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WORKPLACE ENVIRONMENT INFLUENCES ON WORKER ENGAGEMENT AS MEDIATED BY THE AUTONOMIC NERVOUS SYSTEM

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Abstract

This study reiterates the importance of positive psychology and cultures in thriving organizations and the impact on organizational sustainability. Thriving organizations utilize neuroscience to develop strong and viable cultures. Cultivating a viable culture includes intentionally empowering – innovation, inclusion, emotional intelligence, productivity, continual improvement, and project management. Amplifying key competitive advantages, this study highlights theories regarding the relationship between WPEs, WEG, and human ANS mediation. The quantitative, exploratory research design is supported by literature and observational research to form a strong field of study. To remain objective during data collection, this study omitted the distinction among industries or worker type. This quasi-experimental study evaluated 397 responses from an online questionnaire of U.S. workers who lived and worked in the U.S. for at least six months over the past two years. The questionnaire provided more copious responses by eliminating potential distractions of demographic input. Correlations and relationships were analyzed using Hayes Modeling.

INTRODUCTION

This exploratory study aligns decades of information to exhibit how human interactions encompass varying degrees of engagement, happiness, motivation, encouragement, comfort, stress, and support. To further empower intrinsic motivation or make positive impacts among organizations, leaders must understand the basics of interactions incorporating human nature and science (Irwin, 2018; Mauritz, 2018). Workplace environments (WPE) and workers' engagement (WEG) are indicators of an organization's triple-bottom-line, including (a) social/people, (b) culture, environment, planet, and (c) benefits,

financials, profit (tangible, intangible, monetary, or influence) impacts or cost (American Psychological Association, 2015; Foster, 2016). Healthy workers and profitable collaborations are important for an organization's success.

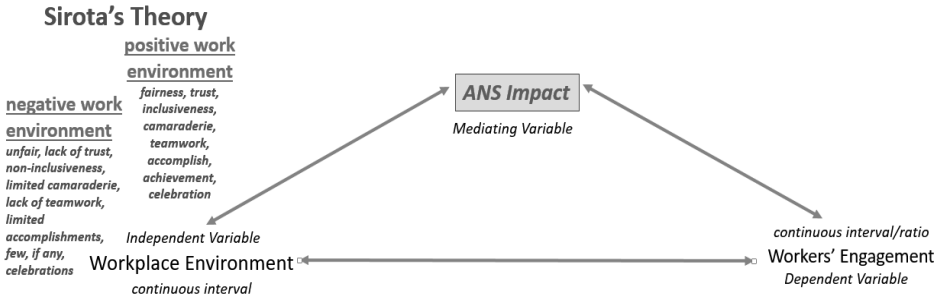
The problem addressed in this study was that there are negative impacts of antagonistic WPEs on WEG. From a portion of the extensive literature review, Mental Health America (MHA) researchers reported over 65% of the 2017 MHA survey respondents report workplace distractions (Hellebuyck et al., 2017). With a 95% confidence level, MHA researchers validated strong correlations between hostile/unhelpful work environments and overall workplace health (r = .70, p <.01), confirming WEG directly impacts productivity. Gallup confirms the essence of *worker engagement* via "70% of the variation between great workplace engagement and lousy workplace engagement can be explained just by the quality of the manager or team leader" (Clifton, 2019, p. 1).

The purpose of this quasi-experimental, correlation study was to increase understanding of the primary relationship between WPE and WEG, hence contributing to the knowledge base and understanding of the constructs. The researchers explored the influence of ANS on the positive correlation between WPE and WEG. Human interaction produces chemicals in the brain, supporting or hindering, a person's health and motivation (Jerath et al., 2015; Sharma, 2016). *Stress* impacts a person's health, and the autonomic nervous system (ANS) balances body functions (Jerath & Beveridge, 2018; National Institutes for Health, & Mikulic, 2019; Pittman, 2020). This study reiterates the importance of positive psychology and neuroleadership in thriving organizations, cultures, leadership, and environments. Increasing the understanding of the primary relationship between WPE and WEG as mediated by ANS expands the understanding of negative impacts of antagonistic WPE on WEG, hence dually maintaining the sustainability of workers and organizational well-being.

