseph Thomas, University of Central Arkansas

ABSTRACT

The nation's universities have traveled an uncertain path since March of 2020. The Covid-19 pandemic created new challenges across the academic landscape and each institution was required to pivot, and then reinvent the way they educated students. The authors of this paper attempt to create a narrative that follows one such mid-sized southern university as they react to the pandemic in the spring of 2020, and then prepare and attempt to maintain a high level of rigor and engagement in its midst. Specifically, this study tells the story of 600-700 statistics students enrolled each semester from fall 2019 to spring 2021. The student success data and the policies enacted by the university combine to give insight into what happened, what worked, and what else could be done.

Keywords: Teaching innovation; Digital learning strategies; Pandemic response; Covid-19

INTRODUCTION

Collegiate teaching has been undeniably impacted by COVID-19 in terms of the traditional foci of pedagogy such as relationship building and contextualization of course content to the student's lived experiences. The ability of an instructor to leverage traditional tools to accomplish these goals has been dramatically altered, perhaps irrevocably. The question remains, however, to what extent are these changes in pedagogical practices driven by the COVID-19 pandemic impacting the equitability of learning within the classroom? A cautious and protective posture by administrators and educators at all levels has led to guidance and policies such as requiring flexible attendance policies or even the outright removal of attendance requirements and other top-down directed changes in content delivery methodologies. However, are the various changes in classroom policies having a negative, and possibly disparate, impact upon learners?

The five major approaches to pedagogy: constructivist, collaborative, integrative, reflective, and inquiry-based learning all require significant yet varying degrees of interaction between the learner and the instructor. It is these very interactions that have been most impacted by responses to the current pandemic. Research on inclusive pedagogy has shown some learners respond differently to various approaches and that due care must be exercised to ensure equitable learning opportunities are available for everyone (Florian, 2015; Florian & Black-Hawkins, 2011). In an era of forced, by policy or simply circumstance, changes to pedagogical approaches in every

classroom, what are the outcomes of these changes, and are there techniques that result in improved outcomes?

Emergent research indicates stress disorders are appearing in students due to many direct and indirect effects of COVID-19 (Ye, Yang, Zeng, Wang, Shen, Li, & Lin, 2020). These anxiety-related traumas induced by the pandemic and the multitude of instructional and procedural responses by instructors, institutions, and civil authorities are negatively impacting our students. Recognizing these impacts and identifying appropriate pedagogical responses such as adopting a flux pedagogy (Ravitch, 2019) based approach and exercising radical empathy (Koss-Chioino, 2006) have become among the highest priorities for many instructors. Individual instructor, departmental, and institutional responses to these challenges are defining current students' programmatic learning outcome success levels. Beyond the direct effects upon student learning, our responses today will impact how these soon-to-be alumni and society as a whole assess the value of higher education both now and in the future.

In this case study, we describe our institutional setting, student profile, and the pedagogical approaches that we employed while teaching our courses during this era of COVID19. Then we will present a statistical analysis of the outcomes of the introductory statistics courses taught across six departments on our campus. We use this course intentionally because although it is taught differently across campus, the University of Central Arkansas (UCA) has designated all six of the introductory statistics courses as equivalent. A substantial and conscious effort was made by UCA's campus community during the 2018 academic year to standardize the introductory statistics course topics across the various offerings and instructional modalities (e.g. traditional face-to-face or online asynchronous) to implement these equivalencies. This provides us with an opportunity to assess pandemic-related effects across a very large student segment that includes many different instructors, instructional methods, and departmental subject foci while controlling for consistent topical coverage.

Our analysis finds significant results between all semesters relating to student outcome measures using the pre-pandemic fall 2019 semester as a baseline. The statistically significant results include a grade spike during the initial pandemic semester of the spring of 2020. These differences coincide with what one may anticipate given the circumstances of forced changes relating to the modes of content delivery. To a large extent, the focus of course instructors was on modality changes and creating materials for the last portion of the semester that resulted in an arguably overly permissive response to student difficulties and understanding of their situations. This created a sense of survival frequently characterized by a triage approach to navigating the effects of this punctuated equilibrium that was forcing rapid changes upon everyone, staff, students, and teachers alike. The results were higher grades and fewer students dropping the course.

This initial pandemic semester's results were followed in the fall 2020 semester by a drop in outcome measures, well below the baseline semester. This occurs during what we refer to as the *radical empathy phase*. This phase was intended to provide support for learners and meet them where they needed to be met to foster a compassionate learning environment given the difficult times. Unfortunately, as it relates to student outcomes, the results were significantly negative, falling below the fall 2019 baseline as the various administrative policies and rules surrounding radical empathy were in full effect.

However, we as educators and administrators learned a great deal during those semesters regarding what worked and what did not as it relates to supporting our students in their learning experiences. The following spring 2020 semester showed a significant increase and a return to the baseline of student outcome measures. This change, we believe is due to changes in policies, procedures, teaching methods, and modalities, some subtle, and some more glaring, that were made between the fall 2020 and spring 2021 semesters. These changes were a result of the conscious shift in focus away from the radical empathy phase that frequently resulted in compassion fatigue or exhaustion. Although we didn't have a theme for this semester while it was ongoing, we later identified an appropriate phrase that we will use to describe the spring 2021 and following semesters. This phrase was articulated by our Provost during the fall 2021 faculty convocation as "*caring, not caving*."

The realities of the pandemic are that it has real impacts upon our students, our campus, and our teaching. These effects remain to this day, and likely will linger on for several more semesters at a minimum. Although the challenges have been many, we all have had the benefit of experiencing first-hand a tremendous natural experiment relating to traditional, online, and mixed-mode teaching. A thorough investigation will help us to explore and understand our responses so that we can recognize, embrace, and extend what worked, and eschew what did not. The resultant discussion will help us to improve in our primary role as educators and ultimately help our students learn and achieve success in their educational goals.

The University of Central Arkansas

The University of Central Arkansas is a regional university serving central Arkansas and surrounding areas. The institution was founded as the Arkansas State Normal School in 1907 with a statewide mandate to train teachers. The name was formally changed to UCA in 1975 and simultaneously granted university status. UCA has a current enrollment of more than 10,000 students enrolled in over 80 undergraduate degree programs and 15 graduate degrees and certificates including several doctoral programs offered by 5 colleges housed within the university campus. UCA is accredited by the Higher Learning Commission (HLC) and over 65 program-specific accrediting bodies such as the Association to Advance Collegiate Schools of Business (AACSB) and the Council for the Accreditation of Educator Preparation (CAEP).

THEORETICAL FRAMEWORK

Challenges of Online Teaching and Learning

Kebritchi et al. (2017) conducted a meta-analysis using Cooper's framework from 1990 to 2015 to identify challenges in online education and identified several issues in delivering an online course. For the students, the issues centered on their expectations of online courses, their identity in an online environment, and their readiness to participate in this new format. Online pedagogy has improved but has not eliminated the trepidation for students. For instructors Kebrichi et al. (2017) identified concerns with the changing roles in traditional classrooms vs online, the modification to teaching style required in the new format, time management, and transitioning from face-to-face with higher kinesthetic (i.e. physically moving around the classroom) to primarily a seated position for online courses (Clemons, 2004). The Kebrichi et al. (2017)

literature review also found challenges for course developers including, for example, multimedia integration, the role of instructors in new online course development, and the need for professional development and technical training for instructors. These challenges required time and significant recurring efforts to address. In short, even before the COVID disruption to higher education, there were many challenges to delivering online education for students, instructors, and course developers.

Another factor impacted by the increase in online courses is student engagement. The relationship between taking online courses and student engagement has shown that those who take more online courses are less likely to engage in collaborative learning, discussions, and student-faculty interactions (Dumford & Miller, 2018; Ding et al., 2017). This concern can be addressed during course development but that takes time and careful planning (Dixson, 2015).

Several studies have compared the performance of students in traditional courses to the performance in online courses. Ury, 2005 found both methods to be effective but mean grades for online courses to be significantly lower. In contrast, Summers et al., 2005 found course grades between traditional and online courses to be similar but students in online courses were significantly less satisfied. Pedagogical concepts like active learning, student engagement, and experiential learning can be easily applied in a traditional or flipped course while in a fully online course extra care and effort must be applied to reach similar outcomes (Khan et al., 2017; Fadol et al, 2018; Budhai, 2021).

Case Study

In response to a meta-analysis sponsored by the US Department of Education which suggested that student learning outcomes were superior in online courses, Jaggars and Baily, (2010) reported these findings did not hold for fully online semester-long college courses. They suggest a lack of generalization to traditionally underserved populations and suggest online courses may hinder low-income and academically underprepared students. Online education has been studied for decades with the consensus being that well-designed courses take careful design and planning (Hodges et al., 2020).

When online courses are compulsory they cannot produce the desired results due in part to response time, technical issues, and the lack of socialization students of traditional courses require (Adnan & Anwar, 2020). Hodges et al., suggest a new terminology called "emergency remote teaching" to describe the academic communities' response to COVID-19. In contrast, a typical online course development takes six to nine months (Hodges et al., 2020).

In conclusion, our examination of traditional vs online courses made several observations:

- Effective course development in any format takes time and effort.
- Converting a course from traditional to online is complicated.
- Teachers and students face new challenges when forced to rapidly convert to online.

The current research takes the form of a case study. Yin (2018) suggests five situations that by themselves warrant a single-case design which is, having a *critical*, *unusual*, *common*, *revelatory*,

or *longitudinal* case. A *critical* case satisfies several key circumstances for testing a theory. An *unusual or extreme* case deviates from the norm and is not a typical occurrence.
The third rationale for a single case study is what he refers to as the *common* case. This is a case in which the focus of the study is to observe the circumstances or conditions in a typical situation, typically where the unit of analysis is a subunit within the case. The fourth rationale is the *revelatory* case, one where few scientists have the rare opportunity to study a phenomenon previously inaccessible to others. The last rationale Yin gives for performing a single case study is the *longitudinal* case. A longitudinal case would be one where the same single case is studied at multiple points in time.

The current study meets three of the five conditions that Yin suggests, namely *unusual, common,* and *revelatory*. COVID-19 caused a major disruption to education at all levels. In this study, we examine the *unusual* impact of COVID-19 on traditional courses forced to transform to online in a relatively short time. This rapid conversion is a very unusual situation that warrants deeper understanding. The current study also meets the *common* rationale for a single case because it observes pedagogy in traditional vs online courses but where the influence of COVID-19 is the subunit under analysis. Finally, this study meets Yin's *revelatory* rationale for a single case design because of the opportunity to study a single course, taught by multiple colleges within a single university.

Course Delivery Expectations

Within the context of this case study, a few course delivery methods are discussed. The first of which is the traditional face-to-face method of course delivery, which is denoted TRAD for course registration purposes. Students enrolling in a course labeled TRAD know to expect to meet face-to-face for lectures 2 or 3 days a week depending on the course schedule. Students should not expect lectures delivered online, although many instructors choose to assign and collect course assessments using the online learning management system, Blackboard.

The next course delivery method is fully online, asynchronous, which is denoted DEAS in the course registration management system. Students enrolling in a course designated DEAS know to expect that there will be no face-to-face or synchronous lecture requirement. All course activities, assignments, and assessments are delivered fully online through the Blackboard, LMS.

The final course designation that was traditionally used by the university is called the hybrid delivery method or HYBR. The hybrid delivery method is used to define a course that has at least one traditional lecture replaced by online activity. However, typically courses designated HYBR will have roughly half of the face-to-face lectures replaced by some online or distance component. Of the three, HYBR is the least used designation.

PANDEMIC RESPONSE

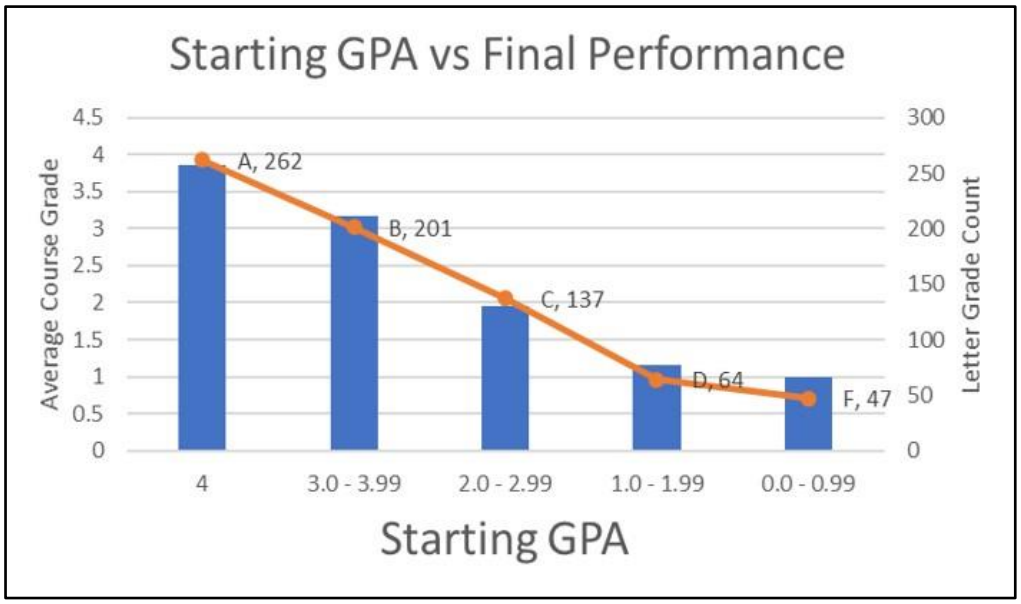
Baseline (Fall 2019)

The fall of 2019 started and ended like all semesters since 2018 when introductory statistics courses were standardized across campus. Therefore, it is reasonable to assume that the student

experiences and outcomes in 2019 would be similar to the previous semesters, and as such, relevant to the study for establishing a baseline. In all introductory statistics courses taught across campus, there were 711 students enrolled. There were 249 male students and 462 female students. Of the 711 students, 87 were enrolled in an asynchronous online section, and 624 were enrolled in a traditional face-to-face offering.

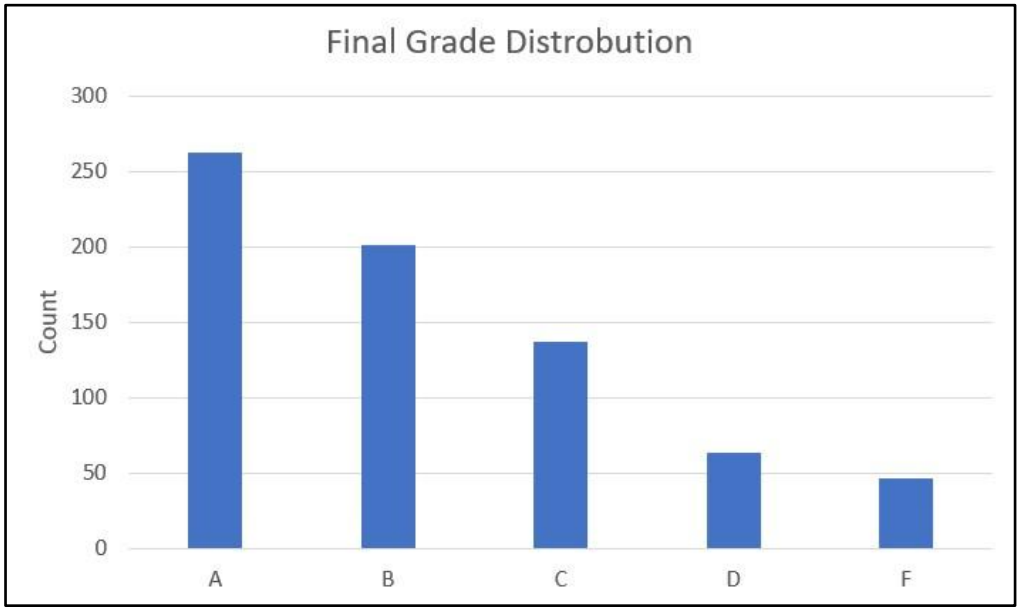
The average institutional grade point average (GPA) of entering fall 2019 semester students was 3.19. Students that started the semester with a perfect 4.0 GPA averaged a final grade of 3.86 on a 4-point grading scale. Students that started with a GPA between 3.00 and 3.99 finished with an average grade of 3.17. Students beginning in the 2.00 to 2.99 GPA range earned an average grade of 1.95, while students carrying a GPA between 1.00 and 1.99 averaged a final grade of 1.15. Finally, students bringing less than a 1.00 GPA into the semester finished with an average grade of 1.00 on the same 4.0 scale.

Figure 1 *Fall 2019 GPA entering the semester v. final performance in statistics 4.0=A; 3.0-3.99=B; 2.0 – 2.99=C; 1.0-1.99=D; 0.0-0.99=F*



Overall, the 711 students enrolled in introductory statistics courses in the fall of 2019 earned an average final grade of 2.78 on a 4.00 grading scale. With 37% earning an A (4.00), 28% B (3.00), 19% C (2.00), 9% D (1.00), and 7% F (0.00). 16% of students earned either a D or an F, which are final letter grades that typically result in retakes for grade forgiveness in Bachelor of Science programs.

Figure 2 *Fall 2019 Grade Final Grade Distribution*



Disrupted Equilibrium (Spring 2020)

Students enrolling in courses for the spring semester of 2020 mainly did so in the mid to late fall of 2019. There was no indication during this time that there would be any deviation from the norm, so students enrolled in online and face-to-face courses at a similar rate to those in the fall. Overall 641 students enrolled in an introductory statistics course, 73 of whom selected an online asynchronous section, while the other 568 chose a traditional classroom setting. There were 268 male students and 373 female students.

The 641 students who enrolled in the introductory statistics courses carried an average overall institutional GPA of 3.06 into the semester. The semester progressed as was customary until the first weeks of March. At that time the news of local cases of Covid-19 began to spread across the United States, and by March 12 the university president sent the following message to faculty, staff and students.

"Dear Students, Faculty, and Staff:

I am reaching out today with another very important update regarding the University of Central Arkansas and COVID-19.

The University of Central Arkansas has decided to cancel all classes from Friday, March 13 through Monday, March 16. Class cancellation will allow us to set "social distancing" in motion and will give faculty some time to transition their classes online. The amended instructional schedule is as follows:

- *Friday, March 13 - Monday, March 16: All classes canceled*
- *Tuesday, March 17 - Friday, March 20: All classes held online*
- *Saturday, March 21 - Sunday, March 29: Spring Break*
- *Monday, March 30 - End of spring 2020 semester: All classes held online*

During this time, the university will remain open, university housing and food service will continue to serve students, and day-to-day business operations will proceed as normal. University employees are expected to report to work unless they are sick or exhibiting flu-like symptoms. Telecommuting opportunities may be approved on a case-by-case basis at the discretion of the division supervisor.

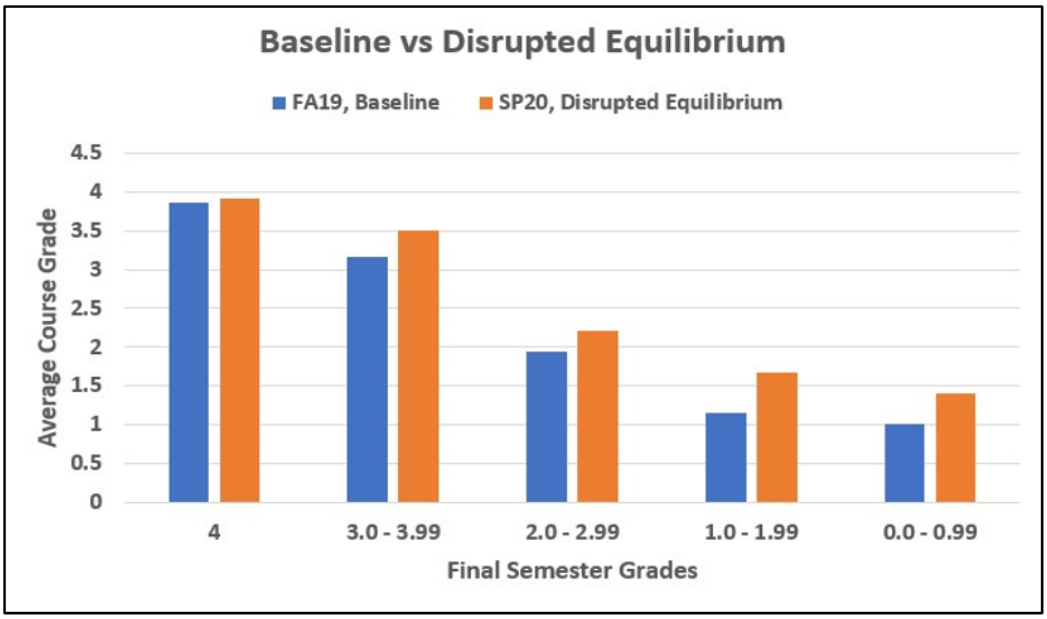
Much thoughtful consideration and preparation have gone into the decision to shift our inperson classes fully online. We acknowledge that this can be a big adjustment for many instructors and students. The UCA Center for Teaching Excellence has worked diligently to develop training and resources to help faculty move in-person classes fully online. We appreciate their excellent work on this initiative.
…"

Although this news was anticipated by faculty the sudden termination of all face-to-face classes still seemed abrupt. The university's timeline allowed the faculty five days to make the sudden pivot, and in doing so also recommended that they show sweeping compassion when deciding how to proceed with course requirements, grading, and reporting of final grades. This message may have created a scenario, wherein students that had been struggling academically were given opportunities they would not have normally received.

As the spring semester ended, statistics instructors reported grades that reflected an overall average final grade of 2.98 on a 4-point grading scale. This was a statistically significant increase over the previous semester.

Not surprisingly, students that started the semester with a perfect institutional GPA of 4.00 had a final average grade of 3.92, and students that started with an institutional GPA from 3.00 to 3.99 finished with an average final grade of 3.5. Students beginning the semester with an institutional GPA of 2.00 to 2.99 earned an average final grade of 2.22, while students carrying a 1.00 to 1.99 institutional GPA averaged a final grade of 1.68.

Figure 3 *Baseline Semester v. Disrupted Equilibrium Final Grades*



Students that began the semester with an institutional GPA of less than 1.00 finished the semester with a final grade average of 1.40. Overall, of the 641 students enrolled in introductory statistics courses in the spring of 2020, 45% earned a letter grade of A, 27% earned a letter grade of B, 15% C, 7% D, and 6% F. Letter grades results of D and F had a combined percentage of 13%, which was the lowest of any semester studied.

Radical Empathy (Fall 2020)

Leading into the fall semester of 2020, the university developed policy and guidelines for faculty to follow when preparing the courses that they would be teaching. The policies, discussed in detail in the background section of this paper, held one central theme, radical empathy. Specifically, all coursework and activities needed to be delivered in such a way that did not require a student's physical presence in the classroom. Although the intent was to ensure that no student felt obligated to come to class while experiencing covid-like symptoms, statistically it resulted in a significant drop in student achievement in the statistics courses being studied.

In the Fall of 2020, there were 629 students enrolled in introductory statistics courses. The overall average institutional GPA of those students was 3.18, which was higher than the spring of 2020 starting GPA (3.06) by twelve one-hundredths of a point. There were 236 male students and 393 female students enrolled in these introductory statistics courses.

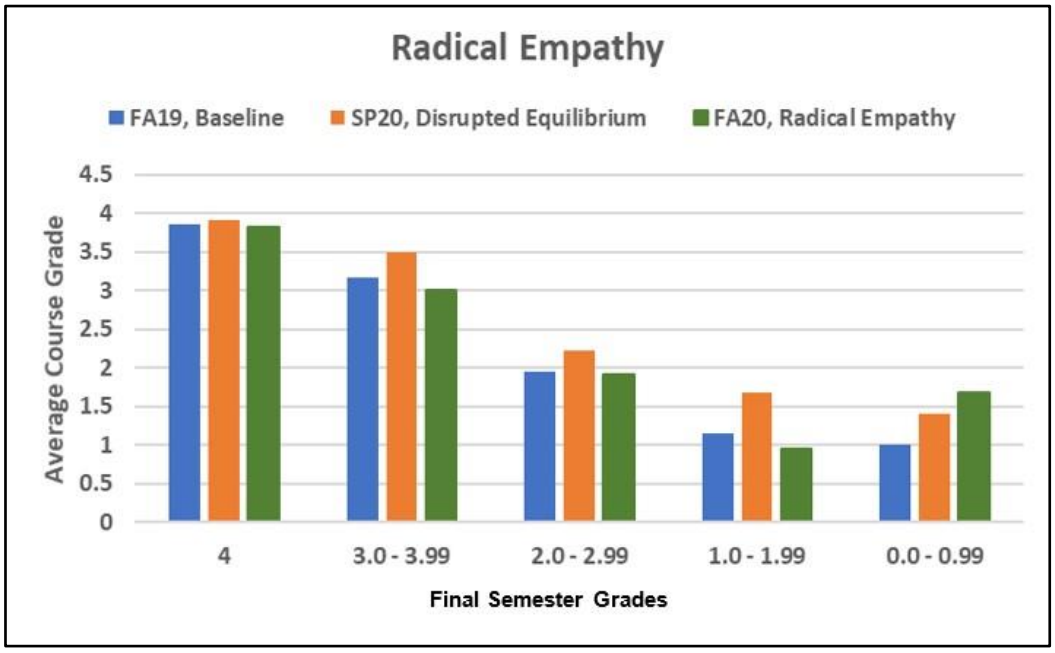
One hundred and thirty-three of the students were enrolled in online asynchronous course sections, while 435 enrolled in traditional face-to-face sections. The remaining 61 students enrolled in traditional face-to-face lecture courses but were switched into online sections because the instructor did not feel safe returning to a face-to-face setting. These students offer a valuable insight into how students that self-select into traditional courses fare in the online setting. Overall

online enrollment nearly doubled from Spring 2020 to Fall 2020 while the overall enrollment fell. This jump is due in large part to the creation of more online sections as a pandemic response.