THEORETICAL FRAMEWORK

The significant theme among the extensive literature review abridges – leaders drive motivation and productivity; and WPEs institute positive or negative approaches to successes. Understanding the WPE influence or impact on the cognitive and physical reactions toward a psychological balance for the human brain, body, and health is vital to the fundamental theory associated with this study (Breuning, 2016; Immordino-Yang, Darling-Hammond, & Krone, 2019; Jerath et al., 2015; Sharma, 2016). To document cognitive behaviors, this study incorporates a theoretical framework based on the significance of Sirota's three factor theory (STFT). Sirota et al. (2005) combined decades of research, establishing a theory outlining the importance of fairness, accomplishment, and camaraderie (Sirota & Klein, 2014; Sirota et al., 2005) among employees.

FIGURE 1.
SIROTA'S THREE FACTOR THEORY



Through the literature review and actual findings of this study, the researchers demonstrated how the impacts of WPEs allow leaders to influence organizational productivity in alignment with STFT and related quantitative data and findings. Expanding the understanding of WPE impacts on WEG requires answering important questions regarding ANS influences on WPEs. This methodology and design are appropriate because organizational sustainability is dependent on WEG. Ensuring productivity and innovation for an organization's triple-bottom-line is imperative (Elkington, 1999; Montani & Dagenais-Desmarais, 2018). This study, via its literature review, incorporates many authors and researchers who demonstrated impacts and influences of WPEs aligning with organizational productivity (Pendell, 2020; Pittman, 2020).

METHOD

This was a quasi-experimentation study using primary data collected via a questionnaire. Sampling frame criteria for participation was people who live in the U.S. and have worked in the U.S. for at least 6 months over the past 24 months. Participants were recruited using the Qualtrics platform. The Northcentral University Institutional Review Board approved prior to initiating recruitment efforts. To measure the primary constructs of interest (WEG, WPE, and ANS), a questionnaire was self-developed.

WEG was a self-reported measure of participants' engagement representing productivity, innovation, well-being/health, and comfort in approaching assignment tasks to be accomplished. The WEG, dependent construct, was measured on a sliding scale from 0 to 100% of the time. The WPE was a self-reported measure of participants' perception of their WPE, including characteristics of fairness, camaraderie, and accomplishment. The WPE was the independent construct measured on an interval, 5-point Likert frequency scale asking respondents to indicate occurrence of specific characteristics (fairness, camaraderie, and accomplishment) experienced in the workplace environment ranging from never (1) to always (5). The ANS was self-reported, via a questionnaire, which measured participants' propensity in the work environment

reflecting flight, freeze, or fight responses. The ANS was the mediating construct measured on an interval, 7-point Likert frequency scale ranging from never to always. Hayes model 4 was used to explore the mediating effect that self-reported ANS has on the relationship between WPE and WEG.

RESULTS

This study reflects on human interactions within organizations (or WPEs) rather than the size, type, mission, or purpose of the organization. Implementing suggestions of multiple existing studies to further apply a quantitative look at the relationship between WPEs and WEG is key. In this study, correlations were found using Hayes Modeling, confirming the relationship of the constructs. Takeaway ideas are not directly wrapped around industry, geographical location, or any worker. For this study, of the 467 returned questionnaires, 397 (85%) held complete questionnaire responses. Data assumptions of normality, homogeneity of variances, and independence were tested and found to meet assumptions for statistical testing. Questionnaire reliability was assessed using Cronbach's alpha. Cronbach's alpha values are shown in Table 1.

TABLE 1.
CRONBACH'S ALPHA RESULTS

Constructs and Items	Cronbach's Alpha (*Results per Question*)
WPE – Q1 (section1)	
Fairness – Q1, Q6, Q7, Q12	.860
Camaraderie – Q2, Q5, Q9, Q11	.848
Accomplishment – Q3, Q4, Q8, Q10	.840
ANS – Q2 (section2)	
Freeze – Q1, Q8, Q9, Q12	.833
Fight – Q3, Q4, Q7, Q10	.852
Flight – Q2, Q5, Q6, Q11	.805
WEG – Q3 (section3)	
ENG (engagement) – Q1 through Q8	.924
WPE – Q1 (section1)	.945
ANS – Q2 (section2)	.925
WEG – Q3 (section3)	.924
Overall – entire questionnaire	.840

Note. Cronbach's Alpha = >.8 = good; and >.9 = excellent

Pearson correlation was used to explore association between the construct items and between construct items and WEG. Association between WEG and ANS items were negative, weak correlations ranging between $r(395) = -.155$ and $r(395) = -.316$. Pearson correlations were statistically significant with the exception of the association between camaraderie (WPE) and fight (ANS) of $r(395) = -.028$ and between fairness (WPE) and fight of $r(395)$ of -.063.

Descriptive statistics for the three primary constructs of interest were: WPE M = 3.74, *SD* = .91; WEG M = 65.87, SD = 20.55; and ANS M = 3.41, *SD = 1.30.* The WEG held a positive, strong correlation with WPE, $r(395) = .63$, $p < .01$; and a negative, weak correlation with ANS, $r(395) = .28$, $p < .01$. WPE and ANS held a negative, weak correlation, $r(395) = .24$, $p < .01$.

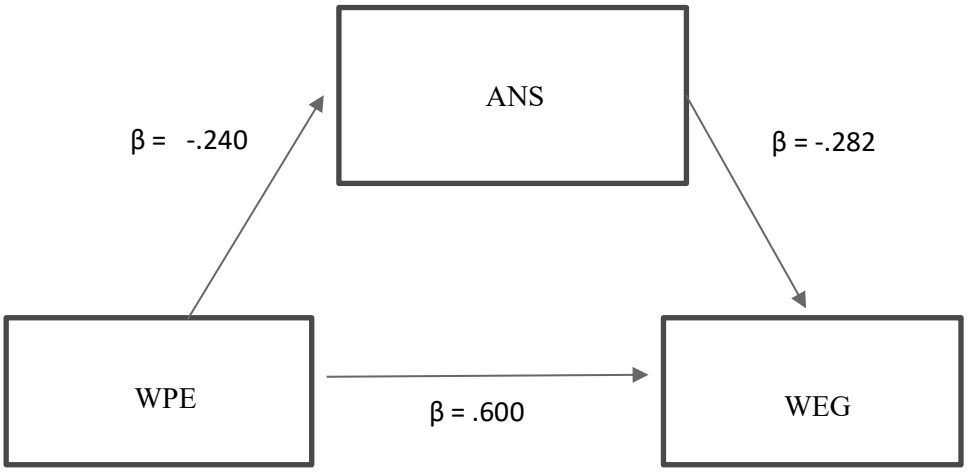
The WEG engagement construct consisted of 8 questions (α = .92). The construct of WPE consisted of three work environment items. The WPE fairness item consisted of 4 questions (α = .86), the WPE camaraderie item consisted of 4 items (α = .85), the WPE accomplishment item consisted of 4 questions (α = .84). The ANS construct consisted of three psychological response items. The flight item consisted of 4 questions (α = .86), the ANS freeze item consisted of 4 questions (α = .86), and the ANS fight item consisted of 4 questions (α = .85).

The study participant criteria were intentionally broad because WPEs affect every worker, every task, and the related success. Demographics were intentionally excluded from this study to encourage and enhance participants' comfort-level in answering the questions, allowing data collection to focus on the variables. A significant response rate was achieved (i.e., doubling the expected responses), which exceeded the Qualtrics project management process expectations in volume and timing. These results propose that the option of self-reporting without demographics is a fairly unique approach to data collection.

To express the theoretical model hypothesizing whether the positive relationship between WEG on WPE is influenced, in part, by ANS, a model was developed (Figure 2). Hayes Model 4 was used to determine the statistical significance of the indirect effects of ANS. Overall, WPE predicted WEG, moderated by ANS, $R^2 = .419$, $F(2, 394)$, $p < .001$. The analysis supports the theoretical model that the relationship between workplace environment and worker engagement is mediated by the autonomic nervous system. Standardized calculations for the indirect effect, direct effect, and total effect are

Direct effect = c'= .600
Indirect effect = *ab*= -.240(-.282) = .06768
Total effect = c= - .600 + .06768 = .66768