Although students were afforded great flexibility with how, when, and if they attended lectures, once final grades were reported, the overall average score of introductory statistics students for the fall semester of 2020 was 2.72 on a 4-point grading scale. This is a significantly lower mean grade score than both our baseline semester (2.78) and the disrupted semester (2.98).

Students that began the semester with a perfect 4.0 GPA ended the semester with an overall average score of 3.80, the lowest in the study for that group. Students starting the semester with an institutional GPA of 3.00 – 3.99 earned an average final score of 3.01. Students beginning in the 2.00 to 2.99 GPA range earned an average grade of 1.91, while students carrying a GPA between 1.00 and 1.99 averaged a final grade of 0.94.

Figure 4 *Fall 2019, Spring 2020, Fall 2020 Final Semester Grades*



Finally, students carrying less than a 1.00 GPA into the semester finished with an average grade of 1.67 on the same 4.0 scale. All GPA strata, other than those with an institutional GPA of less than 1.00, achieved the lowest average score of all semesters studied. Overall, 36% of students finished with a letter grade of A, 28% earned a B, 17% received a C, 9% achieved a grade of D, and 10% earned F's. The percentage of D and F grades is also the highest of any semester studied.

Caring not Caving (Spring 2021)

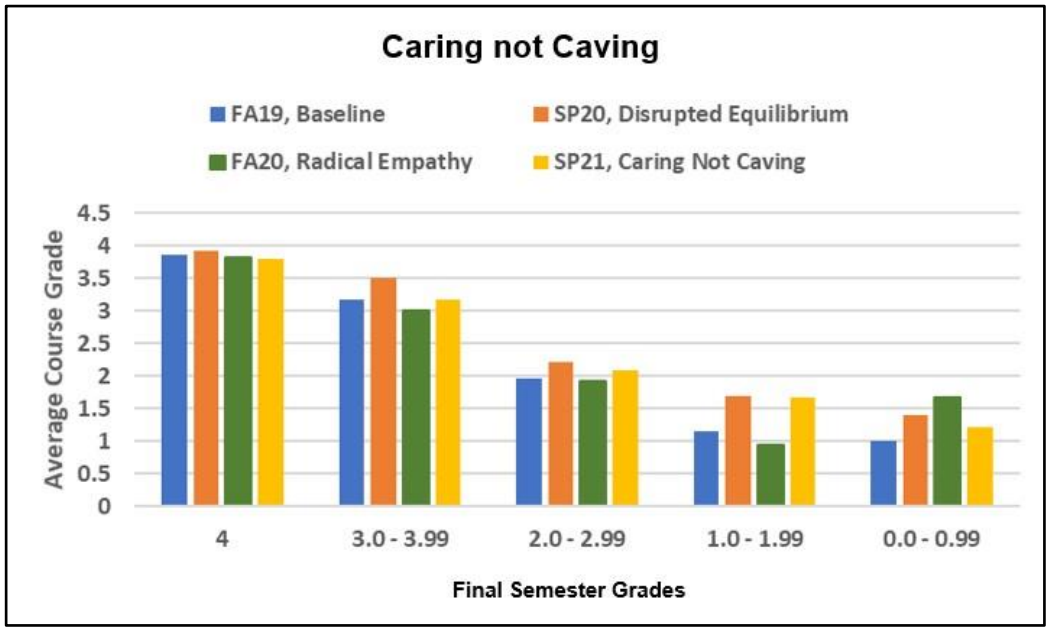
As the fall of 2020 turned into the spring of 2021, the pandemic ebbed for a time, vaccines became a certainty, and students and faculty began to prepare for the new semester. As intimated by the section title, faculty gained a new understanding of empathy. Rather than allowing students the choice to consume the course content however they chose at any given time, options were limited

and reserved for special circumstances. Students also seemed to respond with a renewed self-awareness.

In the spring of 2021, there were 598 students enrolled in introductory statistics courses. The enrollment was split between 198 students enrolled in online sections, and 400 were enrolled in courses designated as hybrid or traditional face-to-face offerings. The courses designated as hybrid offered students the same experience they had in the fall of 2020, while the students enrolled in courses designated as traditional face-to-face could expect an experience more similar to those of pre-pandemic semesters. Creating this new distinction, allows the traditional face-toface faculty more flexibility to enforce attendance policies, due dates, and typical class norms.

The overall average final grade of students enrolled in introductory statistics courses in the spring of 2021 was 2.82 on a 4-point scale. This is significantly higher than that of the previous semester. Students carrying a 4.0 institutional GPA into the semester had an average final score of 3.80. Those entering the semester with an institutional GPA from 3.00 to 3.99 earned an average final score of 3.17, and students starting with a 2.00 to 2.99 institutional GPA finished with an average final score of 2.09 on a 4- point scale.

Figure 5 *Fall 2019, Spring 2020, Fall 2020, Spring 2021 Final Semester Grades*

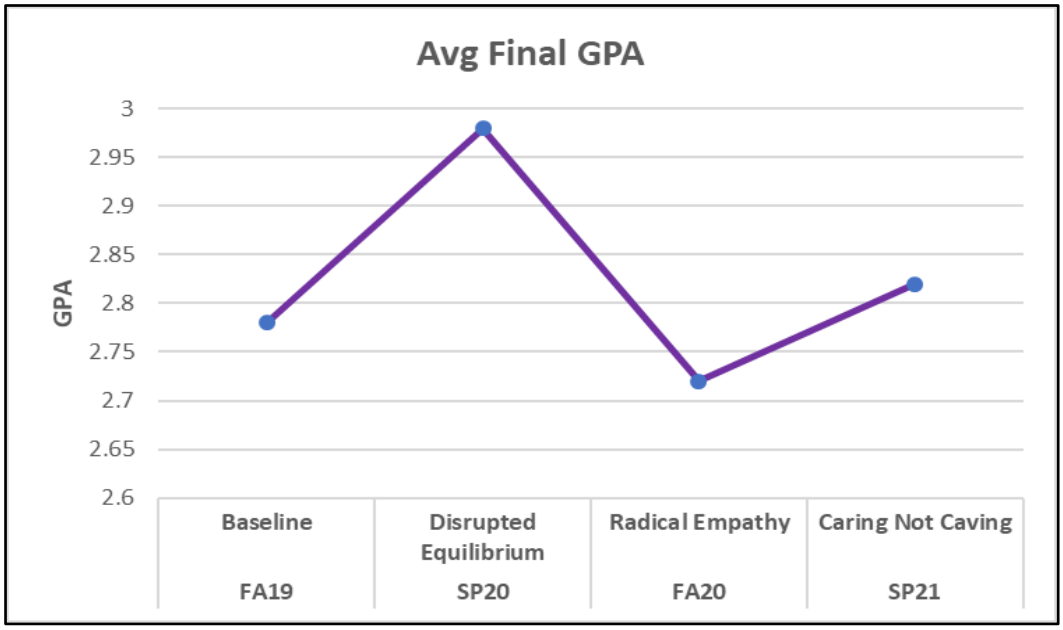


Finally, students enrolling with an institutional GPA of 1.00 to 1.99 had an average final score of 1.67, while students with an institutional GPA of 0.00 to 0.99 earned an average final grade of 1.20 on the same 4-point scale. These final scores contained letter grades of 37% A, 30% B, 17% C, 8% D, and 7% F. The percentage of D and F grades fell to 15% from 19% in the previous semester.

DISCUSSION

The most notable observation from the semesters studied is the unexpected jump in average final grades in the spring semester of 2020, and then the precipitous drop in the fall semester of the same year.

Figure 6 *Fall 2019, Spring 2020, Fall 2020, Spring 2021 Final Grades*



Disrupted Equilibrium

An initial impression might lead one to believe that the abrupt disruption in the status quo would affect student achievement adversely. However, the Spring 2020 data does not reflect this to be the case. The reason for this can be better understood by looking at the breakdown between online courses in the Spring 2020 semester, and the traditional delivery courses.

While the online course average final grade saw a bump from 2.83 in Fall 2019 to 2.90 in Spring 2020, the TRAD courses' average final grades went from 2.79 to 2.99 in the respective semesters. This data suggests that the face-to-face courses were the ones that sustained the biggest disruption from the pandemic. It stands to reason as those were the courses that stopped and then continued using a different modality.

Taking a closer look at the traditional delivery courses during the spring of 2020 reveals that those courses lost a full week of instruction during the initial move from online to face-toface. Combining that finding with the knowledge that, traditionally, most introductory statistics courses were offered face-to-face, 88% in Fall 2019, it stands to reason that most introductory statistics instructors were left with the daunting task of creating fully online content for the final
5 weeks of the spring semester, all while dealing with the realities of the pandemic themselves. It is also reasonable to concede that course rigor fell with the sudden switch to online, under the

aforementioned circumstances. The decrease in rigor was also likely a result of the grace and understanding offered to students by instructors throughout the remainder of the semester. The combination of a less rigorous final 5 weeks, which generally covers the most difficult content, and the sympathetic approach taken during that time could explain the unexpected jump in final average grades for the spring semester of 2020.

Radical Empathy

Over the summer leading into the Fall 2020 semester, the university developed multiple course delivery method options for instructors accommodating student attendance, social distancing in classrooms, and potential isolation for Covid-19 positive cases and close contacts.
The table below was disseminated for planning purposes.

	Model	Description	Considerations	Possible Scenario
More Face-to-Face	Essential/Traditional Face-to-Face	• Courses whose enrollment do not exceed maximum occupancy limits • Courses deemed most critical to meet learning objectives and to best provide students with a necessary college experience • Courses that have clinical, practicum, or other situations and need F2F to meet accreditation, certification, or licensure requirements • Lab and studio classes that cannot be effectively delivered online	• Space must accommodate 100% attendance. • Priority to classroom space may be given to these classes. • Classes might meet in non-traditional settings such as the Student Center. • A process needs to be established to use non-traditional spaces to offer priority to those courses with the greatest F2F need (e.g., a clearinghouse). • Online delivery must still be available for students who physically cannot attend class.	• A first-year course that is deemed essential to form a strong foundation and to set expectations for future courses meets F2F in a space that can accommodate 100% attendance. • A course with eight students in a classroom that can accommodate them all meets in-person at its assigned time while adhering to social distancing protocols does not need to alter its delivery method.
	Split Sections	• A single F2F section of a course is split into multiple F2F sections so that each section does not exceed maximum classroom occupancy limits. • Section sizes determined by occupancy limitations, available spaces, and times that do not conflict with other regularly scheduled classes.	• All students get the benefit of 100% F2F delivery. • Students who share resources (such as transportation or childcare) will need to be in the same section. • The new section(s) cannot conflict with existing class schedules. • Online delivery must still be available for students who physically cannot attend class.	A faculty member prefers to repeat the instruction one or more times so that all students get F2F delivery rather than utilizing the technology to provide real-time or recorded instruction.
	Hybrid Delivery: Modular Approach	• Instruction requires planning in a series of modules. • Some modules are F2F and others are completed online. • Modules are repeated for groups of students until all students have completed the same instruction.	• Every student gets equal in-class and online experience. • Students who share resources (such as transportation or childcare) will need to be in the same group. • Works best when content does not have to be delivered sequentially (i.e., students can complete the online module without having had the F2F interaction).	Faculty plans a module that can be done online while teaching another module F2F. On the next class day, the groups switch and get the module not presented to them on the previous day.
	Hybrid Delivery: In-Class/Online Groups (Synchronous)	• Students are assigned to either the in-class or the online group. • How to divide up students can be determined by faculty or other factors. • Class is live-streamed for those who "attend" online.	• Allows for interaction with those viewing online. • In-class attendance must not exceed maximum occupancy limit. • In-class/online groups can alternate delivery method so that both groups receive some in-class instruction (e.g. the two groups switch at some interval and those in-class become the online students and vice versa)	Faculty delivers the content for an in-class group while the remaining students view the content real-time but online.
Less Face-to-Face	Hybrid Delivery: In-Class/Online Groups (Asynchronous)	• Students are assigned to either the in-class or the online group. • How to divide up students can be determined by faculty or other factors. • Class is recorded so that those in the online group can view when convenient.	• Online attendance gets no real-time interaction. • In-class attendance must not exceed maximum occupancy limit. • In-class/online groups can alternate delivery method so that both groups receive some in-class instruction (e.g. the two groups switch at some interval and those in-class become the online students and vice versa)	Faculty delivers the content for an in-class group and then provides a recording of the content for the online group to view.
	Hybrid Delivery: Consultation Model	• All content delivered online. • Faculty meet F2F with small groups on a regular basis.	• Small groups must be organized and scheduled. • Small group meetings must follow safety guidelines.	A faculty member delivers all content online and then schedules regular consultations with small groups of students for F2F interaction.

The table was meant to guide the delivery of classes designated TRAD in the registration system. Instructors teaching traditional courses were encouraged to use the table to decide how much face-to-face interaction their course required, and how best to facilitate that. Another course designation was also created for instructors that no longer wished to offer face-to-face courses due to personal health reasons. These courses were marked DEEV, which was designated an emergency online delivery. Roughly 10% of introductory statistics students (61 out of 629) enrolled in a TRAD course that was then changed to DEEV a few weeks before the beginning of the fall semester.

In addition to the course delivery suggestions in the above table, one week before the beginning of the Fall 2020 semester the following memo was distributed to university faculty:

"Dear Faculty:

Due to the unique demands of the fall semester, we are asking all faculty to record and make available in Blackboard all of their in-person or online, live-streamed (synchronous) class sessions.

Why Do We Need to Record?

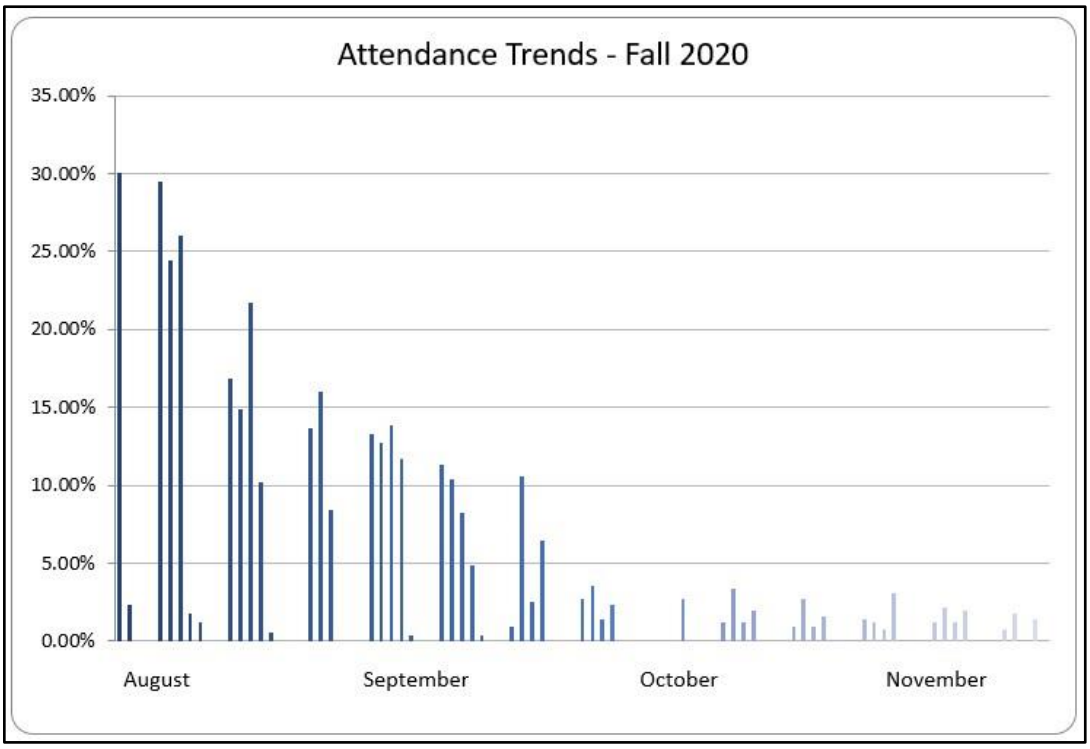
Because of the potential for students to be unavailable at scheduled class sessions due to illness or being isolated or quarantined, faculty should record live class sessions delivered in-person or online via Zoom, Blackboard Collaborate, or Google Meet. Recordings also ensure that students who experience technical issues during the live class session do not miss content or activities.

These recordings will benefit all of our students too because it allows them to review class sessions; research shows that traumatic situations like the one we've been experiencing the past six months negatively affect memory and learning in general. Thus, recordings will assist all students in mastering course content.
…"

Despite the late notice, the concept of live-streaming and recording every class during a pandemic was presented with satisfactory justification by the administration. However, the unintended result of giving students too many options for attending class lectures may have ultimately resulted in the abrupt drop in the average final student grades for Fall 2020.

Introductory statistics courses across the university are coded as sophomore level. By and large, the students enrolling in introductory statistics are young and relatively new to college academics. Allowing those particular students, the choice of attending class face-to-face, via live stream, or watching a recording may have facilitated an overall drop in face-to-face lecture attendance. While students that were not attending face-to-face should have been reviewing the recorded lectures or attending the live stream, it is difficult, or in some cases impossible, to ensure that they were doing so regularly. The data shown in the figure below was compiled by instructors from the same department that teaches Business statistics. It represents face-to-face attendance in their classes during the fall of 2020.

Figure 7: Face-to-face attendance trends; Fall 2020



With instructors unable to ensure that students were consuming the lectures appropriately, the responsibility for success moved closer to the fully online model where the students are maximally in charge of their learning. While many see this move as one of extreme empathy, it is reminiscent of the old idiom that starts, "when given enough rope…." In other words, it appears that introductory statistics students exercised their option not to regularly attend lectures, and also likely did not watch the recorded lectures, and since student achievement is highly correlated with student attendance, the average final grade of students fell significantly below the initial baseline semester to 2.72, which was the lowest of any semester studied.

Caring Not Caving

By the end of the fall semester of 2020, the region sees a significant decline in Covid-19 cases, and vaccines are undergoing final testing for emergency approval by the FDA.

FUTURE RESEARCH

As we reimagine university education post-Covid-19, one area of future research for the current study is the adoption and impact of new pedagogy techniques. One such technique which is under development and testing at UCA's College of Business (COB) is small group discussion boards tasked to solve non-graded content-based problems individually and then together as a group with dialogues similar to social media discussions. These small group discussion boards could be implemented in the current statistics courses to see if they improve student performance, increase peer-to-peer learning, and faculty-student interactions.

The current study also lends itself to a longitudinal study of these courses. Tracking the subject courses long term as new classroom technology is developed and new pedagogical methods are applied, could provide valuable insight into their benefit or detriment. In the event another pandemic or similar disruption to education occurs, a longitudinal study might provide a unique understanding of pedagogical changes over time.

Another area for future research is the development of a more formal emergency response plan for course delivery. In the event of a future pandemic or similar disruption to course delivery, universities need a robust emergency response plan which meets learning objectives, student engagement, faculty continuity, and university responsibilities. Universities can adapt lessons learned by emergency responders (e.g. medical triage, fire and rescue units, and the military) to pedagogy in new and novel ways.

CONCLUSION

This article intended to provide a narrative record of the effects that the COVID-19 pandemic has had upon both teaching and learning at our institution. In doing so we have documented statistically significant effects on learning outcomes for students in our introductory statistics courses. These impacts could be termed grade inflation as it relates to the fall 2020 semester. However, the inflationary effects appear to be transitory given the return to near baseline results in the following semesters. This would indicate that there may be no long-term effects on higher education. However, the question remains open as to what are the long-term impacts on the individual learners that were directly impacted by these pandemic semesters.

The significant differences in outcomes across semesters highlight the importance of disaster planning and preparation at the institutional level. Grade inflation, albeit transitory, is not an indicator of a successful outcome. Regardless of when this particular pandemic abates, there will be other emergent situations that will arise in the future. Not every emergency is global in scope and it does not need to be for proper planning and foresight to be beneficial. It is incumbent upon all institutions to take an introspective look at their response to COVID-19. This critical assessment should help guide them to identify their successes and shortcomings. Learn from this opportunity and not just relegate the experience to the dustbin of history.

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CREATING FLEXIBILITY WITH A NEW FACULTY CLASSIFICATION

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ABSTRACT

In recent years Institutions of Higher Education have refocused their instructional methods toward online or remote options. This rearrangement has brought challenges to many universities and colleges, the likes of which have not been seen before. Preparing, encouraging, and converting faculty to online instructors has been one of the core issues. Within Higher Education at major colleges and universities a professor whose primary responsibility is teaching strictly online has not been widely accepted. This paper explores the relatively recent changes in Higher Education, types of instruction, the traditional faculty structure, and calls for the addition of an online faculty rank, to include logistics, and recommendations.

Keywords: Higher Education, Faculty, Faculty Ranks, Online Instruction, Online Faculty

INTRODUCTION

The COVID-19 pandemic, which began impacting the United States in March 2020, necessitated adaptations to university teaching, learning, and general operations (Smalley, 2021). Although online programs and class options had been a consistently growing area, within a matter of weeks most universities cancelled in person classes (Smalley, 2021) and became 100% online, at least temporarily. This led to a variety of disruptions for students, faculty, staff, and administrators. DePietro (2020) discussed the complexity of the impact COVID-19 had on higher education (for classes as well as administrative offices), signifying that some of the changes implemented to temporarily respond to the pandemic may become the new normal.

While health and safety demanded these changes, the quality of education, especially as weeks passed without a return to normal campus operations, came into question. This was particularly true because of the rapid change, for individuals (whether they be faculty or students) who had no experience with online teaching or distance learning. While faculty and staff weathered the first few weeks of the online shift, many of the changes were not sustainable (Locke, 2021). Although best practices suggest that designing an online course should be accomplished over a period of 5 months (How long does it take to develop a fully online course? n.d.), the pandemic required shifts to take place within a week or two. Faculty needed training to successfully teach online classes, and students needed training to successfully learn from online classes. As COVID cases dropped and many classes reverted to face to face learning in Fall 2021, some faculty and students welcomed the shift whereas others longed for the geographical and time flexibility of the pandemic arrangements. As Locke (2021) stated, “Similar to telehealth, consumers enjoy the power and

convenience that the online modality has given them and don't want to return to having to be in a set place at a set time dictated by the provider" (para. 5). Although vaccines and treatments are now available, new strains of the virus continue to leave individuals unsure of the future; it may be that a return to online could happen once again. Jaschik's (2022) article "Dealing with COVID-19" the fate of the Spring 2022 semester was particularly relevant as many colleges had previously been encouraging students and faculty to return to normal operations. This exemplifies the constantly changing situation in higher education. Each semester brings new guidelines and recommendations based on case counts, and what data has been gathered regarding student performance and/or preference.

The technology for transforming the college and universities traditional model of teaching from face-to-face to online had been available for quite a while. Events in the last few years have compelled (for better or worse) the need to adopt these tools more rapidly than were originally envisioned, as illustrated by Akram, Yingxiu, Al-Adwan, and Alkhalifah (2021), who wrote that the COVID-19 pandemic "raises the importance of technology integration in education, and teachers are required to update their competencies, respectively" (para. 1). The ramping up of the skill set required to convert courses from face-to-face to online occurred at numerous institutions within weeks. In a lot of cases this hasty expansion could be characterized as a band-aid until training could be developed and scheduled.

The instructors that already had been teaching online were at a distinct advantage. Scaling up the rest of the instructors in some cases was problematic. While the technology had been in use within the education industry, more than a few faculty only had tangential familiarity. These faculty needed significant help and in many cases in-depth training. Since the need to implement these technologies occurred in the middle of the term, training had to be postponed and individuals with adept knowledge, specialized organizations, or a combination of both were marshaled to the forefront to manage this new instructional reality. As a result of this change in circumstances 42.5% of faculty participated in over 40 hours of online teaching training and another 20.8% participated in between 20 to 40 hours of online teaching training prior to the beginning of the Fall 2020 semester (Kelly, 2020).

Not only did institutions of higher learning need to be concerned with the quality of course content, the opportunities for students to engage with their peers and faculty were severely limited. Out of classroom activities such as athletics, clubs, and other social events vital to the college experience were put on hold, as administrators grappled with how to offer these types of involvement in a safe manner. As a result, a number of elite institutions — such as Princeton University, Williams College, Spelman College, and American University — substantially discounted tuition for their fully online experience in an historically unprecedented fashion (Gallagher & Palmer, 2020, para. 3).