FIGURE 2
HAYES MODEL 4



Andrew Hayes' work contributes significantly to clarifying and applying various models for research (Hayes, 2017; Hayes, 2021). Strong significance among the constructs' relationships was consistent with existing research and aligns with STFT. An emphasis on the relationship between WEG and WPE appears beneficial with the addition of a self-reporting aspect that allows for participants' responses regarding their ANS reactions to their WPE. The results indicated a significance of WPEs on WEG and establish support for a balance of people, planet/environments, and profits while highlighting the role of an employee's ANS response to this relationship. WPEs can institute and influence positive or negative approaches to success (Austin, 2019; Heathfield, 2020).

DISCUSSION

Refining and rebuilding are essential for the brain and the human body. Everyone can seek their full potential by effectively finding the reward activation key in their team, workgroup, organization, studies, and endeavors. Based on a combination of the literature review and the data analysis for this study; undoubtedly, a person's brain and their WPE have a connection. A person's brain and their WPE have a connection. Human chemistry supports engagement through ANS (Dabke, 2016; Zwaan et al., 2019). The ANS balances and blends paradox-savvy leadership into more productively influencing and positively encouraging WPEs. Engagement is critical to being proactive, adaptive, and innovative workers, and is synthesized as a current and influential topic. Motivation is driven by leadership (Irwin, 2018). Emotions, feelings, thinking, and self-regulation are developed by experience for every person. Neuro-capital,

when embraced, balances a person's portfolio, paying dividends for the health and well-being of each unique person (Buisson-Narsai, 2020).

The sample, in this study, was designed to avoid distinguishing between industries or types of workers to remain objective across human-beings – no matter the industry or their work responsibilities. For example, Olympic teams comprised of individuals who greatly excelled at their craft but did not 'gel' well together as a team, is an example of the missing element of camaraderie among a WPE. Alexander the Great, leading the Macedonians to overcome the significantly larger Persian army, is a superb example of the combination of humanity, camaraderie, and teamwork that achieves organizational sustainability. Understanding effective coaching, emotional intelligence, and leadership plays an imperative role in organizational success.

Gilin-Oore et al. (2015) presented a strong review on workplace conflict and the relationship and power of leaders in the workplace environment. Sankovic (2018) illuminates the importance of structures and processes for reporting, repairing, and healing from workplace environment gaps, conflicts, and issues. Montani et al. (2018) showed how leaders should address, change, and improve WPEs by removing barriers and nurturing human capital among productive atmospheres. In parallel, Epitropaki (2020) determined forgiveness institutes incredible repair. Methot et al. (2017) clarified: positive, negative, ambivalent, and indifferent relationships by blending social-functional emotions perspective with four major streams: "(1) sources, (2) outcomes, (3) temporal dynamics, and (4) measures of ambivalent and indifferent relationships" (Methot et al., 2017, p. 1797), and "link[ed] social interactions, discrete emotions, and workplace relationships with the four research streams" (Methot et al., 2017, p. 1791).

Ghadiri et al. (2012) show that brain-friendly work environment(s) provide productive and beneficial workspaces while aligning neuroscientific specifics with biology, brains, environment, motivation, leadership, and growth, and noted a renewed intent to develop neuro-leaders who understand, respect, and formalize effective approaches to meet the basic brain needs in the business world. Brains think 'safety first' (Buisson-Narsai, 2020). Lee et al. (2020) especially noted the findings of multiple variable and constructs for future research suggestions. The impact of emotional intelligence (EI) on knowledge sharing (KS) behavior and the supporting roles of the mediating variables – organizational justice (OJ) and work environment (WE) prove significant (Tamta & Rao, 2017). Dabke (2016) demonstrates leadership effectiveness in correlation to EI, motivation, intellect, and influences.

Multiple regressions and Hayes modeling demonstrate a strong and viable regression analysis approach (Hayes, 2017; Soper, 2021; Thakkar, 2020; Tomaselli et al., 2020; Vogt, 2007). Building a multiple regression model via IBM SPSS® add-ons, as needed, to explore the variables' relationships based on

log-linear analytical methodologies (Hayes, 2017; Tomaselli et al., 2020) expands on existing research by reflecting on the latent variables. Decomposition of the latent variables was key. Multi-regression analysis, along with appropriate statistical analysis (i.e., mean, standard deviations, t-tests, and distributions) (Vogt, 2007), clearly presents the findings.