The campus community (particularly in traditional universities with a high on campus residency rate), faced additional obstacles to offering out of classroom opportunities, as these interests became sidelined in the hopes of keeping COVID infection rates down. Dormitories were closed and students were encouraged to live with their families. As universities were forced to vacate their campuses "students lost access to campus labs, technology, transportation, athletics, library services, dining halls and more" (Justin & Oxner 2020, para. 16). This reduction of the overall

college experience led many students to switch to more budget friendly universities. Options which may not have been a choice because of location now were within the realm of possibility. Students and their parents asked questions like: Why pay private school tuition if you are taking online classes without a chance for personal interaction? Why pay fees for on campus activities or amenities if they are not being offered? Some examples of these fees would be parking, athletic, and recreation or health center fees. When on campus living was closed, many students needed to relocate hours away to be with family and wouldn't have been able to access services even if they remained open. As indicated by Fishman, Hiler, & Nguyen (2021), the pandemic rise led high school seniors to rethink their college choices; 31% applied to schools closer to their families, and 29% applied to schools with lower costs.

ENROLLMENT

The unpreparedness of many institutions and students to go completely online as a result of the COVID-19 pandemic was evident. A comparison of the top ranked U.S. Institutions (Figure 1) and the ranked top U.S. Liberal Arts Institutions (Figure 2) between Fall 2019 (the last full term before the onset of COVID-19) and Fall 2020 (the first full term following the onset of COVID-19) indicates that many top schools experienced a decrease in enrollment (U.S. News and World Report 2020 & Best Colleges in America). While there were a few clear exceptions (Amherst College, Pomona College, and Columbia University) within the top ranked schools, the rise in enrollment for these 3 institutions suggests that they found a successful strategy to both recruit and retain students.

Figure 1 *Top U.S. Institutions*

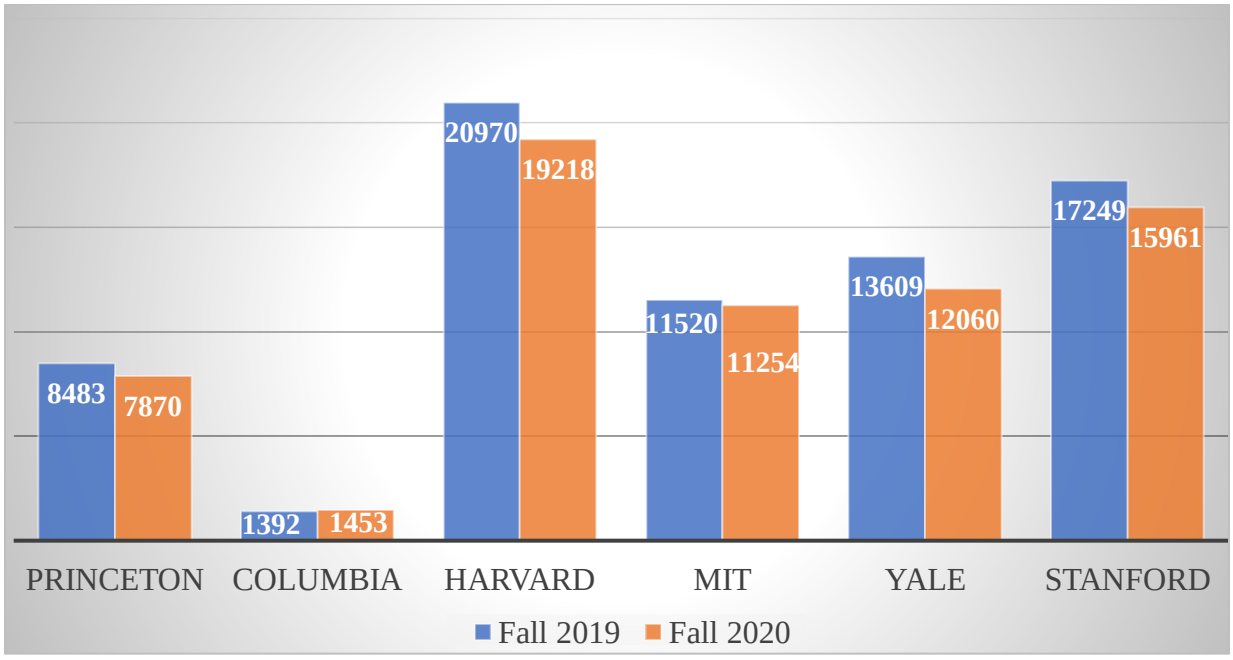
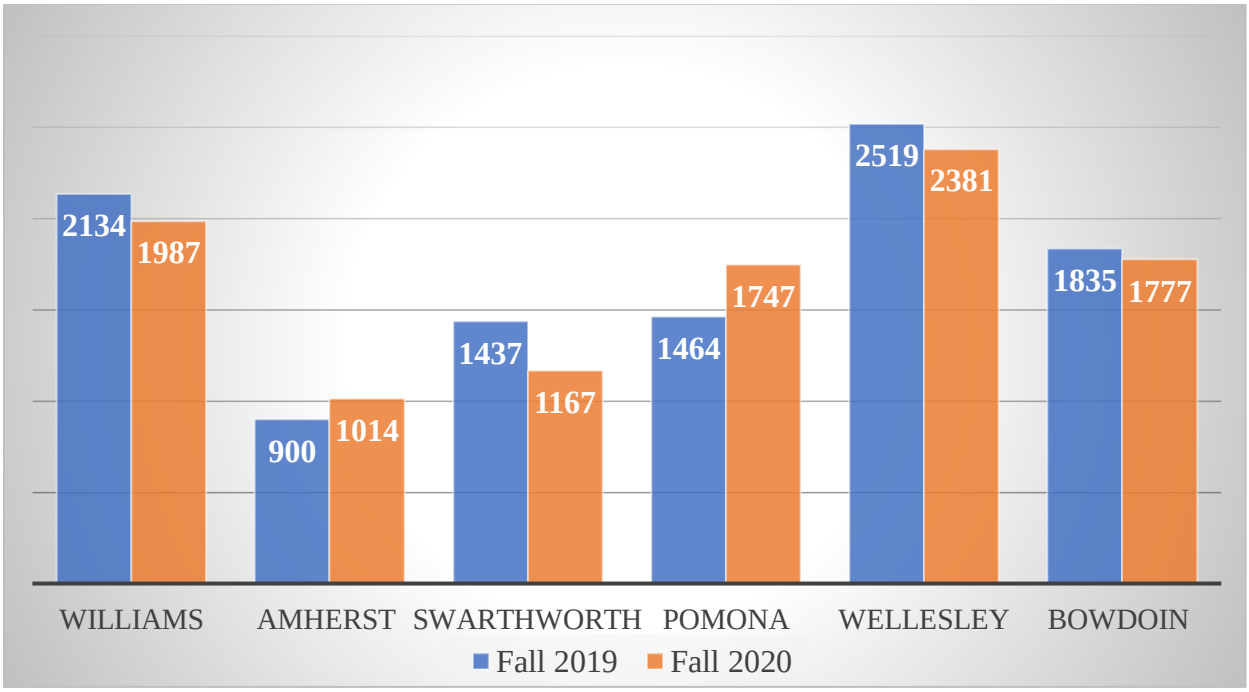


Figure 2 *Top Liberal Arts Colleges*



There could be a lot of reasons to account for why some enrollments increased and some decreased in the above referenced institutions. Since most institutions went completely online in the middle of the spring 2020 term and stayed online for the next year, it follows that students were already locked into whatever particular school they were already attending. The subsequent term is a different story. There is a myriad of reasons students may not have returned as alluded to throughout the paper. Certainly, the loss of the college experience is chief among them. Another main reason seems to point to instruction. Whether it is the format or the quality of instruction, a better trained online work force could have made a difference. Clearly the drop in enrollment at the very least signifies that there is room for improvement concerning online classes, expectations, and offerings.

INSTRUCTION TYPES

In reality, course delivery exists along a continuum of interaction type, as can be seen in Table 1 adapted from Allen & Seaman (2010). Courses may be traditional and completely in person with no technology, or fully online with no face-to-face interaction. In between those extremes, faculty may use technology and the internet to facilitate learning, or as the main modality of learning. In some cases, the term "remote learning" has been used in place of "online learning". However, a remote learning model could be seen as more dependent on real time instruction and interaction, through an online platform. For many faculty new to the online teaching world, this has been the go-to method for the initial shift in course delivery. Presenting the same content through video lectures in real time would arguably be the quickest and most straightforward way of transitioning to an online course; but most likely it would be better categorized as a remote course. This paper utilizes the learning classifications from Allen and Seaman, the BABSON Survey Research Group, and The Sloan Consortium, previously published by Goralski & Falk, 2017.

Table 1 *Learning Course Classifications*

Type of Course	Typical Description
Traditional	Course with no online technology used – content is delivered in writing or orally.
Web Facilitated	Course that uses web-based technology to facilitate what is essentially a face-to-face course. May use a course management system (CMS) or web pages to post the syllabus and assignments.
Blended/Hybrid	Course that blends online and face-to-face delivery. Substantial proportion of the content is delivered online, typically uses online discussion, and typically has a reduced number of face-to-face meetings.
Online	A course where most or all of the content is delivered online. Typically have no face-to-face meetings.

(Allen & Seaman, 2010, p. 5)

FACULTY STRUCTURE

Faculty are organized and structured in various ways worldwide, but the United States system has remained consistent across time. Variations do exist at different universities, but in general categories take into account whether faculty are full or part time (full time presumes it is the individual's primary place of employment). Full time faculty are often given duties such as teaching, service & research. Whereas part time faculty teach specific courses and typically do not have obligations outside of the classroom.

Faculty can be on a tenure track or a non-tenure track line. Tenure indicates more stable employment and is usually awarded (typically after 6 years of tenure track work). Non-tenure track faculty need to be renewed fairly frequently to remain employed.

The 1940 Statement of Principles on Academic Freedom and Tenure was released by the American Association of University Professors and updated in 1970. The purpose of the document is to describe why there is a time limit for tenure track positions. It also illustrates the importance of tenure in terms of academic freedom and the freedom to pursue knowledge. The benefits of tenured professors go hand in hand with their obligations of the pursuit of truth for society. Specifically, the document states, "Academic freedom in its teaching aspect is fundamental for the protection of the rights of the teacher in teaching and of the student to freedom in learning. It carries with it duties correlative with rights" (p. 14).

Although tenure and promotion to associate professor often go together, tenure is not always tied to faculty rank. The normal order of tenure track faculty ranks are assistant professor, associate professor, and full professor. An emeritus status may be granted to extraordinary faculty after retirement. Subsequently, non-tenure track faculty are usually referred to as lecturers or instructors.

Full time faculty appointments, with some variations due to rank, typically include different levels of teaching, service, and research or professional achievement. Service may be to the student body, department, college, university, community, or profession. Falk & Lemanski (2020) listed and summarized the responsibilities of the most common university faculty ranks.

ADJUNCT PROFESSORS/LECTURERS

Adjunct professors or lecturers are part-time employees who may teach a few courses each semester at a university. The adjunct's responsibility is to provide instruction for the specified courses, communicate with students, grade papers, projects, assignments, and report final grades. They do not have research or service obligations.

LECTURERS

Full-time lecturers teach approximately 4-5 courses per semester and have contracts of typically one to five years, which are renewable. Their work efforts are usually concentrated on teaching students.

ASSISTANT PROFESSORS

Assistant Professors are the starting rank of a position which usually holds a terminal degree in field. Assistant professors typically are held to higher research expectations than other ranks, as they need to establish themselves in a research area in order to be awarded tenure after a period of around 6 years.

ASSOCIATE PROFESSORS

Associate professors are typically tenured faculty, although they may be newly hired faculty with experience who will have a tenure evaluation sooner than they would if hired as an assistant professor.

FULL PROFESSORS

Full professors are usually tenured faculty. They have had significant accomplishments in teaching, research, and service which have allowed them promotion from the associate rank to the full professor rank (p. 194).

PROPOSAL OF A NEW FACULTY MEMBER CLASSIFICATION

As established previously, there are 5 general classifications for faculty at higher education institutions within the United States. These are: Adjunct, Lecturer, Assistant Professor, Associate Professor, and Full Professor. A separate classification for a fully online/remote faculty position has not been common practice at most universities. As of July 2020, around 95% of faculty positions advertised on the HigherEdJobs website categorized as online/remote were for online only institutions, and/or for adjunct faculty. This statistic remains consistent as of January 2022.

Higher education has been altered since the widespread COVID-19 pandemic of 2020. As infections rates and cases of the virus fluctuate, flexibility in conducting university business online remains a priority.

> As Jaschik (2022) wrote - some colleges were holding a few weeks of classes online, and a portion of those colleges were discouraging students from returning to campus. Other colleges have delayed the start of their semesters. And still others were switching the start of the semester to online only (para. 3).

A distinctly online university faculty pathway would contribute to the flexibility required during widely uncertain times. To offer stability for students and faculty, the online professor should be a tenure track line, focusing on teaching with a secondary role of service or research. Individuals hired would need to have the organizational and technical skills for online course delivery, and a terminal degree in their field.

CONSIDERATIONS

Many different variables influence how to organize an online only faculty line. Some of the student characteristics that need to be considered are the percent of students who are commuter versus resident, and student experience with online learning. Faculty knowledge of online teaching and learning theory and practice, as well as the degrees being offered by the university must also be taken into account. This paper proposes some guidelines and considerations, but with so many different situations, a rigid prescription of how universities should proceed in this endeavor would be ill advised.

One possible starting point could be converting tenured faculty nearing retirement who have both in person and online teaching experience. These faculty members would have the experience necessary in teaching, service, and research, as well as a firm grasp on institutional goals and practices. These pioneers of the online only teaching role could mentor newer faculty.

Alternatively, as new programs are developed (and as faculty are hired for new programs), these hires could be brought into the institution as fully online faculty. This would lessen the demands of change within the program, as materials and methods would be optimized for online delivery from the start. Faculty who start in these roles could branch out and help traditional programs in their transition to online teaching/learning, if it befits the institution, students, faculty, subject matter, etc.

There are other monetary aspects which could make the creation of an online category of faculty an intriguing option for universities. Once the initial outlay is made for the needed infrastructure (training, equipment, salaries, and related benefits) “the return on investment, as opposed to the traditional associated costs of brick and mortar, can be tremendous” (Goralski & Falk, 2017, p. 274). One of the greatest expenses that institutions face is related to the purchase/construction, restoration/maintenance, and the monthly operation costs for classroom and office space at their education sites. It is estimated by the Nation Center for Education Statistics (n.d.) that during the 2018-2019 academic year institutions of higher education spent between 4% and 9% of the total budget on auxiliary enterprises, no small amount when you consider that these same institutions

had an operating budget of over $632 billion dollars. These expenses were greatly reduced during the crux of the COVID-19 pandemic as the bulk of educational efforts were moved online and the need for physical resources like water, power, and sanitation supplies decreased after an initial spike related to health protection measures (Korn, 2020).

As institutions begin to slowly return toward more traditional face-to-face instruction models, those expenses will continue to rise, but they don't necessarily need to reach the same levels as previously seen. If institutions consider the growing prevalence and success of online instruction, combined with the potential for reduced operational costs, it seems reasonable that the creation of an online faculty classification is a logical next step in securing greater financial stability.

ONLINE FACULTY EXPECTATION SCENARIOS

A typical full-time faculty member's duty involves the three areas - teaching, research, and service. While the COVID-19 Pandemic has demonstrated that many service obligations can be performed remotely through Zoom or file collaboration applications, the role of teaching remains the largest challenge for transitioning online. Research, the other main responsibility can be and has been routinely conducted over long distances sometimes with colleagues at other institutions as well as individually. Thus, scenarios for what is expected from strictly online faculty members are wide open.

Although most emphasis for this new type of faculty member is on teaching, research is an integral part of many faculty members' teaching experiences. Universities could still continue the trend of connecting scholarship with classroom experiences for an online faculty member. The removal of service from their roles would allow for more online classes taught, which would offer flexibility to students during uncertain times like the COVID-19 pandemic, as well as allow for students in remote areas or with challenging schedules to earn a degree. Highlighting teaching and research would also (as with other faculty lines) most likely necessitate a support mechanism (to include a budget for travel and/or research expenses). Furthermore, an internal office dedicated to faculty for research design guidance and the specific requirements defining research expectations (how many and if publications or presentations are needed) may also be helpful. In this setting, service to the department, college, university, etc. would not be emphasized.

Another scenario might be to continue to have faculty concentrate primarily on teaching and secondarily on service. The emergence of COVID-19 has led to more widespread use of developed technology helping to ease interaction from a distance. As a direct result, faculty members from a far could lead the efforts on substantial time-consuming committees like curriculum development, assessment, and internal department policy development. In this instance the research component would be eliminated. For this situation a terminal degree might not be necessary, as the training needed to conduct meaningful research may not be apparent in this level faculty member. As the online only faculty track becomes more solidified and used, newer professors could also join at either the assistant professor level or the lecturer level, with their responsibilities being spread between the three traditional spheres, teaching, research, and service.

Naming of this new type of faculty member is also a consideration. As types of faculty labels differ among institutions, this should be left up to each university, but the name must signify that this

professor is an online faculty member and does not typically meet with students in person or attend campus events in person. Removing the in-person requirement can help universities attract the most qualified candidates without the concern of relocation.

SALARY RECOMMENDATIONS

As consideration is given to the responsibilities of these new online faculty classifications, establishing appropriate salary and compensation ranges needs to be addressed. Currently, traditional faculty salary ranges are based upon their specific job requirements. Within the existing faculty classifications, the main differentiator is whether the individual is expected to conduct research (tenured and tenure-track faculty) or whether no research expectation exists (instructor/lecturer). It would therefore make sense to follow a similar path based on assigned responsibilities for online faculty.

For the purpose of identifying appropriate compensation ranges a strong starting point can be found in recent data from the Faculty in Higher Education Survey conducted by The College and University Professional Association for Human Resources (CUPA-HR).

Table 2 *Salary Data 2019-2020*

Physical Sciences

Job Title	All Institutions	Research Doctoral	Other Doctoral	Master's	Baccalaureate	Associate's
Professor	$92,243	$121,141	$94,119	$87,381	$82,694	$73,209
Associate Professor	$73,446	$88,577	$72,982	$69,840	$67,474	$63,593
Assistant Professor (Excl. New)	$64,692	$78,960	$63,317	$61,127	$60,641	$56,118
Assistant Professor (Incl. New)	$64,696	$79,030	$63,428	$60,918	$60,017	$56,118
New Assistant Professor	$68,000	$81,000	$63,000	$63,000	$58,000	*
Instructor	$59,177	$60,740	*	$55,836	*	$57,917

(HigherEdJobs 2019-20 Salary Data, para. 32)

These figures provide detailed breakdowns based upon institutional designation (Doctoral Research, Doctoral Granting, Master's Granting, etc.) as well as breakdowns based upon existing academic ranks (Tenured Full Professor through Instructor/Lecturer). From these basic salary ranges, institutions could align online focused faculty with the existing pay structures so that faculty who have "similar" job responsibilities (ex: online teaching faculty with research responsibilities vs. online teaching faculty with service responsibilities) are compensated in a similar manner as their traditional instructional model colleagues (tenure and tenure track vs instructor/lecture).

Along with base pay considerations is a need to also identify appropriate classification ranks to distribute compensation commensurate to experience and education attainment. This would be especially important when attempting to identify the appropriate rate for terminally degreed faculty with multiple years' experience in online instruction in comparison to faculty that had been newly conferred with a graduate degree and are entering their initial online teaching opportunity.

The authors of this paper suggest that the compensation for a strictly online professor with a terminal degree and the teaching/research expectation fall toward the lower range of an associate professor. For an online professor without a terminal degree and a teaching/service expectation, it is suggested that the salary to be in the same range as an instructor/lecturer.

HOW TO EVALUATE ONLINE FACULTY

Customarily, faculty evaluations are weighted toward their job responsibilities and contributions. Most universities and colleges have the policies and procedures in place on how to evaluate traditional faculty. With the new online faculty classification, the evaluation process should be tweaked with an eye toward which track (teaching/research or teaching/service) the member is placed on. Since the primary responsibility for both online faculty tracks is teaching, the workload percentage needs to be skewed toward instruction with the research and service roles less emphasized. An appropriate workload ought to be 60 percent teaching and 40 percent in the subsequent area.

Evaluating the teaching portion for this faculty member at most institutions is pretty standard – student evaluations, peer evaluations, and perhaps course materials. In this circumstance (since the faculty member is strictly online) in addition to the common benchmarks, an incorporation of the certification associated with an educational organization that focuses meticulously on online instruction could also be warranted - an organization such as Quality Matters.

For the teaching/research faculty member a certain number of presentations and publications could be used as the basis of the scholarship section of the evaluation. Perhaps something a little above the usual guidelines. For instance, a school accredited by the Association to Advance Collegiate Schools of Business' (AACSB) might have a policy of 6 intellectual contributions within a 5-year period. Two of those contributions need to be articles published in scholarly journals. Since the responsibilities are limited to teaching and research, raising the scholarly publication count to 3 does not seem out of line. Of course, the quality and level of the journal should be consistent with the existing scholarship policy at the home institution.

In the teaching/service track, the service part of the evaluation could be calculated based upon the value of the service. The more substantial committees such as accreditation, assessment, and curriculum development should be assigned (more or less) on a permanent basis. These types of committees seem to make more sense for the online faculty as they are area specific and can be completed without setting foot on campus.

DISCUSSION

The age of the COVID-19 pandemic has brought about changes in higher education and leaves many questions for its future. Instruction became almost 100% remote for Spring and Fall 2020, followed by a return to some in person classes after vaccinations became available. However, as of January 2022, universities are once again transitioning classes to online formats, at least for the first weeks of the semester (Jaschik, 2022). Time will tell how long this will continue. Universities, faculty, and students showed what is possible with remote and online learning. Thus, unlocking the possibilities of keeping these new methods. In fact, many students are now demanding the flexibility of taking classes online, and as Douglas-Gabriel (2020) pointed out, "college faculty members are demanding the right to teach remotely" (para. 1). Universities that have online courses scheduled, or have the ability to quickly shift courses online, are at a distinct advantage in the current environment. The unknowns and week by week count of COVID infections indicate a need for flexibility and quick transitions.

As campuses begin to consider a return to the traditional standardization of face-to-face education the developments brought on by the COVID era may lead to an upheaval of these plans. When the bulk of educational institutions moved to fully online teaching models, it opened a veritable pandora's box where students learned that not only could they complete important educational benchmarks remotely, but they could do so without an apparent significant change in perceived educational quality. Furthermore, faculty that took the time to revamp and restructure their curriculum may similarly choose not to return to their past teaching models. This transformation might not be so easily undone, as students may not consider coming back to an institution that requires face-to-face instruction. The educational innovations that were embraced, coupled with the flexibility inherent within the online learning environment is not something that should be lost.

It might also be reasonable to consider that a full transition back to face-to-face instruction will not ever be truly attained.

> Richards (2021) in her piece for USA today entitled "When will education in America return to normal? Probably never" points a statement from Paul Reville of the Education Redesign Lab at Harvard University about the risk of returning to "normal" teaching. "Normal shouldn't be what we used to have, because what we used to have is inadequate". (para. 3)

If universities and colleges are looking to embrace revised education models as the new normal, the institutional, regulatory, and pedagogical changes will need be addressed in a system that makes standardized distance and hybrid teaching models a permanent reality.

The Online Professor rank affords flexibility and benefits to students and faculty alike. Faculty members who have interest in and wish to focus solely on online teaching will be able to get extra training and practice; students will benefit from online teaching expertise and tried and true methods. Faculty and students will not be geographically limited in their choice of an institution, but can select a university based on specialization, research interest, or other relevant variables.

Providing a stable, attractive option to faculty in order to recruit and retain the most qualified for these online programs is of utmost importance. Quality online programs require dedicated, trained faculty who feel passionate about connecting with students in a non-traditional sense. As circumstances continue to shift regarding the contagion, geographical and accessibility concerns, online course delivery will continue to be prominent in discussions. There may also be other considerations not yet identified that universities would need flexibility to face.

For institutions with decreasing enrollments during the COVID-19 pandemic an opportunity exists to both expand and further develop their distance learning capabilities. Smaller class sizes could allow more experimentation and acceptance of newer digital learning techniques for both the students and the faculty. This perspective would not only directly increase the quality of the instruction but could also make their offerings appealing.

LIMITATIONS AND RECOMMENDATIONS

This paper has outlined the benefits of and need for a new class of faculty at traditionally brick and mortar universities. The need for faculty who specialize in online instruction would be beneficial for students, the institution, and for the faculty themselves. A commitment of resources for supporting online instruction for faculty and students, and a planning process of advancing the online programs over time is required to adopt an online faculty classification.

In addition, to better serve the institution and the students it would be helpful if an in-depth analysis is conducted by the schools that are considering implementing an online faculty rank as to which programs / degrees would benefit most from strictly online faculty. Obviously not all courses lend themselves to online instruction. While just about any course can be taught online, the skills gleaned in some may not be as robust as in a more traditional setting.

Another consideration (before enacting and online instructor rank) might be to screen the student population for online readiness. To do well in an online environment students need be willing to login, check email consistently, and complete course assignments without regular instructor contact. In other words, take responsibility for their own learning. These students also need to have the technological background / skills and equipment. If a student population does not possess these traits an online instructor rank may not be in their best interest.

The catalyst to call for an online faculty rank is the instructional shift created by the recent pandemic. If the pandemic has taught higher education anything, it is the need to be flexible and to be able to adjust almost immediately. While the future for the most part can't be predicted, the current instructional technology allows institutions to hedge their bets by embracing an online component.

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LOVE IS IN THE APP: GEN-Z USE AND PERCEPTION OF DATING APPS

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ABSTRACT

Mobile apps are a prevalent element of daily life, particularly within Generation Z. Online dating applications are being used by tens of millions of Americans and are a multi-billion-dollar industry. An online questionnaire collected information related to dating apps in general and Tinder, specifically, from 469 18-25-year-olds. Respondents indicated a lack of awareness of popular dating apps and sites other than Tinder. Of the eight dating apps and websites mentioned in this study, more than half of the respondents did not have an awareness level or sufficient knowledge to evaluate on six of the eight. Respondents identified several strengths of dating apps including being modern and easy to use, highlighting key reasons for the success of the mobile app. On the other hand, respondents were most concerned with safety as well content factors, such as the emphasis on appearance rather than personality. Respondents' agreement with statements related to Tinder were very similar to the level of agreement with responses related to dating apps in general. Therefore, this begs the question: are 18-25-year-olds simply basing their perceptions of all dating apps solely on Tinder, at the expense of other platforms?

Keywords: Dating Apps; Tinder; Uses and Gratifications; Generation Z

INTRODUCTION

When Apple introduced the App Store in 2008, 500 applications or apps were available. These applications transformed mobile technology. Mobile phones moved a primarily communication device to a mobile computer bringing gaming and utility into our daily lives. Recent data (Holst, 2020) estimates that there are more than 275 million smartphone users in the U.S. In 2019 it was estimated that 96 percent of adults 18-29 owned a smartphone (O'Dea, 2020).

When people are using their smartphone to fill time, they are most likely using an app. Wurmser (2020) stated that U.S. adults spend on an average day four hours with mobile internet, and 88 percent of that time is within applications. In a survey by Reviews.org, nearly 66 percent of the participants stated that they check their mobile phone 160 times a day (Abbott, 2020). According to Dogtiev (2021), the Apple App store offers 2.2 million applications for downloading, and the Google Play Store offers 3.3 million applications. Apple and Google are the two biggest distributors of mobile applications; however, there are more than 300 app stores worldwide (Dogtiev, 2021).

Consumer spending on mobile apps is expected to reach $133 billion in 2021 (Chan, 2021). And, according to reports from Techjury, people spend more than 90 percent of their mobile time using applications (Stancheva, 2021). With more than an estimated five million apps available (Stancheva, 2021), one popular category of apps is dating apps. Dating apps were valued at $7.05 billion in 2020 and the worldwide online dating application market is projected to grow at a compound annual rate of 5.6 percent from 2021 to 2028 (Grand View Research, 2021).

While at one time meeting someone online could be considered risky, the nature and number of mobile applications has transformed dating. Mobile applications can allow people to connect with partners outside their pre-existing networks (Barraket & Henry-Waring, 2008). According to the Pew Research Center, 30 percent of U.S. adults say that they have used a dating site or app, up from 11 percent in 2013 (Anderson, Vogels, & Turner, 2020). In addition, 48 percent of 18-29-year-olds stated that they had used a dating site or app (Anderson, Vogels, & Turner, 2020).

Industry reports indicated there were more than 1,500 dating applications or websites making online matchmaking a $3 billion a year business in 2018 (Lin, n.d.). As of November 2021, the dating application Tinder reported a U.S. mobile audience of 7.86 million users, while dating app competitor Bumble had 5.03 million U.S. users making them the top two mobile dating applications (Curry, 2021). These changes in technology have altered the landscape for dating. Tinder was launched in 2012. While not the first dating app, Tinder used technology to gamify dating with features including its effortless swipe right for yes and left for no, activity designed to appeal to its target audience, young adults (Abolfathi & Santamari, 2020). In their study, Abolfathi and Santamari (2020) found the swipe feature was part of the reason Tinder users frequently described their experience with Tinder as fun more than 2.5 times that of experiences on other mobile dating apps. The current research project applies the uses and gratifications theory to examine perceptions of the usefulness and enjoyment of dating applications among Americans aged 18- to 25-years-old.

LITERATURE REVIEW

Uses and Gratification Theory

The uses and gratification theory (Katz, Blumler, & Gurevitch, 1974) posited that people actively seek out media to satisfy their specific needs. The goal of media use is such that it should gratify users' needs (Rubin, 1983). Uses and gratifications research recognizes that users actively and intentionally select media based on needs and motives to communicate, expectations about the media and alternatives to the media and the consequences of behaviors (Rubin, 2002).

One of the uses and gratifications strengths is its applicability to a wide range of media contexts (Bryant & Sheldon, 2017). Uses and gratification theory has been used to examine the use of the internet (e.g., Diddi & LaRose, 2006; Stafford, Stafford, & Schkade, 2004), mobile devices (e.g., Leung & Wei, 2000; Wei & Lo, 2006), social media (e.g., Krause, North, & Heritage, 2014; Sheldon & Bryant, 2016) and cyber dating (Bryant & Sheldon, 2017; Wang & Chang, 2010).

To better understand the motives behind mobile app use, Lin, Fang, and Hsu (2014) determined it was the immediate access and mobility, social benefits, self-status seeking, entertainment,

information seeking, pursuing happiness, and socializing that motivated mobile app users. Gerlich, et al. (2015) found motives for using applications include passing the time, knowledge and education. Given the wide-ranging applications of uses and gratification theory, it can help understand more about the needs and perceptions of dating applications.

Mobile Applications and Dating

Mobile applications are applications designed to run on a mobile device—a smartphone or a tablet computer. Different from desktop computers and website usage, mobile applications are downloaded and installed on a mobile device. The average mobile app user in the U.S. has more than 100 applications installed on their device (Sydow, n.d.). While many applications are free, it is not unusual for free applications to offer in-app purchases or premium services. Applications frequently ask for profile-type data to understand how mobile owners use applications and the gratifications obtained from such use (Gerlich, et al., 2015).

Dating apps are often popular because people want access to more potential partners, they are curious, they seek convenience, or because they are bored, lonely or hopeful (Cox, 2020). The most popular mobile dating applications in the U.S. in 2019 include Tinder, Bumble, Plenty of Fish, Match.com, OkCupid, Grindr, Hinge, Zoosk, MeetMe and Ashley Madison (Clement, 2020). Both online dating sites and apps require a user to create a profile including descriptions, photos and a variety of preferences. Users are then able to "like" or 'dislike" other profiles. A match constitutes both parties "liking" each other. Mobile dating applications differ from websites as, in many cases, the mobile application requires users to link to an existing profile, for example a Facebook profile to cross-check identity. It is features like this form of authenticity as well as elements of mobility, proximity, and immediacy (Chan, 2017) that help differentiate mobile dating applications from online dating websites.

Although online dating websites and dating applications both promote their ability to help people connect, there are differences in the platforms. Previous studies found that people typically used dating websites to find long-term partners (Albright & Simmens, 2013) while mobile dating applications have been viewed as a way to find more casual relationships (Licoppe, Riviere, & Morel, 2016). A previous study by Bryant & Sheldon (2017) looked at both online dating and mobile applications. This study looks at mobile dating applications, and their use within the 18-25 age demographic.

Cohort Description and Target Market

Born after 1997, Generation Z or Gen Z, is considered the most racially and ethnically diverse and largest generation (Parker & Igielnik, 2020). Comprising more than 27 percent of the U.S. population, it is often called the first "digital natives." Gen Z's identity is tied to the digital world, and they are frequently described as digital pioneers because of their ability to blend the physical and digital worlds and work across multiple devices.

From how they spend their time to the ways in which they communicate, Gen Z's experiences and dating experiences in part due to technology are different from previous generations. In its study, *the State of Gen Z 2020*, the Center for Generational Kinetics reported that more than 58 percent

of Gen Z reports that it cannot go more than four hours without internet access before they become uncomfortable (Center for Generational Kinetics, 2020). In addition to their digital fluency, a Google study found that 51 percent of 18-24-year-olds believe virtual dating is important while 65 percent claim dating apps and websites let them date people regardless of their physical location.

Tinder

First launched at the University of Southern California in 2012, Tinder was more of a social platform than dating application (LeFebvre, 2018). Part of what makes Tinder unique in the dating application world, is it was one of the first dating applications designed for mobile technology rather than an extension of a dating website. Unlike a dating website, Tinder removed the requirements of a lengthy profile, and gamified online dating (Cardona, 2019). Account setups are quick (users can sign in via Facebook profiles) and minimal effort is needed with Tinder's swipe-right-to-like approach allowing users to make fast, impulsive and automatic decisions. This swipe feature is part of why its users frequently describe their experiences as "fun" more than two-and-a-half times more than experiences on other mobile dating applications (Abolfathi & Santamaria, 2020).

Tinder markets itself on Apple's App Store as creating 30 billion matches to date and more than 26 million matches per day (Apple, 2020). On the Google Play Store, the Tinder application has 1.2 million 5-star reviews (Power, n.d.) During a 2018 interview, the CEO of Match Group (which owns Tinder) noted that the mobile dating application "particularly resonated with 18–25-year-olds because it provides a fun and easy way to meet people" (Perez, 2018). With the volume of users, Tinder offers one of the largest, if not the largest, pools of single people.

According to Tinder (2021), 50 percent of its members are between the ages of 18 and 25 (Gen Z). Gen Z seems to be big on digital dates. Nearly 68 percent of Gen Z Tinder users report that it is easier to make connections online and 67 percent say it is more liberating to meet new people online (Tinder, n.d.). Part of what contributes to Tinder's dominance is that it can deliver a date 10 times faster than other dating applications. Additionally, Tinder implemented a double-blind match system requiring both parties to "like" each other to receive a match—which eliminates rejection. Tinder's core application features are free and the experience offers game-like conditions eliminating boredom (Lerner, 2017).

Standard stereotypes often indicate that Tinder is used primarily for hookups, whereas, dating applications like Bumble are used by those more interested in developing a relationship. However, examination of the perceptions toward dating sites including Tinder among the targeted age group of 18–25-year-olds, the top users of the application, is more limited. Therefore, this study adds to existing scholarship by analyzing this group's attitudes toward, and use of, dating applications.

RESEARCH QUESTIONS

To analyze millennial and Gen Z perceptions of dating applications, this research seeks to answer the following research questions:

RQ1: How aware of dating applications are 18- to 25-year-olds?

RQ2: How much do 18- to 25-year-olds use dating applications?

RQ3: What is the opinion of dating applications among 18- to 25-year-olds?

METHOD

The data for this project were collected using a self-administered, online survey questionnaire that included sections on respondent demographics, awareness of dating apps, use of/experience with dating apps and evaluation of dating apps. The demographic questions asked for respondents' age, gender, relationship status and work hours per week. The respondent's level of awareness was determined by asking for their level of knowledge about eight popular dating apps. Rates of dating app use were determined with items related to whether or not they had ever used a dating app, and the average time per week on the apps. The respondent's evaluation of dating apps was determined with questions that asked them to rate eight of the most popular dating applications. Additionally, the respondent's opinion of dating apps in general was measured by their level of agreement with 15 value statements related to dating apps.

A draft questionnaire format was administered to 25 students within the age range desired in the research and their comments were used to develop the final questionnaire format. Based on the student responses to the draft instrument, changes were made to the introduction, the directions for several questions, and the number of popular dating apps included. The pre-test respondent comments also resulted in the removal of three questions.

Undergraduate students in a research methods class at a public university in the Midwest were tasked with recruiting respondents using nonprobability-based sampling. In addition to completing an online training regarding ethical research involving human subjects, the students were given guidelines for the required respondent age range and helped to create and edit the final questionnaire. Using primarily network sampling (Dainton & Lannutti, 2021), over 500 responses were collected. After removing respondents who were outside of the age range, did not provide an age, or did not complete a majority of the questionnaire items, 469 respondent answers were included in the final data set. Data analysis was conducted using SPSS.

RESULTS

Respondent Profile

The majority of the respondents identified as females (297, 63.3%), with an additional 159 (33.9%) identifying as males. Only five (1.1%) identified as some other gender, and eight (1.2%) did not answer. The researchers limited responses to individuals who were in the age range of 18 to 25 years, since that group was most likely to be actively using dating applications. Respondents who identified as older than 25 or did not provide an age were removed from the data set. Table 1 indicates the number and percentage of the respondent pool that fell into each year of age. Efforts were made to recruit individuals at the lower end of the range, since they would be the most likely

to be using a dating app and not already be in a long-term relationship. The recruitment efforts led to just less than one-half of the respondent pool (218, 46.5%) indicating a current age of 18 or 19.

The current relationship status of the respondents was also an important variable, as it may impact the likelihood of using a dating app. Given the age range of the respondents, it is not surprising that a majority (218, 56.9%) identified themselves as being single and that only nine (1.9%) were married (see Table 2).

Table 3 *Hours Worked*

Hours Work	N	N%
0	138	29.4
1-5	18	3.8
6-10	73	15.6
11-15	46	9.8
16-20	57	12.2
21-25	28	6.0
26-30	29	6.2
31-35	9	1.9
36-40	47	10.0
41+	18	3.8
Missing	6	1.3
Total	469	100

The final demographic variable collected was the respondent's average number of hours worked per week, as indicated in Table 3. While respondents were open to write in any number of hours, for ease of reporting, the hours were placed into five-year groups. Just less than one-third (138, 29.4%) reported not working at all. The mean number of reported work hours was 15.3 and the median was 12.

Table 1 *Respondent Age*

AGE	N	N%
18	110	23.5
19	108	23.0
20	78	16.6
21	97	20.7
22	36	7.7
23	26	5.5
24	7	1.5
25	7	1.5
Total	469	100.0

Table 2 *Relationship Status*

	N	N%
Single	267	56.9
Married	9	1.9
Relationship < 6 months	39	8.3
Relationship < 6 months	143	30.5
Other	5	1.1
No answer	6	1.3
Total	469	100

Awareness

Much of the past research, especially from trade or professional publications, provide measures, such as the number of downloads and number of monthly users, but do not measure the respondent's self-reported familiarity with different apps. Thus, one goal of the current investigation was to determine the respondent's awareness and knowledge of the major dating apps, as noted in RQ 1 which asked how aware 18–25-year-olds were with dating applications.

Respondents were presented with a list of eight popular dating applications. They could indicate that they had never heard of the app (unaware), did not have enough information to evaluate

(uninformed), or they could provide a rating on a five-point scale. The ratings of those who felt sufficiently knowledgeable to provide the evaluation will be discussed in a later section. As indicated in Table 4, only two dating apps, Tinder and Bumble, had an awareness and information level high enough within the respondents so that a majority of the respondents provided a ranking. For the remaining six dating apps, more than 50 percent did not provide an evaluation either because they had never heard of the app or did not have sufficient information to evaluate it.

Table 4 *Awareness of Popular Dating Applications*

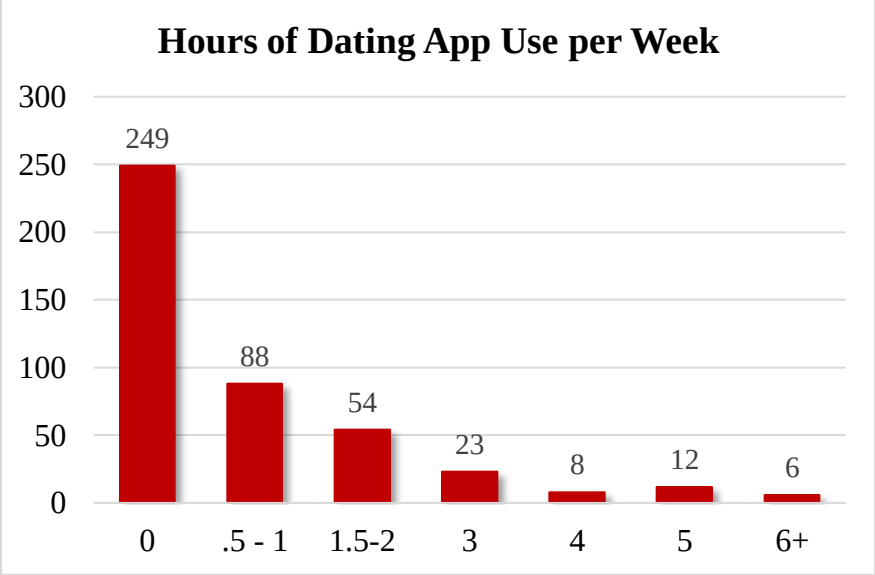
	Never heard of the app	Not enough info. to evaluate	No Response	Total No Evaluation
Tinder	0	40 (8.5%)	3 (0.6%)	43 (9.2%)
Bumble	58 (12.4%)	89 (19.0%)	3 (0.6%)	150 (32%)
eHarmony	41 (8.7%)	201 (42.9%)	3 (0.6%)	245 (52.2%)
Match.com	47 (10.0%)	210 (44.8%)	4 (0.9%)	261 (55.7%)
Grindr	72 (15.4%)	199 (42.4%)	3 (0.6%)	274 (58.4%)
Hinge	120 (25.6%)	172 (36.7%)	5 (1.1%)	297 (63.3%)
OKCupid	134 (28.6%)	208 (44.3%)	4 (0.9%)	346 (73.8%)
Plenty of Fish	184 (39.2%)	186 (39.7%)	5 (1.1%)	375 (80%)

Use of Dating Apps

In addition to knowing the respondents' familiarity with dating applications, the research attempted to ascertain the respondents' use of dating apps, as noted with RQ 2. Only four of the 469 respondents did not answer the simple question of whether they had ever used a dating app. Nearly two-thirds of the respondents, 304 (65.4%) indicated that they had used a dating app with 161 (34.6%) indicating that they had not.

Since the first item only asked if they had ever used a dating app, the researchers were also curious about the level of use. An additional item asked how many hours in an average week they use dating apps (see Figure 1). Given that just over one-third of the respondents indicated that they had never used a dating app, it is not surprising that 29 (6.2%) chose to not respond, and 249 (56.6%) indicated they used these apps zero hours per week. The remaining 191 responses were generally between .5 and 5 hours per week, with only six responses indicating more than 5 hours. The overall mean score for the 440 who responded was just under one hour (.96), a reflection of the fact that over one-half of the respondents reported no time using them.

Figure 1 *The number of respondents reporting this number of hours of dating app use per week*



Evaluation and Perception of Dating Apps

To answer RQ 3, those respondents who felt they had sufficient knowledge of a dating app were asked to evaluate the app using a five-point rating system (1-5) with choice labels of Terrible (1), Poor (2), Okay (3), Good (4) and Excellent (5). Table 5 presents the mean score for those evaluations, as well as the number of respondents who did and did not complete a rating. Nonparametric tests show no statistically significant differences in the responses, which is not surprising given that there is just less than a one-point difference (.98) between the high and low mean scores and that three of the mean scores are within two, one-hundredths of each other. As the median score on the scale is a 3.0, having all the scores clustered around the median value is an indication that there are not major differences of opinion regarding these popular dating apps.

Since the ratings of the dating apps all tend to cluster around the center, the researchers then wanted to ask whether general attitudes toward all dating apps might be a factor, rather than simply the results in Table 5 exhibiting an expression of few preferences for certain apps. To determine the respondents' general attitude toward dating apps, they were asked to indicate their level of agreement with 15 general statements about dating apps. The results are presented in Table 6.

Table 5 *Mean Rating for Popular Dating Apps*

	Mean	N/%	Total No Evaluation
Tinder	3.62	426 (90.8%)	43 (9.2%)
Bumble	3.49	319 (68%)	150 (32%)
Hinge	3.22	172 (36.7%)	297 (63.3%)
Match.com	3.21	208 (44.3%)	261 (55.7%)
eHarmony	3.20	224 (47.8%)	245 (52.2%)

Grindr	2.92	195 (41.6%)	274 (58.4%)
OKCupid	2.76	123 (26.2%)	346 (73.8%)
Plenty of Fish	2.64	94 (20%)	375 (80%)

The respondents indicated their level of agreement using a five-point scale ranging from strongly disagree (1) to strongly agree (5). The results in Table 6 show greater differences than the ratings presented in Table 5. The results demonstrate that respondents have some clear positive and negative views of dating apps. The respondents view these apps as being modern, easy to use, convenient and efficient. However, in a more negative view, the dating apps are viewed as being sex/hook-up-focused and appearance-focused. The dating apps received the lowest mean scores for being reliable, safe, personality focused, romance-focused, and honest. Thus, respondents saw dating apps as a modern and efficient alternative to traditional methods of meeting others, but also indicated using these apps were considered a shallow alternative.

Table 6 *Agreement with Statements Related to Dating Apps*

Dating or matching apps…	Mean	SD
… are modern.	4.13	.767
… are sex/hook-up-focused.	4.05	.822
… are easy to use.	3.99	.855
… are convenient.	3.98	.893
… are appearance focused.	3.81	1.215
… cater to a diverse range of sexual orientations.	3.59	.969
… provide many options to choose from.	3.57	.991
… are efficient.	3.12	.955
… are something I am knowledgeable about.	2.99	1.142
… provide successful matches/dates.	2.97	.899
… are reliable.	2.60	.846
… are safe.	2.50	.861
… are personality focused.	2.46	.885
… are romance-focused.	2.30	.926
… are honest.	2.23	.827

Table 7 presents the mean scores and standard deviations for the responses to twelve statements related to Tinder. The statements are presented with the statement receiving the highest level of agreement first and then descending based on the mean score. The agreement level was measured using a five-point scale with 1 representing strong disagreement and 5 representing strong agreement. The statements with the highest level of agreement note that Tinder is easy to use, easy to understand, is used by their friends and is used for entertainment. Thus, the strong agreement items deal with the ease of using the app and the social or entertainment value. The statements

receiving the most negative mean scores say that the respondent uses Tinder for dating and for hook up. One interesting note related to Table 7 is that while the number of people responding to the statements was very consistent, only ranging from 292 to 300, only 205 provided a response to the statement that "I use Tinder to hook up."

Table 7 *Respondent Agreement with Statements Related to Tinder*

	Mean	SD	N
Tinder is easy to use.	4.27	.693	292
Tinder is easy to understand.	4.19	.729	292
My friends use Tinder.	4.16	.771	296
I use Tinder for entertainment.	3.89	1.043	294
I am well informed about Tinder.	3.85	.972	300
Swiping is the most efficient way to find a "match".	3.54	1.079	294
I have had positive experiences with Tinder.	3.43	.998	294
I use Tinder to meet new people.	3.42	1.117	294
I would recommend Tinder to others.	3.40	.944	296
Tinder gives me better results than other apps.	3.29	.951	296
I use Tinder for dating.	2.99	1.233	295
I use Tinder to hookup.	2.72	1.374	205

DISCUSSION

Without question, dating apps' awareness and usage has reached unprecedented levels, particularly among its target demographic of 18-25-year-olds. Tinder by far was the dominant dating app platform used by these respondents. Of the eight dating apps and websites mentioned in this study, more than half of the respondents did not have an awareness level or sufficient knowledge to comment on six of the eight. In fact, the two applications with the highest familiarity, Tinder and Bumble, were also the two largest mobile apps according to Clement (2020). Therefore, this begs the question: are 18-25-year-olds simply basing their perceptions of dating apps solely on Tinder, at the expense of other platforms?

Also significant was the amount of time respondents reported being on dating apps. While not surprising that more than half of the respondents indicated they spend little to no time on a dating app, or that very few spend more than five hours, the results do indicate some intriguing avenues for future research further examining usage. Of note, the researchers found most intriguing

respondents' differing views of dating apps based on technology versus content. For example, respondents' identifying strengths such as the apps being modern and easy to use indicates the main characteristics of a successful mobile app, directly alluding to while content-wise.
The results of the current investigation are consistent with past research on mobile apps. For example, the four statements about Tinder with the highest level of agreement indicated that Tinder was easy to use, easy to understand, was used by friends (social) and was used for entertainment. The items with high levels of agreement are consistent with Lin, et al.'s (2014) findings that mobile apps are used for socializing and entertainment. On the other hand, respondents were most concerned with safety as well as content factors, such as the emphasis on appearance rather than personality. The responses indicate that dating apps are viewed as a way to develop casual relationships, thus being sex/hook-up focused. These results are consistent with the findings of Licoppe, Riviere, and Morel (2016).

The results presented on Table 7 noted respondents' agreement with statements related to Tinder were very similar to the level of agreement with responses related to dating apps in general, as located on Table 6. Like dating apps in general, there was a high level of agreement that Tinder was easy to use and to understand. The lowest levels of agreement in the Tinder results on Table 7 were statements about the respondent's personal use of Tinder for dating and hooking up. Those low scores seemed to coincide with the responses on Table 6 noting the perception that dating apps are not honest, romance-focused, personality-focused, safe or reliable. With those negative perceptions of dating apps related to dating, it is not surprising that for Tinder the lowest levels of agreement were about using Tinder for dating and hooking up. These results can also be tied into the question for future research about whether the perception of Tinder was driving the responses for dating apps in general, since some other dating apps are much more focused on creating long-term relationships (e.g. Match.com) and are considered safer than Tinder (e.g. Bumble).