The chemistry of leadership was demonstrated in the Clifton (2019) article reflecting on 70% of the responsible for the engagement of workers resides with leaders and managers (Clifton & Harter, 2019). Similarly, Dabke (2016) "studied the relationship between performance-based EI [emotional intelligence] and transformational leadership [TL] as exhibited by participants in the work role with leadership effectiveness as perceived by their superiors and subordinates" (Dabke, 2016, p. 27) to assess leadership chemistry and effectiveness as correlated with EI, TL, behaviors, motivation, intellect, and influences. Dabke (2016) presents strong use of SPSS® with results reflecting Pearson's correlation coefficient and multiple regression analyses resulting in a variety of positive relationships among variables and reflects on behavior, rather than EI, accounting for greater impacts on effectiveness.

Chemical releases and balancing occur naturally based on indications to the brain regarding the anticipated or understood paths of fight-flight, rewards, moods, emotions, feelings, and bonding (Buisson-Narsai, 2020). The significance of understanding the benefits of treating every brain with respect and forgiveness is the combination of STFT and neuroleadership. Achieving the purpose of increasing the understanding of the primary relationship between WPE and WEG as mediated by ANS expands the knowledge base and the understanding of the problems associated with the negative impacts of antagonistic WPE on WEG.

The *take-home message*, ideally, is the big picture of *getting to the hearts and minds of people* to empower and motivate. Doing so requires work environments and cultures of productively harvesting the strengths of fairness, achievement/recognition, and camaraderie/teamwork. Positive environments and positive psychology presented a balance of forgiveness rather than developing antagonistic situations. An organization's triple-bottom-line reflects the health, well-being, chemistry, brainpower, innovation, teamwork, and productivity of its people. Human nature via the innate ANS components of fight, flight, and freeze (i.e., amygdala) intrinsically impacts motivation and well-being among organizations' team members and the success and sustainability of the organization. This study supports Sirota's theory of fairness, camaraderie, and accomplishment as basic requirements for the success and sustainability of people and organizations.

LIMITATION OF THE FINDINGS

Limitations of the findings include population representation; respondents' intent and perspective of the research topic; randomness; plausible sampling bias; mitigating errors; mediating analysis, conditional analysis, and modeling; and clarification or rework if processing or leftover errors occur. Delimitations include volunteer population sample; lack of specific geography, region, or culture supports randomization allowed for extensive modeling analysis; not limited to a specific industry or location; and the researchers focused on attributes of the variables rather than specific or pre-determined organizational attributes. And, the variable ANS, represents parasympathetic and sympathetic states for humans. This research design and the data collection approach support an intentional focus on less complicated survey participation and responses related specifically to the variables for this study. This effort especially supports the initial content validity, the research regarding reliability, and establishes the fundamentals for future research to further validate the data collection instrument and process. Utilizing Qualtrics' project management support and allowing the participants an opportunity to reflect only on the subject matter without demographics, revealed the availability of substantial, timely, and applicable data collection. This approach may prove beneficial for future research by further presenting quantitative evidence and suggesting organizational improvements.

IMPLICATIONS

Strong leaders must be flexible, adaptive, and focused on followers' needs (Immordino-Yang et al., 2019). Social contributors are essential in continued brain development and added value regarding brain-friendly workplaces and humans' related requirements to be motivated, learning, and growing (Immordino-Yang et al., 2019). This study contributes to the knowledge base by presenting a renewed focus on addressing concerns regarding the primary relationship between worker engagement (WEG) and workplace environment (WPE), as mediated by the autonomic nervous system (ANS). Consistent with other studies, the results support, and further outline the significance of meeting human challenges with neuroleadership-related practices to develop healthier and resilient WPEs. Combining business, human nature, and science is important to the success and sustainability of organizations. This study links multiple WPE related theories and reiterates the importance of positive psychology and neuroleadership. Researchers continue to find that safe, healthy, and productive WPEs are about the *we* of an organization – i.e., thriving, encouraging, and strengthening, productively, rather than antagonistically. To do so, is to protect the ANS, like guarding against a broken arm or violence in the workplace. Organizational sustainability requires leaders to manage in a manner that engages the calm (parasympathetic) state of mind. This is the key to harmonizing the triple-bottom-line. Continually improving organizational approaches to people, environment, and benefits/profits will remain a goal for this researcher. Further

developing a theory supporting thriving workplaces can provide tools to refine the approach and results of work environments.