Limitations

This study provides a wealth of information on insights into Generation Z's usage of mobile dating apps and how these platforms are prevalent in the 18-25-year-old demographic's technological and societal use. Some limitations did present themselves over the course of the study. One was the researchers gathered self-reported data from respondents. Another limitation was the respondents were recruited using non-probability, convenience/network sampling. Thus, the responses cannot be generalized to a larger population. Finally, given the fluid nature of social media, cross-sectional research such as the present investigation can only provide results for one point of time. Longitudinal research could look for changes that might occur over time.

Marketing applications and Suggestions for Future Research

There are several avenues of future scholarly examination from this research. One possibility is studying changes in dating app use in light of the COVID-19 pandemic. How has the pandemic influenced or impacted how people utilize these apps for connections? Additionally, future studies may focus on how dating apps' technological updates have changed awareness, usage and perceptions. A second avenue for future investigation is to move away from self-reports of usage and to use data to examine the actual time users spend on dating apps, and the similarities and differences in this data versus self-reported statistics. Future investigations would also benefit from

probability-based sampling techniques drawing a representative sample that would allow for the generalization of the results.

It would be valuable to further examine both the user interface and the marketing of these dating apps impacts perception. Given the competition among these apps and the lack of recognition of many apps, does the nature of Tinder's gamification experience help the apps popularity?

Beyond understanding the reasons for and types of usage, it would be helpful to examine how the different dating apps segment user groups and approach development beyond ease of use. For example, marketers traditionally segment their user groups and define marketing opportunities. Are dating apps held to a different standard related to the result rather than a more fine-tuned segmentation of relationship needs and values?

On an even more practical level, marketers may find that advertising on Tinder and other dating apps that take ads will help them to reach a crucial audience who by abandoning traditional media, have forced marketers to find them in new places. Consider advertising for restaurants or vacation resorts, the types of advertising that may benefit from being on a dating app. "Tinder is also a great placement option if you want to advertise a business, especially it is a great way to reach young demographics. Users can't use ad blockers on Tinder, so you can be sure that you will be able to reach the users" (Tinder ads explained, 2022). Additionally, Tinder is not flooded with advertising, "…as advertising revenue accounts for only 3% of their total revenue." (Tinder ads explained, 2022).

"Tinder ads can show up as a display ad on the main page of Tinder with an option to click into the advertisement, or as an interactive advertisement that requires a swipe left or right option to learn more about the advertisement or to dismiss it" (Tinder Ads Help, 2021). Since Tinder advertising can incorporate the gaming aspect of the app itself, marketers may have an easier time getting users to swipe right for more information. Future research may wish to further study advertising on Tinder and other dating apps. Some examples of initial research could include conducting a content analysis to determine the current advertisers, studying the analytics for different advertisers or industry categories or conducting an experiment to determine if the "swipe right" feature of Tinder advertising does lead to increases in ad engagement.

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THE POLITICAL YOUTH VOICE SPIRAL: AN APPLICATION OF THE SPIRAL OF SILENCE TO OPINION EXPRESSION AMONG YOUNG AMERICAN VOTERS

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ABSTRACT

Drawing on the *Spiral of Silence* theory, this study investigates young Millennial and Generation Z voters' willingness to voice their political beliefs in divergent public opinion climates during elections in the digital media era. Young voters in every generation have typically been more cynical, more susceptible, and less informed than older age groups, and more easily influenced by unbalanced media consumptions and skewed social and political contexts. However, this pattern is changing through 'given' and 'chosen' media consumptions and generational political characteristics. Utilizing a quasi-experimental design of 2 (pro- vs. anti-voting message exposures) x 2 (self pro- vs. self anti-voting attitudes) x 2 (young Millennial voters (N=81, in 2004) vs. young Generation Z voters (N=102, in 2016)), the study found that young voters in the internet and social media eras were not silent any longer. This study observed the deviating patterns of the fading *Spiral of Silence*, the dual *Spiral of Voice*, and the reverse *Spiral of Silence* among the two youngest generations in the American political landscape, and the tendency was stronger for Generation Zs over Millennials. Generation Z young voters in the 2016 election year were much more expressive regardless of public opinion climates and even more expressive in incongruent opinion environments, and formed stronger counter views, compared to young Millennial voters in the 2004 election year.

Keywords: Spiral of Silence; Young Voter; Public Opinion; Millennials; Generation Z

INTRODUCTION

One of the most studied theories of public opinion, the *Spiral of Silence* theory, postulates that individuals' willingness to express their true beliefs in public depends on the congruency between personal beliefs and the public opinion climate (Noelle-Neuman, 1974, 1977, 1984). People who perceive their opinions as similar to those of the majority are more likely to express their views publicly, while individuals who believe the majority does not share their views are less willing to speak up (Noelle-Neuman, 1974). However, subsequent research has argued that the relationship between one's willingness to speak publicly and the public opinion climate is not as direct and straightforward as originally hypothesized. This relationship is mediated by many

other factors, such as the context of the communication (Ho & McLeod, 2008; McDevitt, Kiousis & Wahl-Jorgensen, 2003), a person's internal mood and attitude strength (McDonald, Glyn, Kim, & Ostman, 2001), group affiliation (Krassa, 1988), culture and ethnicity (McCroskey & Beatty, 1998; Toale & McCroskey, 2001), media use, and demographics such as education (Moy, Domke, & Stamm, 2001). Not only the majority opinion, but also other various factors influence an individual's willingness to voice personal opinions in the public sphere.

Does the *Spiral of Silence* theory still apply to the latest, newest generations of American voters, the Millennials and the Generation Z? The youth of these two newest generations might have deviated away from the pattern of public opinion expression from the general public, and the youth voice has been shown to be mediated by generational political, social, and media culture. Previous research on the youngest voting groups, 18-to-24 years old, has shown that this population is poorly informed about politics (Kaid, McKinney, & Tedesco, 2007), highly cynical (Elenbaas & De Vreese, 2008), highly apathetic (Bennett, 2000), highly vulnerable (Kaid et al., 2007), and less willing to engage in political behaviors than older voters (Delli Carpini, 2000; Lopez, Kirby, & Sagoff, 2003; Putnam, 2000). Partly responsible for the state of young voters are the news media as coverage has focused on the shortcomings of public figures and state institutions that hint at negative majority public opinion and the routine coverage patterns marginalizing the social minorities, thus signaling young voters' vulnerable and unimportant political status (Moy & Pfau, 2000). However, the political climate has changed, and new media technology has brought new venues and patterns for political dialogues for the youngest generations of our time (Kalogeropoulos, Suiter, Udris, & Eisenegger, 2019). Drawing upon these theoretical perspectives, this study explores political youth voices from the two youngest generations, young Millennial voters in 2004 and young Generation Z voters in 2016, who were born and grew up with digital media and rapidly changing political and social culture, and investigates changes in the willingness of the young voter cohorts to publicly express political beliefs over two decades spanning from the 2004 U.S. general election to the 2016 U.S. general election.

THEORETICAL UNDERPINNINGS

Political Communication Landscape from Young Millennials to Young Generation Zs

Young voters were considered more vulnerable to negativity and strategic framing than older voters because they have less real-world political experience and newer, developing, and less crystallized political attitudes (Jennings & Niemi, 1978, 1981). Before meeting Millennials in the political world, a great number of scholars concluded that the consistent lower voting turnout among young voters can be directly attributed to the political communication landscape, such as prevalent negative political rhetoric by a few dominant communication channels and sources (Lau & Erber, 1985). However, starting in the early 2000s, digital technologies such as the Internet and social media have changed political campaigning as well as media coverage, and caused different media consumption patterns among Millennials and Generation Zs compared to previous generations. Millennials, sometimes referred to as Generation Y, were born between 1977 and 1994, and are believed to be a more self-reliant and independent generational cohort (Williams & Page, 2011). Generation Zs were born between 1995 and 2010, and have been identified as a more self-confident generational cohort, having more diverse ideas from wider

backgrounds compared to previous generations (Seemiller & Grace, 2016; Williams & Page, 2011). When these youngest American voters met political momentums, they have made important changes in American political history (Lopez, Kirby, Sagoff, & Herbst, 2005; Allcott & Gentzkow, 2017).

Researchers have observed the gradually decreasing youth voting turnout since 1972 – except for a brief spike in the non-traditional campaign election year of 1992 with the utilization of the Internet for the first time targeting non-majority voters (Owen, 2006). However, the sharp turning point of the 2004 U.S. presidential general election, having 10% increases in young voter turnouts, aged between 18 and 24, compared to prior presidential election in 2000, was a very noticeable phenomenon in the U.S. electoral process with young Millennial voters. The 2004 U.S. general election was the very first U.S. election when the earliest Millennials reached the voting age (Lopez et al., 2005).

In 2004, the increase in youth voter turnout is considered a direct aftermath of the 2000 presidential election between George Bush from the Republican Party and Al Gore from the Democratic Party, which was decided by only a few hundred votes. During the 2004 campaigns, not only mass media and political parties but also numerous independent organizations went to great lengths to target more permeable voter groups, such as young voters, with mobilizing messages (Lopez et al., 2005). For example, there were unprecedented amounts of speeches made by young surrogates, such as the Bush twins and the Kerry daughters, the famous "Vote or Die" T-shirt, viral PSAs with celebrity spokespersons, and intensive online and television campaigns during the 2004 campaigns. The six most prominent non-partisan youth advocacy groups, including Rock the Vote and The New Voters Project, spent close to $40 million on voter registration drives and awareness messages (Hampton, 2004).

In a majority opinion climate supportive of active participation targeting young voters, typical young voters who used to be cynical, apathetic, and uninformed would find themselves visible and meaningful in the political arena. Various polls and surveys conducted during the campaign months before the 2004 U.S. presidential general election seemed to indicate that the strong pro-voting public opinion climate had increased political interests and produced active voting intentions among young people (Lopez et al., 2005). The voting turnout for the young voters aged from 18 to 24 in the 2004 presidential election was 46.7%, sharply increased by 9.6 percent compared to that in the previous election of 2000 (U.S. Census, 2019). These figures were significantly higher among the college student population, a group that reached 66% of young voter turnout rate (Lopez et al., 2005). On college campuses, the prevailing public opinion was that voting does make a difference and that any eligible voter must show up at the polls on Election Day (Lopez et al., 2005).

The youngest Generation Zs became eligible as first-time voters in the 2016 U.S. presidential election, which was another unprecedented contest between a hyperbolic business man and a politically seasoned women, and was filled with conflicting scandals, gossips, and fake news, escalated identity clashes, social cleavage, and far extreme political polarizations (Allcott & Gentzkow, 2017; Yun, 2021).

In 2016, the micro-targeting of young voters continued as campaign strategy. Celebrities' messages targeting young voters aspired young voters to be more engaged in and identified with political messages. Non-partisan initiatives for registration drives were also continuing campaign processes through both internet and traditional media beyond physical in-person table setting drive events (Panagopoulos, 2016). The micro-targeting approach by political and non-political public groups for more reliable base mobilization has been an increasing campaign trend than old-fashioned strategies that used to focus on persuading less 'reliable' voting populations, such as independents. This micro-targeting approach has gradually more intensified political polarizations for the last two decades in American politics (Panagopoulos, 2016). Along with such changes in the political and campaign processes, the historically divided presidential election in 2016 amplified negative, contradictory, and incongruent voices and conversations (Yun, 2021). Right after the 2008 presidential election by the Democratic Party candidate, Barack Obama's extensive voter mobilizations (Kenski, Hardy, & Jamieson, 2010), young voters have gradually dropped out and expressed their feelings of alienation in 2012 and even worse in 2016 (Southwell, 2016).

The political communication landscape reflected a lowering voting turnout to 43% among the young voters aged from 18 to 24 and showed lower participation for Generation Z young voters in 2016 compared to Millennial young voters in 2004 (U.S. Census, 2019). Moreover, although young white male voters increased, racially more diverse young voters were presented in 2016 than the youth electorate in 2004 (Circle, 2016). Like the conventional electoral norm has been, in the 2016 presidential election, college students were twice as likely to vote and engage in politics than non-college youth (Circle, 2016). These early Generation Z young voters seemed to disappear in the visible political sphere, but were more likely to be involved in political actions, discussions, and shares "when they see political content online" (Circle, 2017).

In addition to the changes in the political landscape, the media landscape has also changed from 2004 to 2016 and played important roles for early Millennial and Generation Z young voters' political voices and activities. There have been increasing amounts of political information, sources, and channels since the advent of online technologies in the early 2000s, expanding upon, and even replacing some traditional media, such as newspapers and television. Scholarly work has noted that diversified digital media messages have shown various effects in different directions and dimensions. For instance, social media not only have been cultivating positive, efficient, and interactive political information environments, but also have been feeding negative and inaccurate self-assuring political bias and misinformation (Bode, Vraga, Borah, & Shah, 2014). More specifically, these new types of political information by digital media are often more personalized information within circles of individual social networks and by individual preferences and interests (Bode, 2016).

In 2004, while TV and newspapers were still primary sources of political information, there was a noticeable increase in internet use (29%) for political information from the previous general election cycle in 2000 (18%) among American voters. The internet (18%) became one of the top three primary political news sources followed by TV (78%) and newspapers (39%). However, back in 2004, online political information that American voters were obtaining was provided mostly by websites of major news organizations and newspapers (54%), and other non-mainstream news sources such as professional political blogs and government or candidate

websites (24%). These rising new information channels like the internet, not only made political information consumers more selective, but also made the audiences encounter more diverse and contradicting information (Rainie, Cornfield, & Horrigan, 2005).

In 2016, there had been a more divided and diverse media environment. The general voter populations reported TV news (24%) and social media (14%) as their most helpful political information sources, while young voters identified social media (35%) and news website/app (18%) as their top political information sources. In the multi-media era, about half of American voters (45%) learned about politics from five or more sources (Gottfried, Barthel, Shearer, & Mitchell, 2016). With multiple emerging political information sources, there were unconfirmed and invalid political and social information circulating and spread through formal and informal conversations largely by social media. The 'average American adult' was exposed to these information sources around the general election time and tended to believe stories consistent with their views (Allcott & Gentzkow, 2017).

While there is much debate over the cutoff between the two generations, both Millennials and Generation Zs have grown up in periods with similar debates over political issues such as abortion, diversity, climate change, and gun control, but they have each experienced different waves of technological innovation. Millennials remember a time before cell phones, social media and modern modes of expression. Generation Zs on the other hand have never known a world without access to instant information, entertainment and self-expression (Nuzulita & Subriadi, 2020). While Millennials use social media for maintaining relationships, staying connected on Facebook and business purposes, Generation Zs are drawn to platforms that allow for more self-expression and entertainment purposes. The social media platforms of Millennials are not the primary outlet for many younger members of Generation Z who prefer TikTok, SnapChat and Instagram over Facebook and Twitter. Generation Zs are at a point in their lives where they are striking out to define themselves and many do not like to be lumped in or compared to Millennials despite existing similarities (Noor, 2020).

Theoretical Evolutions in Political Youth Voice

There have been both distinctive similarities and disparities between early Millennial young voters and early Generation Z young voters. The young voters of the two generations have demonstrated deviating patterns of political voices along varying and evolving political, social, and media contexts in 2004 and 2016. This study scrutinizes the classic public opinion theory, the *Spiral of Silence*, in applying its theoretical framework to understanding the political youth voices of the latest voting age generations, Millennials and Generation Z. The political, social, psychological, and media landscapes have changed over time, and political values, norms, and voices are evolving along with the changes. The *Spiral of Silence* theory can be unfolded and expanded to multiple versions of perspectives in order to explain newly emerging patterns of public opinion by Millennials and Generation Zs in the digital media environment.

The classic *Spiral of Silence* in the traditional media era

Elisabeth Noelle-Neumann (1974) introduced a theory of public opinion called the *Spiral of Silence*. According to the classic theory, individuals observe their external opinion environment

and adhere to the opinion of the majority mainly from an internal motivation to avoid isolation from people around them. Individuals who perceive the majority opinion to be in agreement with their own beliefs are willing to talk in public, while individuals who perceive majority opinion to be in disagreement with their own opinions tend to keep silent (Noelle-Neumann, 1974, 1977, 1984). In other words, the minority viewpoints self-censor themselves into silence as a result of social pressures (i.e., fear of isolation, normative reasoning, group affiliation) or individual cognitive and perceptual factors, while the majority opinions gain more support and become legitimized through systems of information dissemination such as mass media (Glynn & McLeod, 1984; Salmon & Kline, 1985).

Scholars have been fascinated by, and agree with, the assumptions of the *Spiral of Silence* theory regarding the dynamics between public and individual opinion. Glynn, Hayes, and Shanahan's (1997) meta-analysis of all major research on the *Spiral of Silence* theory from the mid-1980s to mid-1990s found that most studies confirmed the connection between individuals' willingness to express opinions and their perceived majority opinion climate. Taylor (1982) investigated voters' willingness to voice opinions in political discussions and to express their candidate preferences, and concluded that individuals who believe that the public mood supports their political preference are more likely to express their opinion than those who do not share the congruency of perception.

The main reason that minority opinion holders prefer to keep silent is their fear of social isolation. Noelle-Neumann (1984) argued that fear of social isolation more strongly determines one's public discourse than a person's true views. The proposition that fear of disapproval is inversely linked to one's willingness to speak in public has been a general agreement among scholars in public opinion studies (Glynn & Park, 1997; Kim, Han, Shanahan, & Berdayes, 2004; Neuwirth, Frederick, & Mayo, 2007; Willnat, Lee, & Detenber, 2002). An alternative to keeping silent is to voice opinions congruent with those of the majority, while hiding true personal attitudes in order to avoid social isolation (Glynn & McLeod, 1984). When minority opinion holders experience fear of isolation, they tend to adopt avoidance strategies such as lying or making neutral comments (Neuwirth et al., 2007), trying to change the subject or reflecting the question back without answering it (Hayes, 2007). In cognitive dissonance processes, minority opinion holders may even adopt the attitudes of majority groups in order to attain validating information and to satisfy a broad set of normative social goals and expectations (Deutsch & Gerard, 1955; Kelly, 1952; Kelman, 1958). As a consequence, for instance, people are more likely to publicly support a candidate if they perceive that the candidate is winning the election according to a mainstream news media poll (Glynn & McLeod, 1984).

The divergent *Spiral of Silence* in the digital media era

However, as the political and social atmosphere and the media environment have changed dramatically since the theoretical perspectives of the *Spiral of Silence* were introduced in 1974, the unfolded aspects of the theoretical parameters need further exploration to understand new, different, and various trends of contemporary public voices. Noelle-Neumann (1974, 1977) identified the instruments for understanding opinion climate in her earlier studies: social being, majority accordance, opinion adjustment, social-psychological mechanism-*Spiral of Silence*, individual observation of the social environment, readiness to stand up for own opinions, and

perception of polarization (Noelle-Neumann, 1977, pp.144-45). We may need to revisit the meanings of the instruments in order to correctly apply the measures in today's political climate and legitimately interpret them in political voices of current societies.

In American society and politics, these *preconditions* of social being and value of agreement over disagreement, *perceptions* of opinion status, social approval, individual judgement, and opinion diversification, and *socio-political behaviors* of opinion expression and adjustments, have been changed in the past several decades, and thus these components of political voices should be re-interpreted in the current political and social contexts. Noelle-Neumann foresaw a few deviating potentials of preconditions, perceptions, and behaviors and noted them in her earlier research (1974, 1977, 1979). Public opinion is "objects of awareness" and individuals' willingness to speak varies in different political circumstances, therefore the conversations with likely-minded members or in different degrees of mixed opinion can impair the sense of opinion status (Noelle-Neumann, 1974, p. 46). There are always exceptions like "the hard-core" in the different stages of opinion formations and these hard-core minorities were more willing to stand up than majorities, and the readiness to stand up for their own political voices differ across different demographic groups (i.e., young people are more speak out) (Noelle-Neumann, 1977, pp. 150-51, 157; Noelle-Neumann, 1979, p. 155). Noelle-Neumann's speculations for deviating conditions and factors have saved the values of the novel theory of the *Spiral of Silence* in studies from different times across different political and social contexts.

Scholars in the fields of public opinion, political communication, and new media have revisited the *Spiral of Silence* theory to reevaluate the value of the theory and validate the theoretical approaches in current political and social environments that differ greatly from 1970s and 1980s. Lasorsa (1991) discussed the deviating circumstances elaborating that a person's political outspokenness is linked not only to perception of majority opinion but also to demographics (gender, age, education), one's interest in politics, level of self-efficacy, the importance of an issue to that individual, media use and opinion strength, expanding on the main mechanism of spiral voices from a congruent opinion climate. Lin Cao, and Zhang (2017) revisited Lasorsa's argument in online contexts and confirmed the deviating outspokenness in online discussions among young college students. Ho and McLeod (2008) added that the social sense of disapproval and isolation is diluted where information sources are mixed and diverse, such as in online contexts. Schulz and Roessler (2012) argued that the new media technologies have created a diversified and indirect environment for individuals' perception of public pressures beyond the original assumption of the *Spiral of Silence* that the major source for assessing the majority public opinion is the mass media (Noelle-Neumann, 1974, 1977, 1984).

The adaptive applications of the *Spiral of Silence* to the political youth voices in the digital media era

Key political events and information may impact younger generations more profoundly because they are in a formative age (Jacobson, 2019). The political issues and battles the United States has faced and the diversifying information channels and sources over the last two decades have formed the political personalities and beliefs of Millennials and Generation Zs. Perhaps owing to increased social and ethnic diversity, multiple fragmented information sources, and increased social awareness among younger generations in the U.S. (Fry & Parker, 2018; US Census, 2019),

Millennials and Generation Z tend to be more likely to believe that racial diversity is good for society and express much more support for issues, such as biracial and same-sex marriages, compared to the Silent Generation, Baby Boomers and Generation X (Parker, Graf, & lgielnik, 2019).

Inspired by Noelle-Neumann's (1974, 1977) early speculation in deviating effects of the *Spiral of Silence* for young voters and varying effects in impaired opinion environments by mixed opinions, this study explores young voters' public voice along with evolving political and media landscape, unfolding the theoretical framework of the *Spiral of Silence*. This study proposes the three feasible patterns of unfolded *Spiral of Silence* about political youth voice in American society: the fading *Spiral of Silence*, the dual *Spiral of Voice*, and the reverse *Spiral of Silence*.

The fading silent spiral of youth voice. The *preconditions* of social being and value of agreement over disagreement are no longer sustainable conditions or statuses. In the evolving American society with more diverse people, less consensus, and higher communication technology, people are getting less vulnerable to out-group voices, and the status of agreement and disagreement gets more ambivalent. Some individuals and demographic groups, such as young voters, can be even much less likely restrained by predominant social norms and expectations, living in various degrees of political consensus upon their observations owing multiple channels and sources of information (Moy & Scheufele, 2000; Ho & McLeod, 2008).

Under the new preconditions where political information exposures have been increased and political participations have been encouraged and easier for young voters due to diversified socio-political contexts and communication technologies, political expressions are getting more natural, and socio-psychological barriers for joining public conversation gets lower (Keating & Melis, 2017). Apart from one's opinion status as the precondition of the original *Spiral of Silence* theory (1974, 1977), these new preconditions mediate the link between individuals' opinions and the willingness to express their opinions in the current American politics. Under the evolving preconditions, the less vulnerable young Millennial and Generation Z voters tend to be more expressive, erasing the used-to-be silent habits of youth political expression in American politics (Milkman, 2017; Seemiller & Grace, 2016).

The rising dual spiral of youth voice. The *perceptions* of social approval and fear of isolation are no longer an unswerving filter for political voices. In the divergent political and media climates, "quasi-statistical sense" referred by Noelle-Neumann, can be easily impaired and "fear of isolation" can be weakened by multiple information sources and interactive communications (Ho & McLeod, 2008). Therefore, less bounded individuals and groups, such as young voters, are not always restrained by predominant opinion pressures and afraid of being denied, and rather more freely express themselves publicly (Glynn et al., 1997; Moy & Scheufele, 2000).

Mutz and Martin (2001) found that the exchanges of mixed comments, such as in online forums, confuse the perceptions of validated views because people are more likely to encounter multiple views by less homogenous groups compared to face-to-face communications and interactions that are often among people with similar political, social, and cultural backgrounds. Young voters living in evolving political and media climates where diversified views come across, perceptions of opinion status are unclear, and consistent social approval is absent, tend to be less

afraid of being different from public views or consensus, and thus express their own opinions (Yun, 2020), creating a dual spiral of voice on a debatable and polarized political issue.

For instance, the youngest generations of Millennials and Generation Zs have raised more divergent and polarized political voices. As for the role of government in our lives, both younger generations are more likely to express a belief that government should increase its role in society and do more to address problems, while older generations tend to believe that government's role should be limited, emphasizing the role of individuals and business. These widened generational changes have been shown in other socio-political areas including environmental issues such as climate change and energy. Younger Republicans in the Generation Z and Millennial age ranges differ greatly from older Republicans, showing more support for renewable energy such as solar and wind, but less support for nuclear energy (Funk & Tyson, 2020). Moreover, Generation Zs are somewhat more progressive about new ideas and terms, such as gender-neutral pronouns (Parker et al., 2019), creating clearer dual signals on social and political issues.

Given these positions on many important political issues, Millennials and Generation Zs who are generally less afraid of disapproval and more expressive in divergent and selective opinion climates compared to the older counterpart, may show more opposing views, polarized voices, and dual opinions in various political issues (Fisher, 2020).

The reverse spiral of youth voice. The *socio-political behaviors* of opinion expressions and adjustments are no longer a unimodal in the contemporary American politics in the new media era. Sunstein and Hastie (2015) noted that people tend to be more outspoken when they are exposed to controversial issues with diversified opinions. Glynn and Park (1997) also argued that attitude strength mediates the fear of isolation-public expression relationship. The fear of social isolation mostly affects those whose opinions on a topic are moderate in intensity (Glynn & Park, 1997), but people holding intense beliefs are less likely to be silenced by pressure from an opposing or divergent public opinion, and rather more strongly express their political preferences (Krassa, 1988; McDonald et al., 2001).

When opinionated individuals face opposing views in the discordant opinion climate than where their views are supported, they are more likely to express themselves publicly to legitimize their views and to correct other views. In other words, people who have strong beliefs about, high interest in, and high involvement with an issue, referred as the hard-core by Noelle-Neumann (1974, 1977), tend not to let an opposing public climate silence them, but rather more likely to speak strongly in a mixed or incongruent opinion climate. The reverse pattern of the *Spiral of Silence* has been observed by various scholarly experimental and survey research (Davison, 1983; Eveland & Shah, 2003; Gunther, 2014). More importantly, the pattern is more prevalent among the Millennials and Generation Zs, and the trend is more consistent for educated young people, such as college students (Lin, Cao, & Zhang, 2017).

As newer generations join in society and politics, people are getting more polarized and opinionated (Abramowitz & Saunders, 2008). Gunther (2014) argued that selective information processes in mixed opinion climates, where Millennials and Generation Zs live in, intensify counter attitudes and voices against different views and biases. Eveland and Shah (2003) elaborated more on that diversified conversations with 'similar others' increase bias against even

their own views. The tendency is getting stronger for the two youngest generations in the current political communication, and even more so for Generation Zs than Millennials (Parker et al., 2019).

The emerging political expression pattern of the newest generations is a coincided speculation about the louder speaker in mixed opinion environments that Noelle-Neumann (1977, 1979) and Davison (1983) anticipated about a half-century ago. Based on the inferences by the scholarly work on strong minority counter public voices, this study tests the reverse pattern of the *Spiral of Silence* among the two youngest generations in the American political sphere.

HYPOTHESES

Despite the similar traits of Millennials and Generation Zs, their political communication has evolved differently. The less vulnerable and more outspoken youngest generations in the political arena have deviated from the original propositions of the *Spiral of Silence* theory. The theory stipulates that people's perception of majority opinion, which can be gauged from projecting personal opinions upon the public, influences their willingness to speak publicly. Fear of isolation pushes individuals to avoid expression of their true feelings if these feelings do not match the majority public opinion. How does this relate to young voters in the past two decades in a diversified opinion environment? How do those opinionated hard-core individuals express themselves in divergent opinion environments? This study posits three different versions of the *Spiral of Silence* in political voices of young Millennial and Generation Z voters and propose the divergent models of the *Spiral of Silence.*

H1: ***Fading Spiral of Silence***:

1.1 Young voters are getting less likely to be vulnerable to public opinion climate and more willing to express their political voices regardless of opinion climates.

1.2 Young Generation Z voters are more likely to be politically expressive than young Millennial voters regardless of opinion climates.

H2: ***Dual Spiral of Voice***:

2.1 Young voters are getting less likely to be afraid of disapproval by public views and more willing to express their political voices both in congruent and incongruent opinion climates.

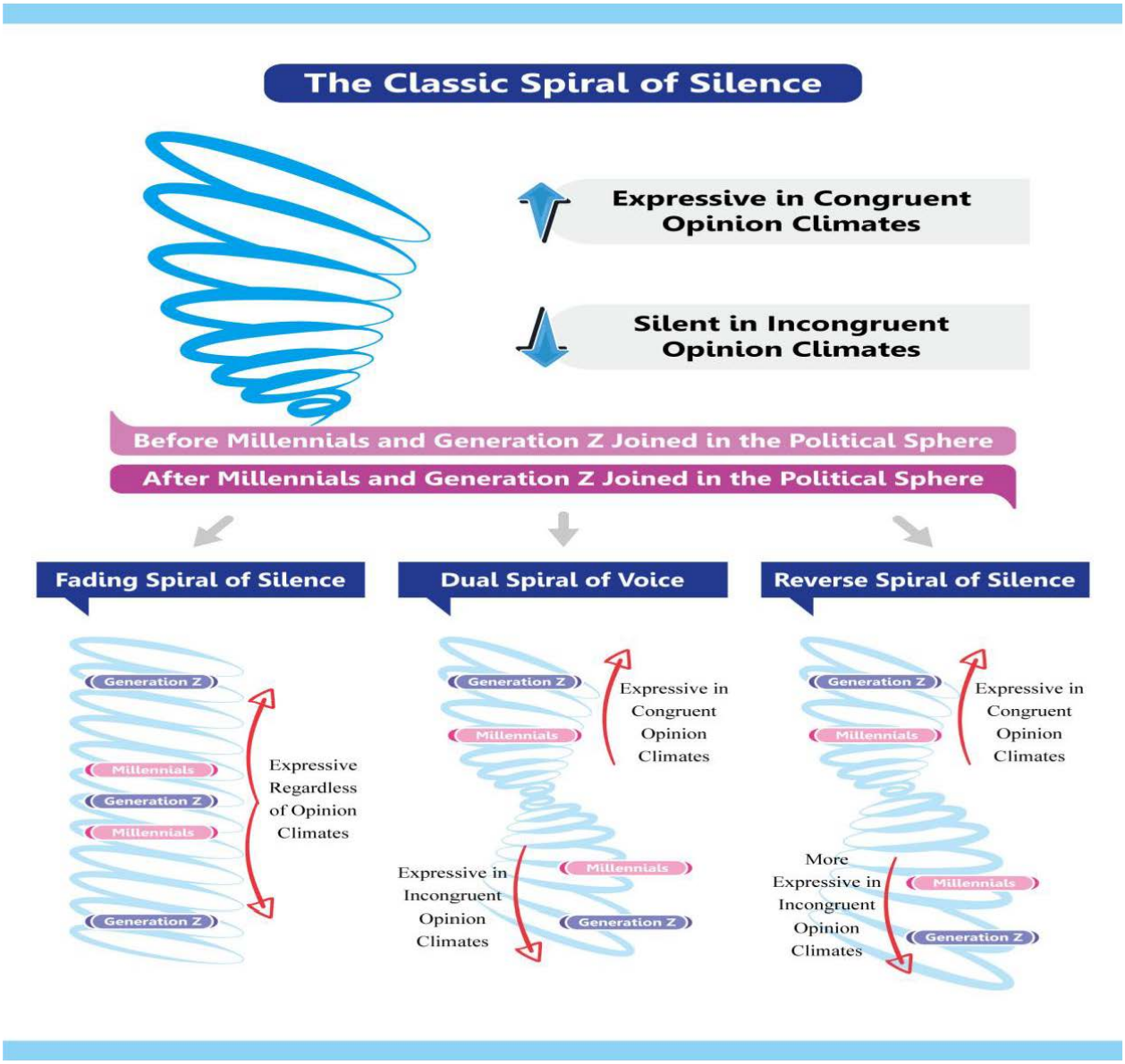
2.2 Young Generation Z voters are more likely to form a more distinctive dual spiral of voice than young Millennial voters across congruent and incongruent opinion climates.

H3: ***Reverse Spiral of Silence***:

3.1 Young voters are getting more expressive with their political voices against, and resistant to, incongruent public views.

3.2 Young Generation Z voters are more willing to express their political voices in a hostile opinion climate than young Millennial voters.

Figure 1 *The Divergent Models of the Spiral of Silence*



METHODS

Research Design

This longitudinal quasi-experimental research was designed by initiating experiments with young voters during the 2004 presidential election and repeating the same experiments with young voters during 2016 presidential election in order to observe the changes in young voters' political expression across the two generations, early Millennials and early Generation Zs. In both the 2004 and 2016 experiments, the participants (n = 81 in 2004; n = 114 in 2016) were

undergraduate college students at large Southern state universities. Participants who were outside the age ranges of Millennials in 2004 and Generation Z in 2016 were excluded from the study. The young voter participants in each generation in 2004 and 2016 were randomly assigned to one of two conditions and exposed to either pro-voting or anti-voting messages. Each set of stimuli, one with pro-voting messages and the other with anti-voting messages, was presented as representing majority opinion by telling participants that a public opinion poll conducted by Gallup found that a majority of voters shared the opinions presented in those messages. Each set of stimuli included three kinds of crafted messages: an article published by a university newspaper, an article published by *The New York Times*, and two opinion pieces/posts written by young voters (peers) via the internet. In the 2004 experiments with Millennial young voters, a pair of newspaper articles came from *The Concordian*, the official student newspaper of Concordia College in Moorhead, Minnesota. On October 1, 2004, this campus newspaper ran editorials expressing pro- and con-voting opinions in connection to the 2004 presidential election. One pro-voting and one anti-voting editorial were selected for this study. Participants in the pro-voting condition were exposed to the pro-voting editorial, and participants in the anti-voting condition were given the corresponding editorial. Another pair of similar pro- and con-voting messages was collected from less known media sources, such as blogs and local newspapers, but manipulated to look like they had been published on *The New York Times* Web site for source credibility in order to reduce bias and enhance the message impact on readers. This decision was made based on Pew surveys (2003) that identified the Internet as a favorite source of news for young people and *The New York Times* Web site as one of the most popular online news destinations. The last pair of stimuli were peer group opinions posted by young voters in the *You Tell Us* section of the *MTV Choose or Lose* website − by "Stacy, 23 years old" and "James, 25 years old," − and each made strong arguments for and against voting. Peer group messages were used in order to intensify the signal of surrounding public opinion based on evidence from research shown that young voters are susceptible to influence from family, friends and peers (Niemi & Hanmer, 2004). For a parallel comparison in the 2016 experiments with Generation Z young voters, the similar messages consisting of the same elements from the 2004 experiments were crafted and presented as dominant public views by Gallup polls for both pro-voting and anti-voting stimuli in the experiments. Likewise, these messages were labeled as articles by a university newspaper and the *New York Times* and as posts by young voters via *Rock the Vote Twitter* for the same reason of source credibility (Flanagin, 2014).

Participants were exposed to the assigned message stimuli after they were asked their political predispositions, such as political cynicism, interest, efficacy, and activities, and their personal attitudes toward voting, and before asking demographic characteristics and their willingness to express voting attitudes publicly. Participants were allowed to read the message stimuli at their own pace and then instructed to fill out the questionnaire. The experiments in 2004 were administered in a classroom setting in October before the general election, and the experiments in 2016 were also conducted in October before the general election, but via online survey utilizing Qualtrics, reflecting the trend and validity of experiment research. After excluding the participants who did not belong to the generational cohorts' age groups at the time of the experiments, the total valid sample sizes were 81 (n=40 in pro-voting message stimuli and n=41 in anti-voting message stimuli) for Millennial young voters from the 2004 experiments and 102 (n=59 in pro-voting message stimuli and n=43 in anti-voting message stimuli) for Generation Z young voters in the 2016 experiments.

The purpose of the experiment design was primarily meant to activate participants' attitudes about voting and politics in general and to create a public opinion climate for them to be aware of a majority opinion, by clearly indicating that each set of messages was the current majority public opinion about voting. Although the message exposures are unlikely to change people's attitudes and behaviors over a short period of time, the researchers expected the sets of messages to create a clear signal of opinion congruency or incongruence between public opinion climate and each participant's personal attitude and stimulate awareness of their willingness to express political views publicly. As scholars in the fields of memory, knowledge, and learning recommended (Tulving, 1985), the experiment design with three repeated stimuli of media sources was proven to be sufficient to signal public opinion pressure to participants. Ultimately, the study was designed to observe the deviating patterns of the *Spiral of Silence* in political expression over the last two decades, replicating the same experiments with young voters from two youngest generations, Millennials in 2004 and Generation Zs in 2016.

Measures & Variable Constructions

Media consumption. The media environments have changed over time and are given to and chosen by different generations. Millennials as young voters in 2004 had a different pattern of media consumption from Generation Z young voters in 2016. For instance, in 2004, social media were at the infant stage and started gradually to expand, but in 2016, they became the main channels for young voters' political information (Schill & Hendricks, 2017). Within a given media environment, media consumption patterns have been differently embedded into the two different generations of Millennials and Generation Z. Therefore, in this study, the media environments and consumption patterns were treated as part of generational components rather than being controlled for the analyses.

Political predispositions. A seven-item index of political cynicism with measures adopted from the American National Election Studies and from previous research done by Agger, Goldstein, and Pearl (1961) were created on a scale of 5 with an acceptable Cronbach's alpha value of .73 (see Appendix). A seven-item index of political efficacy adopted from previous researchers (Kaid, McKinney, & Tedesco, 2000) was measured on a scale of 5 with a moderate Cronbach's alpha value of .78 (see Appendix). One question item of political interest about how much the respondents were interested in the presidential campaign was sufficient to measure the level of political interest in the analyses of political attitudes about voting and adopted for this study (See Appendix). A seven-item index of political participation related to campaign activities from donation to persuasion adopted from previous researchers (Kaid et al., 2000) was created by counting the total number of campaign activities to measure the overall level of the respondents' political participation (See Appendix). These political predispositions are derived from both generational and individual traits, and thus were included as covariates and controlled in the analyses.

Self view. Self-attitudes about voting were accessed by asking the respondents how important voting is in the presidential election in each year on a scale of 5, from 1 'not important at all' to 5 'extremely important.' The respondents who chose between 1 and 3 were categorized as 'anti-voting' attitude holders and the respondents who answered 4 or 5 were categorized as 'pro-voting' opinion holders. The independent and interactive effects of the dichotomous variable of

self-voting attitudes with given majority opinion stimuli were included and evaluated in the analyses to determine the status and effect of opinion congruence and incongruence on political voices (see Appendix). Respondents whose voting attitudes aligned with the message stimuli were classified as majority opinion holders, while those with opposing attitudes were considered minority opinion holders. For instance, in the pro-voting message exposure group, participants with positive personal attitudes about voting were categorized as the majority opinion holders, and respondents who expressed negative attitudes toward voting as the minority opinion holders. In the anti-voting message exposure group, participants with negative personal attitudes about voting were categorized as the majority opinion holders, while respondents who expressed positive attitudes toward voting as the minority opinion holders.

Willingness to speak. Noelle-Neumann's original question of willingness to express opinions in public (1974) was adopted verbatim in this study. The current study asked participants' willingness to express their opinions about voting in online or in person publicly on a scale ranging from 1 (not willing) to 5 (very willing) and analyzed it as the dependent variable in the analyses (see Appendix).

Demographics. The demographic backgrounds of the Millennial young voters in 2004 and Generation Z young voters in 2016 in the study were consistent. The mean ages of the Millennial and Generation Z participants were 20.37 (SE=.20) and 19.64 (SE=.12) respectively. In both experiments, there were more female participants (64.2% in 2004 and 72% in 2016) than male participants (35.8% in 2004 and 28% in 2016). The party affiliations were also similarly divided among the participants in 2004 and 2016. There were 42% Democrats, 35.8% Republicans, and 22.2% Independents among the Millennial participants, and 31.2% Democrats, 36.6% Republicans, and 32.2% Independents among the Generation Z participants. These demographic backgrounds as young voters were similar among the participants of the two generations, and thus these demographics were considered as the common characteristics of the target population of this study, young voters, rather than being controlled for the analyses.

RESULTS

Political Predisposition and Media Consumption

Millennials and Generation Zs have different bags of mixtures with both 'given' and 'chosen' media consumptions and generational political characteristics. As the new media generation, Millennials started to use the internet (7.4%) as their main source of political information, but the traditional media, such as TV (61.7%) and newspapers (27.2%), were still dominant sources of political information for Millennial young voters in 2004. As the media landscape changed dramatically and rapidly, the majority of young Generation Z voters (59.6%) identified the internet and social media as their primary sources of political information, followed by other various sources such as news feed apps (19.3%) and TV (14.9%). The different patterns of political information consumption between Millennials and Generation Zs reflect the changes in media technology and the availability of social media (χ^2=107.879, p≤.001) (See Table 1). Accordingly, young Generation Z voters (40.4%) were more likely to use the internet for their political expressions and discussions than young Millennial voters (24.7%) (χ^2=5.186, p≤.023), while Millennials (17.3%) were more likely to express and share their views in public meetings

than Generation Zs (7.9%) (χ^2=4.013, p≤.045). Moreover, young Millennial voters were predominantly more likely to have political talk with people within their primary networks (93.8%), such as family, friends, and co-workers, compared to young Generation Z voters (81.6%) (χ^2=6.148, p≤.013). However, both generations were unlikely to express themselves politically via traditional media, such as TV, radio, and print (See Table 2).

Under the differently 'given' media environment and 'chosen' media consumption over time, young voters across the two generations showed both common and different political predispositions. Consistent with the youth in the previous generations (Kaid et al., 2007), both Millennial and Generation Z young voters (M=3.73, SE=.07 and M=3.69, SE=.05 respectively) showed somewhat cynical political attitudes (See Table 3 and Appendix). However, Millennials had much higher political interest (M=4.21, SE=.10) and political efficacy (M=3.49, SE=.08), and engaged in more political activities (M=2.78, SE=.18) than the young voters of the following Generation Z (M=3.15, SE=.11, t=7.162, p≤.001; M=3.10, SE=.06, t=3.826, p≤.001; and M=1.33, SE=.13, t=6.711, p≤.001 respectively) (See Table 3 and Appendix).

Political Voice of Un-Silent Generations

Fading Spiral of Silence. Unlike the argument in the original theory of the *Spiral of Silence* that people who share the views of the majority public are more likely to voice their opinions, while individuals with differing beliefs tend to remain silent, there was a fading *Spiral of Silence* effect among young Millennial and Generation Z voters. The results showed that the young voters of both generations tended to be less vulnerable to public opinion climates and still voiced their political views regardless of public opinion pressure, and that the Generation Z young voters were more likely to be politically expressive than the Millennial young voters in any opinion climate. As posited in Hypothesis 1, there were fading *Spiral of Silence* effects among young voters' political voices as newer generations join in the political sphere for the last two decades. The Generation Z young voters (M=3.29, SE=.10) were more willing to express their political views than were the Millennial young voters (M=3.09, SE=.15) regardless of opinion climates (F=10.259, p≤.002, See Tables 4 & 5).

Dual Spiral of Voice. These newly arising youth voices have gradually invaded even the silent sphere of political discordance. Unlike the general public's stronger tendency of expressing opinions in supportive public environments rather than in hostile opinion moods, young voters were not afraid of raising their voice against the majority public opinion. As a result, there were dual *Spiral of Voice* effects among young voters of the two newest generations, and they were more willing to express their political voices both in congruent and incongruent opinion climates. As expected in Hypothesis 2, both Millennial and Generation Z young voters tended to voice their opinions regardless of the surrounding public views, and they did not shy away in the incongruent opinion climate, creating another spiral of un-silent minority voice. Moreover, young Generation Zs were more likely to speak up towards both ends of the opinions (M=3.05, SE=.15 for anti-voting attitude and M=3.36, SE=.12 for pro-voting attitude), thus creating stronger dual spirals of counter views than young Millennials (M=2.25, SE=.41 for anti-voting attitude and M=3.18, SE=.16 for pro-voting attitude) (F=4.431, p≤.037, See Tables 4 & 5).

Reverse Spiral of Silence. As expected in Hypothesis 3, the ANCOVA results showed the increasing reverse *Spiral of Silence* effect in young Millennial and Generation Z voters' political expressions and detected even more deviating reverse *Spiral of Silence* effects between the two newest generations who were equipped with different 'given' and 'chosen' media and political characteristics. Young Millennial voters in 2004 were more likely to be expressive in the congruent public climate (M=3.30, SE=.23 for pro-voting attitude holders in pro-voting message exposures and M=2.60, SE=.51 for anti-voting attitude holders in anti-voting message exposures) than in the incongruent opinion climate (M=3.06, SE=.21 for pro-voting attitude holders in anti-voting message exposures and M=1.67, SE=.67 for anti-voting attitude holders in pro-voting message exposures). Regardless of public opinion pressure, however, young Millennial voters were more willing to express their pro-voting attitudes (M=3.30, SE=.23 in pro-voting message exposures and M=3.06, SE=.21 in anti-voting message exposures) rather than anti-voting attitudes (M=1.67, SE=.67 in pro-voting message exposures and M=2.60, SE=.51 in anti-voting message exposures) in both congruent and incongruent public opinion climates. The higher willingness of young Millennial voters to express their pro-voting attitudes in the discordant opinion environment clearly showed the reverse *Spiral of Silence* effect. Furthermore, young Generation Z voters were more resistant to external opinion climates and willing to express their attitudes against the apparent public opinions in the incongruent opinion climate than in the congruent opinion climate. Among young Generation Zs, anti-voting opinion holders in pro-voting message exposures (M=3.30, SE=.19) and pro-voting attitude holders in anti-voting message exposures (M=3.61, SE=.17) were more willing to express their opposing views against the majority public opinion than pro-voting opinion holders in pro-voting message exposures (M=3.18, SE=.17) and anti-voting attitude holders in anti-voting message exposures (M=2.82, SE=.22). This tendency of reverse *Spiral of Silence* was more consistent and stronger among young Generation Zs than in young Millennials ($F=4.431$, $p\leq.037$). In other words, the Generation Z young voters were more willing to express their political views in the discordant opinion environment where their views were opposed rather than in the supportive opinion climate, and this reverse *Spiral of Silence* effect appeared more consistently in Generation Z young voters than in Millennial young voters, confirming increasing the reverse *Spiral of Silence* effect (See Tables 4 & 5).

DISCUSSION

The goal of this study was to explore how the *Spiral of Silence* applies to the willingness of young Millennial voters in 2004 and young Generation Z voters in 2016 to voice political opinions. Millennials and Generation Z are not only the youngest generations of voting age in the U.S., but also the largest and most racially diverse current living generations (U.S. Census, 2022). The media environment, which is one of the critical factors in the *Spiral of Silence* theory, with media acting as the public's source of assessing the opinion climate, has also changed dramatically during the lifespan of these two generations.

Utilizing a quasi-experimental design, this study found that youth Millennials and Generation Zs under the awareness of public opinion are willing to express their political voices in both agreement and discordance. In 2004, about 52.4% of the majority opinion voters claimed they were willing to voice their opinions, but also 59% of the minority opinion holders. In 2016, 43.2% of the majority opinion holders as well as 57% of the minority opinion holders said they

were willing to speak publicly. These percentages as well as the other statistics presented in the results section show that both Millennial and Generation Z young voters are less likely to comply with the propositions of the classic *Spiral of Silence* theory. Instead, the patterns of the dual *Spiral of Silence* (with people willing to express their opinions in both congruent and opposite environments) and the reverse *Spiral of Silence* (with people more willing to express an opinion in incongruent environments rather than similar ones) apply better. These findings also contradict the prevalent assumptions by previous research into young voters that this category of the electorate is politically cynical, uninformed, and emotionally vulnerable, and shy away from the public sphere.

Young Millennials and Generation Zs' willingness to speak out regardless of their similarity to the perceived dominant public opinion environment can be explained by changes in these generations' political views and attitudes. Both generational cohorts expressed strong opinions which might be mediating the fear of isolation and other deterrents to public speaking. Prior research into the *Spiral of Silence* theory discovered that so-called "hard-core individuals" (individuals with strong personal opinions) are less likely to be influenced by the majority opinion climate, and in fact such individuals might completely escape public pressure to remain silent (Matthes, Morrison, & Schemer, 2010). For example, a three-survey study found that the public opinion has no silencing effect on individuals with high attitude certainty (Matthes et al., 2010).

Along with, Millennial young voters as the internet generation and Generation Z young voters as the social media generation share many similarities in the political arena, especially when compared to previous generations (Parker et al., 2019). However, there are also important differences and changes in political information consumption habits and political attitudes and behaviors between the two youngest American voting generations. Through our findings, we propose that the young voters from later generations are less vulnerable to public views and others' disapprovals, and thus show more divergent and opinionated political views. Moreover, they are more outspoken when their views are opposed in an opposing opinion climate than in a congruent climate. This could be due, in part, to the diversified media environment Generation Zs grew up with. It is also possible that these voters who grew up online and on social media platforms feel empowered to express their opinions in real life just as they would do so online under the perceived safety of an online profile, as other studies have documented (Malaspina, 2014; Mutz, 1998). We suggest that future studies need to further investigate what factors could be decreasing Generation Z voters' fear of speaking out in diverging public opinion climates.

Limited to the purpose and parameter of the study, the current study did not explore why people might choose to remain silent or outspoken across congruent and discordant opinion climates. The *Spiral of Silence* theory lists the factors impeding someone's willingness to speak in public, including fear of isolation, group affiliation, individual emotional and cognitive factors, and several other variables (Noelle-Neumann, 1974, 1979). A future study needs to assess the potential factors that both hinder and foster people's willingness or unwillingness to express political opinions. In addition, a part of pro-voting attributes in the study might attribute to the issue we chose for this experiment. Since the 2000 election was decided by a mere 537 vote-difference, voting has been touted as one of the most patriotic civic duties of American citizens. People might shy away from expressing voting apathy opinions in public due to fear of public

shaming (Kropf, 2016). Other research also found that perceived issue importance is another factor that strengthens someone's willingness to speak out regardless of the public opinion environment (Moy et al., 2001). Given that our study questions participants on their willingness to speak about voting, an issue engrained in every U.S. citizen as the foundation of American democracy, it is possible that our findings were mediated by this issue effect. We encourage future experiment studies to measure the effect of the *Spiral of Silence* on various political and social issues for a better reliability.

Despite the limitations of the study, the experimental methodology- in which subjects were made aware of the majority opinion climate through manipulated media content, and the questionnaire were specifically developed to measure attitudes toward voting, replicating Noelle-Neumann's original study (1974) - well justifies the reliable replication of the classic *Spiral of Silence* theory a half-century later and contributes to the field of public opinion research in the new media era in new American society. Various fine research designs and multiple replications of the *Spiral of Silence* theory need to be continuously explored to understand the evolving communication of new political actors and voices, given that young voters are still the most fluctuating and permeable age groups who can reshape the political climate of our time.

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APPENDIX

1. *Cynicism Index* (Each measured on a 5-point scale, 1 Strongly Disagree – 5 Strongly Agree)
   - One never knows what politicians think.
   - One can be confident that politicians always do the right thing. (reverse coding)
   - Politicians quickly forget their election promises after a political campaign is over.
   - Politicians are more interested in power than in what people think
   - One can always trust what politicians say. (reverse coding)
   - The government is run for the benefit of all. (reverse coding)
   - People are frequently manipulated by politicians.

   * Cronbach's alpha = .73

2. *Political Efficacy Index* (Each measured on a 5-point scale, 1 Strongly Disagree – 5 Strongly Agree)
   - People can influence what the government does.
   - I don't think people in the government care much about what people like my family think. (reverse coding)
   - Citizens don't have a chance to say what they think about running the government. (reverse coding)
   - What happens in the government will happen no matter what people do. (reverse coding)
   - Whether I vote or not has no influence on what politicians think. (reverse coding)
   - People like me don't have any say about what the government does. (reverse coding)
   - Sometimes politics and government seem so complicated that a person like me can't really understand what's going on. (reverse coding)

   * Cronbach's alpha = .78

3. *Political Interest* (Measured on a 5-point scale, 1 Not Interested At All – 5 Very Interested)
   - How interested would you say you are in the presidential campaign?

4. *Political Participation* (Sum of the total political activities on a 7-point scale, 0 No – 1 Yes)
   - I visited my candidate's web site.
   - I wore a button or put a sticker on my car.
   - I gave money to help a candidate.
   - I worked for my candidate campaign.
   - I attended a political meeting/rally.
   - I defended my candidate in front of people who criticized him.
   - I tried to influence others to vote for my candidate.

5. *Self-Attitude about Voting* (Measured on a 5-point scale, 1 Not Important At All – 5 Extremely Important)
   - How important is voting in the 2004 (or 2016) presidential election?
     * Anti-voting opinion holders (1-3) vs. Pro-voting opinion holders (4-5)

6. *Spiral of Silence Question* (Measured on a 5-point scale, 1 Not Willing – 5 Very Willing)

- How willing are you to engage in public (online or in-person) discussions to express your thoughts on voting?

Table 1. Priority Sources of Political Information

	Political Information Sources				
Generation	**TV**	**Radio**	**Newspaper**	**Internet & Social media**	**Others**
Millennials	61.7%	3.7%	27.2%	7.4%	0.0%
Generation Zs	14.9%	5.3%	0.9%	59.6%	19.3%

χ^2=107.879, p≤.001

Table 2. Channels for Political Expression

	Political Expression Channels			
Generation	**Family/Friends/Co-workers**	**TV/Radio/Print**	**Internet**	**Public Meeting**
Millennials	93.8%	2.5%	24.7%	17.3%
Generation Zs	81.6%	0.9%	40.4%	7.9%
	χ^2=6.148, p≤.013	χ^2=0.571, p≤.374	χ^2=5.186, p≤.023	χ^2=4.013, p≤.045

Table 3. Political Predispositions

	Political Predispositions			
Generation	**Political Efficacy Mean (Std. Error)**	**Political Cynicism Mean (Std. Error)**	**Political Interest Mean (Std. Error)**	**Political Participation Mean (Std. Error)**
Millennials	3.49 (.08)	3.73 (.07)	4.21 (.10)	2.78 (.18)
Generation Zs	3.10 (.06)	3.69 (.05)	3.15 (.11)	1.33 (.13)
	t=3.826, p≤.001	t=0.489, p≤.626	t=7.162, p≤.001	t=6.711, p≤.001
	min.=1, max.=5	min.=1, max.=5	min.=1, max.=5	min.=1, max.=7

Table 4. ANCOVA Test on Willingness for Political Expression

Indicators	**F**	**p**
Intercept	11.004	0.001
Political Participation	10.086	0.002
Political Interest	2.029	0.156
Political Efficacy	1.112	0.293
Political Cynicism	0.563	0.454
Generation (Millennials vs. Generation Zs)	10.259	0.002
Self Pro- vs. Anti-Voting Attitude	3.159	0.077
Exposure to Pro- vs. Anti-Voting Public Opinion	0.135	0.714
Generation * Self View	1.484	0.225
Generation * Exposure	0.585	0.446

Self View * Exposure	0.043	0.837
Generation * Self View * Exposure	4.431	0.037
Error	208.578	
Total	2084.750	

R Squared=.178 (Adjusted R Squared=.124)

Table 5. Means of Willingness for Political Expression

Generation	Self View	Public Opinion Exposure	Mean (Std. Error)
Millennials	Anti-Voting Attitudes	Pro-Voting Messages	1.67 (.67)
		Anti-Voting Messages	2.60 (.51)
		Total	2.25 (.41)
	Pro-Voting Attitudes	Pro-Voting Messages	3.30 (.23)
		Anti-Voting Messages	3.06 (.21)
		Total	3.18 (.16)
	Total	Pro-Voting Messages	3.18 (.23)
		Anti-Voting Messages	3.00 (.20)
		Total	3.09 (.15)
Generation Zs	Anti-Voting Attitudes	Pro-Voting Messages	3.30 (.19)
		Anti-Voting Messages	2.82 (.22)
		Total	3.05 (.15)
	Pro-Voting Attitudes	Pro-Voting Messages	3.18 (.17)
		Anti-Voting Messages	3.61 (.17)
		Total	3.36 (.12)
	Total	Pro-Voting Messages	3.21 (.14)
		Anti-Voting Messages	3.40 (.14)
		Total	3.29 (.10)
Total	Anti-Voting Attitudes	Pro-Voting Messages	2.92 (.25)
		Anti-Voting Messages	2.75 (.21)
		Total	2.83 (.16)
	Pro-Voting Attitudes	Pro-Voting Messages	3.23 (.14)
		Anti-Voting Messages	3.31 (.14)
		Total	3.27 (.10)
	Total	Pro-Voting Messages	3.19 (.12)
		Anti-Voting Messages	3.20 (.12)
		Total	3.20 (.09)

min.=1, max.=5

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DEVELOPING ECG AUTHENTICATION MODELS TO PROTECT PRIVATE DATA BASED ON SUBJECTIVE NORM, EXPERIENCE & PERCEIVED RISK AS ENDOGENOUS VARIABLES

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ABSTRACT

What if your personally identifiable information is compromised? How will you react and what measures will you take to prevent this from happening again? Data breaches have become ubiquitous: from large retailers to government agencies and private citizens - all are targeted with persistent attacks: phishing, malware, zero-day threats, credit card and financial data theft, and healthcare records theft. As we look for means to mitigate these attempts, many of us have used various biometric measures from fingerprints, palm prints, retinal scans, to voice authorization, multi-factor authentication and wearable verification or identification devices. This research continues the exploration of previous work (Lahoud, 2020) by focusing on the acceptance determinants for users of wearable ECG-based authentication devices, and by studying the influence of critical endogenous factors such as Subjective Norm, Experience and Perceived Risk on privacy, adoption and purchase decisions.

Keywords: Wearables, ECG-authentication, Structural Equation Modelling, Partial Least Squares Technology Acceptance Model,

INTRODUCTION & FOUNDATIONAL ELEMENTS

The use of ECG biometrics is largely dependent on various factors related to consumer adoptions and technology implementations. Cost factors, ease of use and reliability are essential components for decision makers. Technology in the workplace is often considered integral to daily processes - it is viewed as an enabler of significant efficiencies, improved productivity and enhanced marketplace competitiveness. However, not all organizations can quickly implement biometric security tools since there is a tendency to adopt technology platforms without a thorough assessment of long-term profitability or scalability (Abrahamson, 1991). This often results in a "bolt-on" adoption of technologies that cannot meet future demand as organizations grow and expand their workforce. Another obstacle organizations face when adopting a new technology platform is underutilization (Davis, et al. 1989; Davis, et al. 1992). During technology adoption life cycles, early adopters set out with a vision to implement a new architecture through the belief that the entire workforce will also adopt this new platform and integrate it into daily activities. However, difficulties arise in the face of adoption due to many factors such as lack of integration, the downtime required to deploy the new architecture, the sizable investment needed to scale the integration and on-going maintenance and support of the new architecture.

Impact of New Technology on Human Behavior

New technology innovations and their adoption are at the core of the relationship that defines how humans adapt and integrate technological advancements into their daily lives. In order to predict the successful adoption of new technologies, social researchers have relied on several well-tested frameworks such as the Technology Acceptance Model (TAM) and its predecessors, the Theory of Information Integration, the Theory of Reasoned Action and the Theory of Planned Behavior.

Information Integration Theory

Information Integration Theory describes the process through which a person integrates information from a number of inputs in order to arrive at a final decision (Anderson, 1974; Fishbein, 1967). The theory also explores how attitudes are formed when integration takes place in conjunction with existing cognitions. The Information Integration Theory states that our attitudes are directly affected by new information we received from persuasive sources or sources of trustworthiness. Within the context of the Technology Acceptance Model (TAM), the integration factor stands as the most important in the Information Integration Theory, which ultimately influences behavioral response to use a new technology platform, in this case ECG Wearable Authentication. This correlates with the Behavioral Intent construct in technology acceptance in the workplace, where employees perceive that information and instructions delivered by their employer, as a source of authority, is trustworthy and beneficial. Hence, their corresponding attitude is positively affected since the employer has taken measures to ensure proper access to information and related resources.

Theory of Reasoned Action

The Theory of Reasoned Action was developed as an improvement over the Information Integration Theory with two pivotal differences. First, the Theory of Reasoned Action focuses on behavioral intentions while underscoring that certain factors can limit the impact of attitude on behavior. Therefore, the Theory of Reasoned Action predicts behavioral intentions, and ultimately predicts behavior. Second, the Theory of Reasoned Action uses attitudes and subjective norms to predict behavioral intentions. Subjective Norm plays a critical part in defining the follow-through actions after attitudes have been defined. It is worth noting that a large number of studies were analyzed to test the predictive efficacy of this theory. In the analyses, a significant correlation was found between the attitudes toward behavior with subjective norm and behavioral intent ($r=0.66$, $p<0.001$) (Sheppard, et. al 1988). Within the context of the Technology Acceptance Model, this correlates to the Attitude and Subjective Norm constructs, which are essential in determining behavioral intent as well as attitude to use ECG Wearable Authentication and associated devices.

The Theory of Planned Behavior

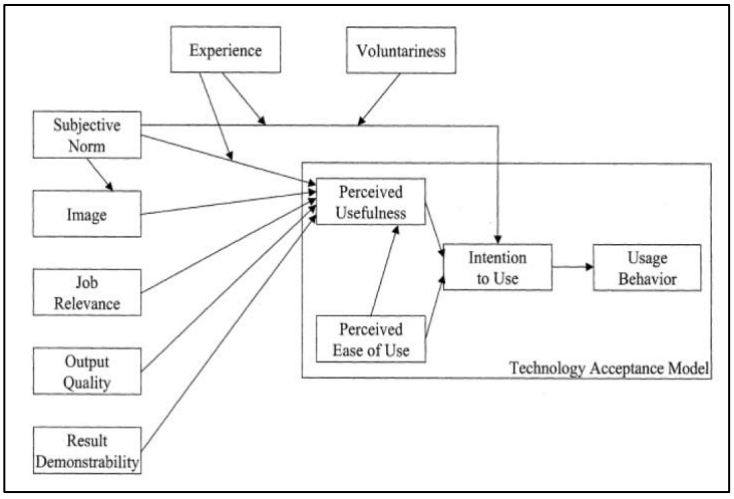
The Theory of Planned Behavior extends the Theory of Reasoned Action by stating that the attitude toward behavior, subjective norm, and perceived behavioral control (beliefs about one's ability to perform a behavior), can predict the individual's behavioral intentions and behaviors. The addition of the perceived behavioral control was the result of the discovery that behavior appeared not to be voluntary or under control. The Theory of Planned Behavior is comprised of three constructs

of beliefs: normative, behavioral, and attitude (Madden, et. al 1994). The Perceived Behavioral Control has a direct effect on Behavioral Intentions while having an indirect effect on Behavior. This indirect effect can be explained by the assumption that Perceived Behavioral Control positively attenuates the Behavioral Intention as it is linked to the availability of resources that can improve or impede performance of the behavior. The Subjective Norm remains part of normative beliefs - beliefs linked to the normative expectations of peers or society. Within the context of the Technology Acceptance Model, the actual behavioral control is important in determining the Behavioral Intent as well as Attitude to use ECG Wearable Authentication. In the workplace, employees perceive their behavior to be under control to the degree by which they feel that their employer has facilitated access to resources in order to perform their assigned duties.

The Technology Acceptance Model

The Technology Acceptance Model (TAM) was developed to predict acceptance of new technology in the workplace (Davis, 1989; Venkatesh, et al. 2000). TAM has been adapted from Theory of Reasoned Action (beliefs determine behavioral intent), while relying on the Theory of Planned Behavior (social influence as a predictor of behavior change). However, a key difference is that TAM encompasses other factors related to technology usage in the workplace such as the users experience, perceived risk and cost elements. Therefore, the beliefs of a person towards a system are also affected by external variables (Davis, et al. 1989, Lai, 2017). As TAM was extended into numerous research fields, TAM2 was developed to enhance the original proposals of TAM. Figure 1 shows TAM2 (Venkatesh, et al. 2000). TAM2 theorized that users' assessment of a system's usefulness at work is dependent on the work objectives vis-à-vis the consequences of performing job tasks using that system. The results of longitudinal studies demonstrated that TAM2 performed well in both voluntary and mandatory work environments. TAM2 evolved into TAM3 and then into the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, et al. 2003). Along with the perceived usefulness, perceived ease of uses, behavioral intention and system use, UTAUT added four predictors of users' behavioral intentions: performance expectancy, effort expectancy, social influence and facilitating conditions.

Figure 1 *Technology Acceptance Model (TAM2) (Venkatesh, at al. 2000)*



ECG & Its Authentication Role

The human heart pumps blood continuously through the circulatory system. The expansion and contraction of the heart, called the heartbeat, occurs approximately 100,000 times and pumps about 2,000 gallons of blood (NIH, 2018). The contracted chambers within the heart are called systolic, whereas the relaxed chambers are called diastolic. The heartbeat represents an electrical impulse that traverses the heart muscle as expansion and contraction takes place, or depolarization and repolarization. An electrocardiogram or ECG results from this electrical phenomenon. An individual's electrocardiogram can be obtained at a healthcare facility where the electrical activity is detected through electrodes, or leads that are applied to the patient's skin. The heart rate can increase or decrease based on activity, exertion levels or due to other requirements from the body. The contracted chambers within the heart are called systolic, whereas the relaxed chambers are called diastolic. Heart rhythms are usually categorized as: Sinus (60-120 bpm, normal activity), Tachycardia (>120 bpm, such as during physical exercise or athletic events) and Bradycardia (<60 bpm, such as during sleep or resting) (Choudhury, et al. 2015).

ECG Waveforms

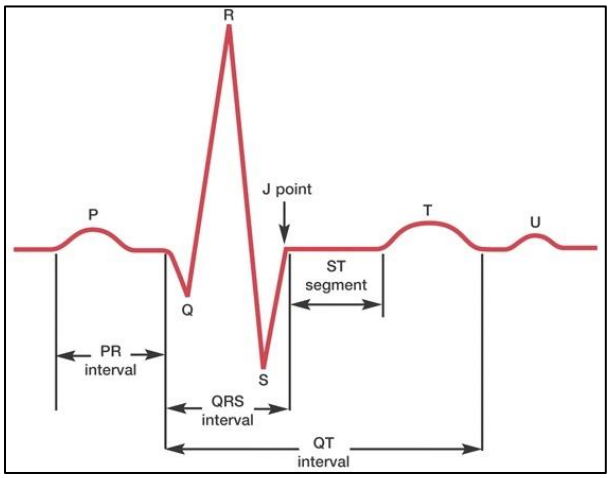
During a clinical ECG test, the heartbeat produces several waveforms as described in Table 1 (Noble, et al. 1990; ECG Learning Center, 2017).

Table 1 *ECG deflections or waveforms*

Waves & Intervals	Special Characteristics
P-Wave	Upward deflection indicating atrial depolarization (starting with right atrial depolarization and terminating with left atrial depolarization) P duration < 0.12 sec, P amplitude < 2.5 mm
Q-Wave	Downward deflection following upward deflection of P-Wave. Q-Wave is associated with septal depolarization
R-Wave	First upward deflection after the P-Wave. R-Wave is associated with early ventricular depolarization.
PR-Interval	This is the interval from where the P-Wave begins and until the start of the QRS-Complex. PR-Interval indicates atrioventricular conduction, 0.12 - 0.22 sec in duration.
QRS-Complex	This is interval from the end of the PR-Interval and to the end of the S-Wave. QRS Complex indicates ventricular depolarization, 0.06 - 0.12 sec in duration.
QT Interval	This is the interval from the beginning of the QRS-Complex to the end of the T-Wave. The QT-Interval indicates both depolarization and repolarization, QT ≤ 0.38 @ 80 bpm QT ≤ 0.42 @ 60 bpm.
S-Wave	First downward deflection after the R-Wave. S-Wave is associated with ate ventricular depolarization.
T-Wave	First upward wave, slightly rounded, following the S-Wave. R-Wave indicates atrial repolarization of the ventricles.
ST-Interval	This interval starts at the end of the QRS-Complex and ends with the beginning of the T-Wave.
U-Wave	Upward wave after the T-Wave; seen occasionally.

The P-Wave is generated first, followed by the QRS-Complex, then the T-Wave is recorded as the ventricles return to a resting state, shown in Figure 2 (Hammad, et al. 2018; ECG Interpretation, 2018).

Figure 1 *The basic pattern of electrical activity across the heart (Ashley & Niebauer, 2004)*



ECG Authentication via the QRS Complex

Temporal, amplitude and morphological features are the hallmarks of fiducial-based procedures. ECG waves, such as P, QRS and T reflect unique temporal patterns of the heart's electrical activity. Additional fiducials are represented within inter-wave time intervals for PQ, RS, RR and ST. Frequent research in the field of ECG biometric relies on several publicly accessible databases, including MIT's Normal Sinus Rhythm Database, the Arrhythmia Database and the Supraventricular Arrhythmia Database. Other databases include the QT Database, the European ST-T Database and the Paroxysmal Atrial Fibrillation Database (Fratini, et al. 2015). MIT's Normal Sinus Rhythm Database (Goldberger, et al. 2000) is publicly accessible; this database stores 18 long-term ECG recordings of patients (5 men, ages 26-45 and 13 women, ages 20-50) who did not exhibit any significant arrhythmias. Therefore, the subjects do not present any bias that could help in the identification stage that follows the verification stage. During a comprehensive review of available literature (Fratini, et al. 2015), more than 100 studies related to ECG biometrics were examined. These studies appeared in a variety of journals, conference proceedings and related publications. Some of these studies utilized the publicly available database such as Physionet, whereas other studies used private databases. Irrespective of the population and study methodology, the accuracy of ECG biometric authentication pointed towards a very promising outlook: an identification rate of 94.95% and an equal error rate of 0.92%. The significance of the EER refers to the point at which authentic and fraudulent error rates are closest to zero. EER compares the false acceptance rates and the corresponding false rejection rate. The lower the equal error rate value, the higher the accuracy of the biometric system. The Identification Rate (IR) refers to the ratio of identification of transactions containing the correct identifier (e.g. ECG wavelength) as compared to the total number of identification transactions.

PLS-SEM & STUDY HYPOTHESES

One of the main objectives of social science research is to forecast and explicate human behavior in individual or group settings (Tarka, 2017). Such research can identify trends and potential outcomes that impact consumer behavior, product development, customer service, healthcare conclusions and a multitude of societal, political and socio-economic developments. As researchers delve deeper in trying to understand factors influencing human behavior, they rely on qualitative and quantitative statistical measurements in which the focus is on understanding the cause-effect relationships for such behaviors. Due to the complexity of social interactions, where observable and non-observable (latent) variables of human behavioral occurrences exist, causal analytics based on Structural Equation Modeling (SEM) are frequently used (Joreskog & Sorbom, 1993). The corresponding model is rendered in SmartPLS3 and uses the extended Technology Acceptance Model constructs, which are: PU-Perceived Usefulness, PEOU-Perceived Ease of Use, ATT-Attitude, BI-Behavioral Intent, SN-Subjective Norm, EXP-Experience and PR-Perceived Risk. A survey instrument developed in Qualtrics also accompanied this research, which relied on Likert-Scale questions that allow the researcher to collect varying degrees of opinion, and subsequently analyze quantitative data. The associated indicators, which correspond to the questions in the survey instrument, are explained in Table 2:

Table 2 *Model Constructs and Indicators*

SN	
Q15-SN1	Because my colleagues at work use ECG wearable authentication, I would also use it.
Q16-SN1	Because my colleagues at work consider ECG wearable authentication easy to use, I would also use it.
EXP	
Q17-EXP1	Workers who use ECG wearable authentication on a daily basis will find it easier to use and adopt this technology than those who have not had a similar experience.
Q18-EXP2	Increased usage of ECG wearable authentication at the workplace will have a positive effect on increased intention to use such technology.
PR	
Q19-PR1	The more I use ECG wearable authentication at work, the more confident I am of reducing the risk of data breaches, hacking or phishing.
Q20-PR2	Because ECG wearable authentication offers more robust data protection at work, I intend to use it.

Partial Least Squares integration within Structural Equation Modeling

Partial Least Squares uses the analysis of variance at its core while attempting to provide a predictive framework for the researcher (Urbach and Ahlemann, 2010; Bacon, 1999). The PLS algorithm traces its origins to Wold's early work on principal component analysis during the mid-1960's (Dijkstra, 2010). PLS integrates within the SEM methodology when:

- Predictive accuracy is paramount to the researcher and to the practical application of the model

- No assumptions have been made about data distribution and the distribution is skewed featuring a small population sample
- Several models exist; PLS is able to handle both reflective and formative models, as well as hybrid models

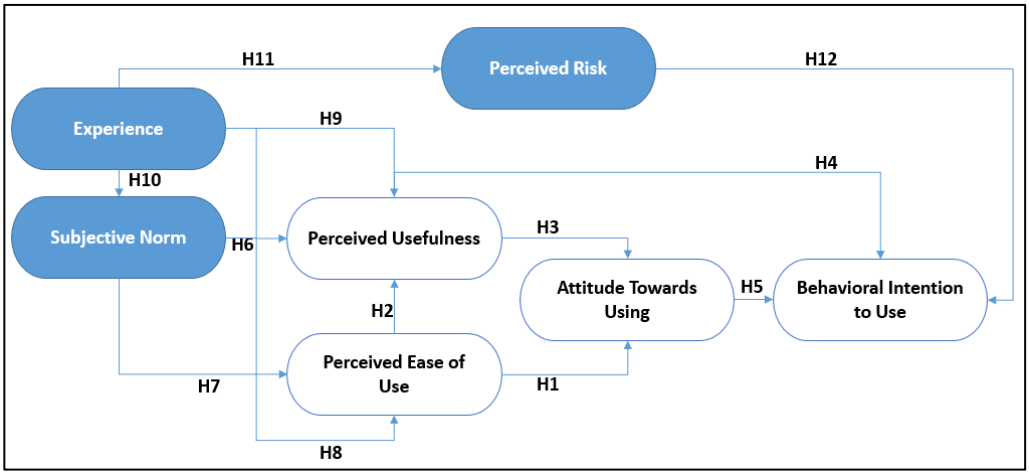
- Hypotheses improvement is required; PLS is better suited for theory development rather than theory testing

Researchers frequently face difficulties in assessing their models when moderating or mediating effects are discovered within the relationships found between dependent and independent variables (Baron & Kenny, 1986). SEM allows for multi-layered (multiple order) modeling of relationships amongst multiple independent and dependent constructs (Gefen, et al. 2000), formerly referred to as exogenous (variables not explained by the model) and endogenous (variables explained by the model's relationships) (Diamantopoulos, 1994). SEM allows researchers to model measurement errors for the model's observed variables, where statistical power analysis can be performed - *a priori*- prior to the research study to establish a sufficient sample size (Hoenig & Heisey, 2001). A priori probabilities are frequently seen in deductive methods of calculating such probabilities; for example, when flipping a fair coin, there is an equal chance of the coin landing on either side (a 50% probability of "heads"), regardless of what the previous toss revealed.

Building the Model & Measuring Acceptance

In this study, the reflective model will be used as shown in Figure 3. The reflective model exhibits all of the concepts defined in theory development - it is theoretical because it represents unobservable variables; it is empirical because indicators are used to measure unobservable variables, and it is derived because of the relationships that exist between the variables.

Figure 2 *The model and its hypotheses (Lahoud, 2020)*



The study hypotheses H6 - H12 are detailed in Table 3 (H1-H5 can be found in Lahoud, 2020).

Table 3 *Model Hypotheses*

H6	Subjective norm will have a positive direct effect on perceived usefulness when ECG Wearable Authentication use is perceived to be voluntary
H7	Subjective norm will have a positive direct effect on perceived ease of use when ECG Wearable Authentication use is perceived to be voluntary
H8	Compared to inexperienced users, experienced users will judge ECG wearable biometric technology as easier to use
H9	Compared to inexperienced users, experienced users will perceive ECG wearable biometric technology as more useful
H10	Increased experience will attenuate the negative direct effect of subjective norm for voluntary ECG Wearable Authentication use
H11	Increased experience will attenuate the negative direct effect of perceived risk for mandatory ECG Wearable Authentication use
H12	Perceived risk is negatively correlated with behavioral intention to use ECG Wearable Authentication use

Hypotheses H1-H6 (Lahoud, 2020) supported that adoption and acceptance of technology is often impacted by the user's own personal technology experiences, exposure to other technologies and frequent usage of such technologies. Since this study targets the workplace, it is reasonable to assume that all of the users have had similar prior experiences with other forms of authentication; and, that ECG wearable authentication is new to them. By reducing or even eliminating pre-existing biases, a more uniform interpretation for ease of use and perceived usefulness can be achieved. Accordingly, this study takes into account prior experiences with similar technologies (such as wearable fitness devices). Moreover, compared to inexperienced users, experienced users will judge ECG wearable devices as easier to use, more useful and will demonstrate greater intent to use ECG wearable authentication.

Subjective norm refers to the pressure exerted by peers or the society to adopt new trends, such as using a new technology. It can also refer to the pressure exerted to avoid adoption or refrain from using a technology (Finlay, et al. 2006). In the context of this study, subjective norm signifies the individual's perception about what important colleagues (such as supervisors) in the workplace believe that individual should do (also known as the normative belief) which is often impacted by the motivation to comply with this belief. Because voluntariness is essential in this study, it is not necessary to include motivation to comply as a condition to participation in the research (Ajzen & Fishbein, 1972). With the perceived risk component, user experiences will typically attenuate the negative direct effect of such risk in ECG wearable authentication usage. The extended model hypothesizes that perceived risk is negatively correlated to behavioral intention to use ECG wearable authentication. In general, when perceived risk is diminished, the attitude towards usage and intent to use elements are increased; after all, one of the primary goals of using ECG wearable authentication is to offer data protection; a reduced risk of data loss attributed to ECG wearable authentication will positively impact relationships in this model.

Model Outputs

With SmartPLS3, the algorithm utilizes an Iterative estimation of latent variable scores, which is repeated until convergence is achieved, or the maximum number of iterations has been exhausted. The settings are:

- Weighting Scheme: the Path Weighting Scheme is selected as it provides the highest R^2 value for endogenous latent variables. PLS-SEM algorithms use standardized data for indicators with a mean of 0 and a variance of +1

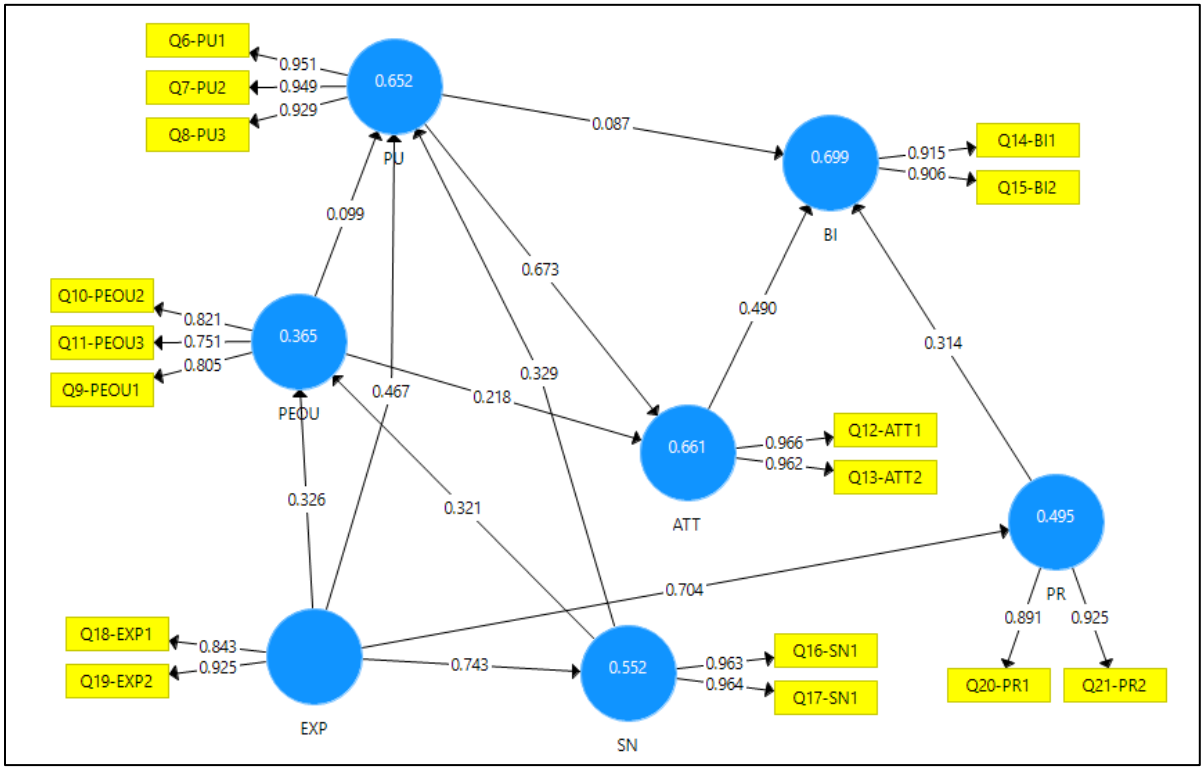
- Maximum Iterations: a maximum of 300 iterations is selected. To obtain a stable estimate, the algorithm should converge before reaching the maximum number of iterations.

- Stop Criterion: a selection of 1.0E-7 (0.0000001) is used to ensure the algorithm stops at this predefined benchmark. The selection made in the Maximum Iterations field also plays an important role in guaranteeing that convergence is attained after 300 iterations at the stop criterion of 1.0E-7

- Initial Weights: are set at a default of +1 for the indicators in the model

The model now reflects the calculations performed by SmartPLS3 shown in Figure 4. The numbers in the circles represent the coefficient of determination, R^2 for latent variables and how they are explained by the other latent variables; the numbers on the arrows represent the standardized path coefficients which explain how strong the effect of one variable is on another variable.

Figure 3 *The model after rendering in SmartPLS3*



Solution Convergence

Prior to discussing the algorithm's results, it is important to check for convergence of the solution, which helps ensure that the coefficients in the model are reliable. Convergence is not often a problem in PLS-SEM - in this study, convergence was reached after conducting six (6) iterations as shown in Table 4, well below the maximum number of iterations set at 300:

Table 4 *Convergence for the model was achieved after six iterations*

	Q10-PEOU2	Q11-PEOU3	Q12-ATT1	Q13-ATT2	Q14-BI1	Q15-BI2	Q16-SN1	Q17-SN1	Q18-EXP1	Q19-EXP2	Q20-PR1	Q21-PR2	Q6-PU1	Q7-PU2	Q8-PU3	Q9-PEOU1
Iteration 0	0.420	0.420	0.519	0.519	0.549	0.549	0.519	0.519	0.563	0.563	0.550	0.550	0.353	0.353	0.353	0.420
Iteration 1	0.467	0.373	0.533	0.504	0.562	0.536	0.512	0.526	0.463	0.659	0.498	0.601	0.356	0.365	0.338	0.417
Iteration 2	0.466	0.374	0.533	0.504	0.562	0.536	0.512	0.525	0.464	0.658	0.500	0.599	0.356	0.364	0.339	0.418
Iteration 3	0.466	0.374	0.533	0.504	0.562	0.536	0.512	0.525	0.464	0.658	0.500	0.599	0.356	0.364	0.339	0.418
Iteration 4	0.466	0.374	0.533	0.504	0.562	0.536	0.512	0.525	0.464	0.658	0.500	0.599	0.356	0.364	0.339	0.418
Iteration 5	0.466	0.374	0.533	0.504	0.562	0.536	0.512	0.525	0.464	0.658	0.500	0.599	0.356	0.364	0.339	0.418

Path Coefficients & Significance

Table 5 details the path coefficients for constructs in the model.

Table 5 *Path coefficients*

	ATT	BI	EXP	PEOU	PR	PU	SN
ATT	0.000	0.490	0.000	0.000	0.000	0.000	0.000
BI	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EXP	0.000	0.000	0.000	0.326	0.704	0.467	0.743
PEOU	0.218	0.000	0.000	0.000	0.000	0.099	0.000
PR	0.000	0.314	0.000	0.000	0.000	0.000	0.000
PU	0.673	0.087	0.000	0.000	0.000	0.000	0.000
SN	0.000	0.000	0.000	0.321	0.000	0.329	0.000

- The model reflects that ATT is strongly affected by PU (67.30%) and moderately affected by PEOU (21.80%).

- The model reflects that BI is moderately affected by ATT (49.00%) and PR (31.40%); the least impact comes from PU (8.70%).

- The model reflects that PEOU is moderately affected by EXP (32.60%) and SN (32.10%).

- The model reflects that PR is strongly affected by EXP (70.40%).

- The model reflects that PU is moderately affected by EXP (46.70%) and SN (32.90%); the least impact comes from PEOU (9.90%).

- The model reflects that SN is strongly affected by EXP (74.30%).

The above findings indicate that the following hypothesized path relationships are statistically significant and are predictors of their corresponding variable: ATT→BI, EXP→PEOU, EXP

→PR, EXP→PU, EXP→SN, PEOU→ATT, PR→BI, PU→ATT, SN→PEOU, SN→PU. The path relationships PU→BI and PEOU→PU are not statistically significant given their standardized path coefficients of 0.087 and 0.099 respectively, which are less than 0.1.

Outer Indicator Loadings

Measurement loadings can vary between 0 and 1. High outer loadings for constructs typically imply that their associated indicators have much in common and thus are statistically significant. For a reflective model, path loadings would need to be higher than 0.70 (Wong, 2013). A sufficient condition is that the outer loadings should be at least 0.708. Indicator reliability may be interpreted as the square of the measurement loading: thus, 0.708^2 = .50 where the latent variable should explain a significant part of each indicator's variance (i.e. it should account for at least half of the variance in each indicator, or 50%) and that variance is typically larger than the measurement error variance. In Table 6, all indicator loadings are greater than 0.708 and thus none are removed from the study. A loading value of 0.70 is the level at which the variance in the construct is strongly attributed to its indicators, and is also the level at which explained variance is greater than the error variance.

Table 6 *Outer Indicator Loadings*

	ATT	BI	EXP	PEOU	PR	PU	SN
Q9-PEOU1				80.50%			
Q10-PEOU2				82.10%			
Q11-PEOU3				75.10%			
Q12-ATT1	96.60%						
Q13-ATT2	96.20%						
Q14-BI1		91.50%					
Q15-BI2		90.60%					
Q16-SN1							96.30%
Q16-SN2							96.40%
Q18-EXP1			84.30%				
Q19-EXP2			92.50%				
Q20-PR1					89.10%		
Q21-PR2					92.50%		
Q6-PU1						95.10%	
Q7-PU2						94.90%	
Q8-PU3						92.90%	

Construct Internal Consistency Reliability & Validity

As observed in the previous step, all of the indicators have individual indicator reliability values that are much larger than the preferred level of 0.7 (or 0.708). Cronbach's Alpha is used to measure internal consistency reliability (Bagozzi & Yi, 1988; Hair, et al. 2012). Cronbach's Alpha is computed by correlating the score for each latent construct with the total score for each indicator and then comparing that to the variance for all individual latent construct scores. Table 7 displays Cronbach's Alpha values with resulting numbers larger than 0.6; therefore, high levels of internal consistency reliability have been demonstrated among all latent variables.

Table 7 *Construct Internal Consistency Reliability & Validity*

	Cronbach's Alpha	Composite Reliability
ATT	0.9240	0.9630
BI	0.7930	0.9060
EXP	0.7310	0.8790
PEOU	0.7060	0.8360
PR	0.7900	0.9040
PU	0.9380	0.9600
SN	0.9230	0.9630

Although Cronbach's coefficient Alpha is a widely used approach to estimate the reliability of tests and scales, Composite Reliability can also be used as a measure of the overall reliability of the latent variables. In Table 7, Cronbach's Alpha and Composite Reliability results are displayed. All values are greater than 0.7; therefore, high levels of internal consistency reliability are present within the model and among latent variables.

Cross Loadings

The Cross Loadings for the model can be found in Table 8. The factor loading indicators for each assigned construct have to be higher than all loadings of other constructs; for example, the indicators for SN are both higher than 96% (0.963 and 0.964 respectively); they are also nearly the highest for the entire model. Overall cross loadings provide evidence for the model's discriminant validity (note the values in gray shading and bold typeface as higher than remaining loadings) (Henseler, et al. 2015; Hamid, et al. 2017).

Table 8 *Cross Loadings Summary*

	ATT	BI	EXP	PEOU	PR	PU	SN
Q9-PEOU1	0.4950	0.4460	0.4710	**0.8050**	0.5580	0.4060	0.3960
Q10-PEOU2	0.4790	0.5260	0.4790	**0.8210**	0.4480	0.5080	0.5340
Q11-PEOU3	0.4240	0.4790	0.3870	**0.7510**	0.4640	0.3780	0.4000
Q12-ATT1	**0.9660**	0.7990	0.7440	0.5970	0.7960	0.7830	0.7070
Q13-ATT2	**0.9620**	0.7630	0.6750	0.5320	0.7490	0.7430	0.7200
Q14-BI1	0.7540	**0.9150**	0.6670	0.4810	0.7190	0.6370	0.7480
Q15-BI2	0.7220	**0.9060**	0.5960	0.6340	0.6770	0.6260	0.6740
Q16-SN1	0.7140	0.7360	0.6900	0.5370	0.7220	0.7120	**0.9630**
Q16-SN2	0.7110	0.7700	0.7410	0.5490	0.7440	0.6980	**0.9640**
Q18-EXP1	0.4920	0.4890	**0.8430**	0.4380	0.4790	0.5530	0.5270
Q19-EXP2	0.7740	0.7110	**0.9250**	0.5500	0.7320	0.7760	0.7570
Q20-PR1	0.6280	0.6390	0.5690	0.5100	**0.8910**	0.5800	0.6300
Q21-PR2	0.8140	0.7480	0.7000	0.6010	**0.9250**	0.6780	0.7450
Q6-PU1	0.7550	0.7000	0.6770	0.5330	0.6800	**0.9510**	0.6820
Q7-PU2	0.7550	0.6720	0.7600	0.5420	0.6790	**0.9490**	0.7320
Q8-PU3	0.7330	0.5890	0.7340	0.4720	0.6090	**0.9290**	0.6520

Fornell-Larcker Criterion

The second criterion is to assess discriminant validity using Fornell-Lacker criterion (Fornell & Larcker, 1981). This method uses the square root of the average variance extracted (AVE) for each

construct which should have a value larger than the correlations of the remaining latent constructs in the model. Table 9 details the Fornell-Larcker findings.

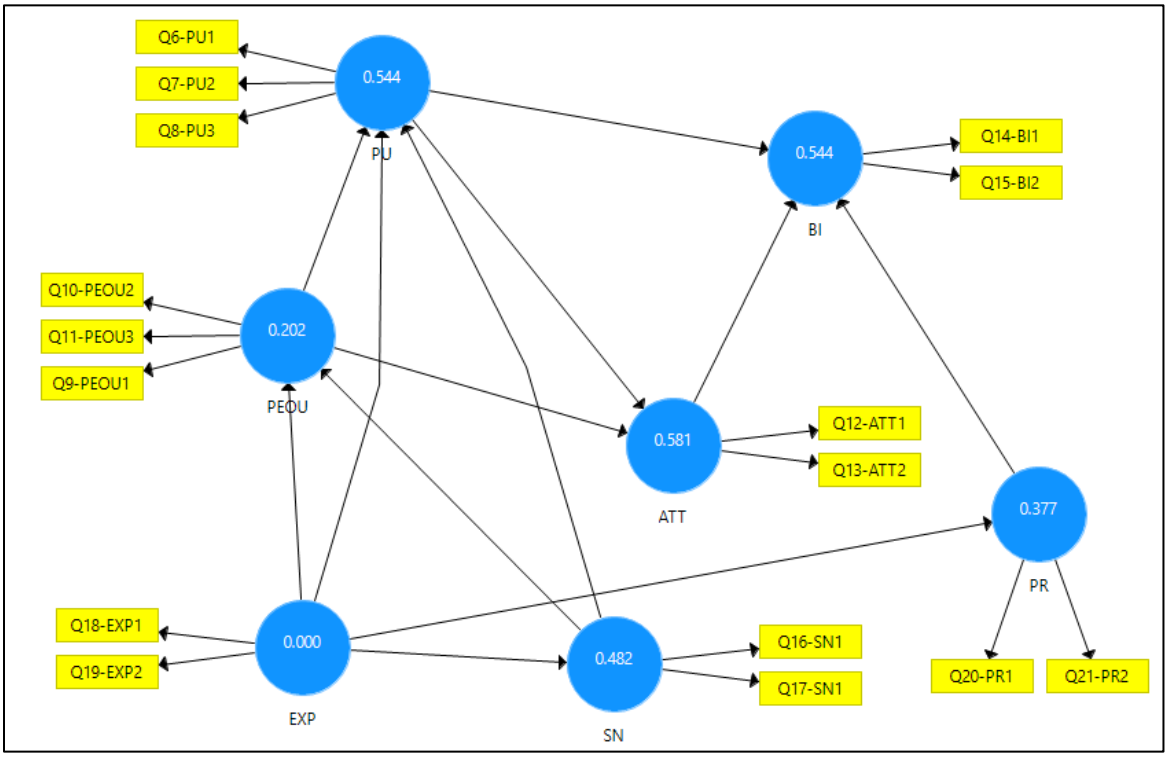
Table 9 *Fornell - Larcker Criterion Summary*

	ATT	BI	EXP	PEOU	PR	PU	SN
ATT	**0.9640**	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
BI	0.8110	**0.9100**	0.0000	0.0000	0.0000	0.0000	0.0000
EXP	0.7370	0.6940	**0.8850**	0.0000	0.0000	0.0000	0.0000
PEOU	0.5870	0.6100	0.5650	**0.7930**	0.0000	0.0000	0.0000
PR	0.8020	0.7680	0.7040	0.6150	**0.9080**	0.0000	0.0000
PU	0.7920	0.6940	0.7670	0.5470	0.6960	**0.9430**	0.0000
SN	0.7400	0.7820	0.7430	0.5630	0.7610	0.7310	**0.9640**

Predictive Relevance Estimation with Blindfolding

In addition to the previously discussed measurements, blindfolding is used as a predictive sample reuse technique to establish accuracy and predict the relevance of the model. Blindfolding calculates the Stone-Geisser's Q^2 value to establish the cross-validated redundancy measure (Akter, et al. 2011, Geisser, 1975; Stone, 1974). The blindfolding procedure eliminates data points for a construct's indicators and then predicts the same eliminated data points on the calculated parameters. Specifically, blindfolding estimates the PLS path model by using the remaining data points. The difference between the omitted and the predicted data point is the prediction error. The sum of squared prediction errors is used to calculate Q^2 through an iterative process. The resulting

Figure 5 *Predictive Relevance Estimation with Blindfolding calculations*



Q^2 shows how well the data can be reconstructed and thus predicted, demonstrating the accuracy and relevance of the model. Q^2 values above zero indicate that values are well reconstructed and

that the model has predictive relevance. Q^2 >0 indicates that the PLS-SEM model is predictive of the endogenous variable being considered. Furthermore, values of 0.02, 0.15, and 0.35 indicate that an exogenous construct has a small, medium, or large predictive relevance respectively (Tenenhaus, et al. 2005). Blindfolding analysis is displayed in Figure 5 indicating $Q^2 > 0$ for all constructs (EXP is a single item construct in a reflective model). Henceforth, the model has a high degree of predictive relevancy and accuracy

There are four cross-validated measures that are calculated based on this formula (Akter, 2011):

$$Q^2 = 1 - \sum_D E_D \Big/ \sum_D O_D$$

- E = The sum of squares of prediction errors
- O = The sum of squares of prediction errors using the mean for prediction
- D = Omission distance (e.g. D=7 implies that every seventh data point of the construct's indicators is omitted during a blindfolding stage)

Predictive Relevance Estimation with Blindfolding calculations are summarized in Table 10. These four measures are based on an omission distance of seven (7), the default setting in SmartPLS3.

Table 10 .*Q^2 (Construct Cross-Validated Redundancy)*

	SSO	SSE	Q^2	Inference
ATT	174.000	72.943	0.581	Large effect
BI	174.000	79.396	0.544	Large effect
EXP	174.000	174.000	0.000	---- (single item construct)
PEOU	261.000	208.370	0.202	Medium effect
PR	174.000	108.429	0.377	Large effect
PU	261.000	118.975	0.544	Large effect
SN	174.000	90.110	0.482	Large effect

RESULTS SUMMARY

In the previous section, several procedures were employed to validate the model and its corresponding hypotheses, H6 through H12. A summary of these findings is detailed below:

- Path Coefficients: The above findings indicate that the following hypothesized path relationships are statistically significant and are predictors of their corresponding variable: EXP→PEOU, EXP →PR, EXP→PU, EXP→SN, PR→BI, SN→PEOU, SN→PU.
- Indicator Loadings: All indicator loadings for SN, PR and EXP exceeded the cutoff of 70% demonstrating that the variance in the relationships of the constructs are strongly attributed to their corresponding indicators.
- Cronbach's Alpha: When measuring the internal consistency reliability, Cronbach's Alpha value for all constructs exceeded 60% reflecting a high level of internal consistency within the model and confirming the hypotheses.

- Composite Reliability: The composite reliability values for the relationships in the model exceeded 70% confirming the strong relationships between the constructs and confirming the hypotheses
- Discriminant Validity: Overall cross loadings were higher than 75% for the constructs within the model. This provides evidence of the model's discriminant validity, thus confirming the hypotheses.
- Fornell-Larcker Criterion: Further evidence confirming the hypotheses was found through calculating the Fornell-Larcker Criterion, leading to highest value for each construct in its relations with the remaining constructs (the highest was 96.40% for both ATT and SN).
- Path Coefficients after Bootstrapping: t-values of larger than 1.96, at p-values less than 0.01 indicating high statistical significance was found after bootstrapping for all but one relationship.

In summary, the above compilation of results validates the hypotheses proposed as H6-H12 for the model:

- H6: Subjective norm will have a positive direct effect on perceived usefulness when ECG Wearable Authentication use is perceived to be voluntary - Confirmed.
- H7: Subjective norm will have a positive direct effect on perceived ease of use when ECG Wearable Authentication use is perceived to be voluntary - Confirmed.
- H8: Compared to inexperienced users, experienced users will judge ECG wearable biometric technology as easier to use - Confirmed.
- H9: Compared to inexperienced users, experienced users will perceive ECG wearable biometric technology as more useful - Confirmed.
- H10: Increased experience will attenuate the negative direct effect of subjective norm for voluntary ECG Wearable Authentication use - Confirmed.
- H11: Increased experience will attenuate the negative direct effect of perceived risk for mandatory ECG Wearable Authentication use - Confirmed.
- H12: Perceived risk is negatively correlated with behavioral intention to use ECG Wearable Authentication use - Confirmed.

LIMITATIONS & CONCLUSIONS

The proposed model and its hypotheses were validated using a variety of statistical and extrapolative methodologies. This has proven that the Technology Acceptance Model (TAM and TAM2) can be used as a predictive framework for the acceptance of ECG-based wearable authentication devices in the workplace by examining the impact of the Subjective Norm, Experience and Perceived Risk on decision-making. Further evidence supported extending our understanding of acceptance by examining external factors such as Subjective Norm, Perceived Risk and Experience. Of these three, Experience was the strongest predictor for the remaining constructs. Due to the limited sample size in this study, a further exploration of results would be beneficial with a larger population sample which can included a longitudinal approach; in addition, a further expansion to other factors such as Cost and Scalability will provide new inputs attributed to the rise in authentication needs for various applications related to ecommerce, ehealth and identity security.

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