SUGGESTIONS FOR FUTURE RESEARCH

Highlighted as a crucial study topic – the impact of WPEs on health, well-being, engagement, and productivity – remains a vital topic for future research. Sankovic (2018) and Montani et al. (2018) recommended future research regarding protection, presence, and eliminating the triggers in WPEs. Methot et al. (2017) recommend future research, including "develop and empirically test models where ambivalent and indifferent relationships predict proximal emotions, which then predict work attitudes and behaviors" (Methot et al., 2017, p. 1809). Some researchers who embarked on qualitative studies highlighted challenges for related topics. Additional quantitative research on WPE and WEG would further expand the knowledge base.

Future studies should broaden variables in relation to leadership, transgression, and the repair of related relationships. Gilin-Oore et al. (2015) recommended more research on the person and the conflict or situation. Cook (2018) referenced creativity and intrinsic motivation in the workplace and embarked on a qualitative study with findings regarding future research suggestions and highlighting qualitative research challenges. In addition to contributing to the knowledge base and expanding the understanding of WPEs' impacts *on humans* and how leadership methods affect motivation or WEG, this study establishes future research suggestions. Future studies could reflect additional populations or samples to further address culture, specific industries, types of leadership approaches, or geographical aspects as constructs or population sample criteria. Additional criteria and related information may be reflected in future variables regarding well-being, health, leadership, and organizational development. Future studies can further expand the knowledge base of WPEs, WEG, ANS, and related variables' influence growth, leadership, and sustainability of an organization.

Future data collection can be tailored to find the - who, how, and where for small businesses, large entities, governments, countries, and any combination of organizations, no matter their size or focus. Exciting topics can be gleaned for future research ideas. Lee et al. (2020) provides a platform "call(ing) for better measurement and study design tha[t] can reduce endogeneity biases and provide more accurate estimates of the relationship between leadership variables" (Lee et al., 2020, p. 18). Immordino-Yang et al. (2019) supports awareness of vital interactions and the triggers of the cognitive processes based on leaders' influences and dynamics among their workers or followers.

CONCLUSION

In this study, the researchers reviewed key research studies, books, and many articles pertaining to the relationships among WPEs, WEG, and vital approaches to better understand affects, effects, impacts, and implications. The problem of antagonistic/hostile WPEs negatively impacts organizations, across the globe.

The essence of this study illuminates the need for organizations to refocus their WPEs in alignment with neuroleadership approaches to focus on the needs and well-being of their people. Positively enhancing WPEs is documented as a key ingredient to increasing the percentage of people engaged in their work. Not including demographics on the questionnaire played a significant role in data gathering. It offered quicker and more abundant responses by eliminating potential distractions throughout the data collection process. Beyond the superficial needs of people and organizations, this study emphasizes the sustaining and thriving needs of organizations, through the needs of people.

This research highlights the magnitude of the influences and consequences of WPE on WEG. Understanding the importance of how to treat brains properly is supported by many studies. The purpose of this study was to expand the understanding of the association between negative impacts of antagonistic WPE on WEG. Organizations can enrich their triple-bottom-lines by focusing on the ANS influences of their WPEs. Positive environments and positive psychology present a balance of forgiveness rather than developing antagonistic situations (Austin, 2019; Breuning, 2016; Buisson-Narsai, 2020; Hellebuyck et al., 2017; Irwin, 2018; Sharma, 2016; Sirota & Klein, 2014; Sirota et al., 2005). The benefits of understanding the impacts of antagonistic WPE can allow leaders to improve their WPEs and encourage sustainability and productivity. Consistent with the results of this study and the messages from the literature review, organizational leaders who focus on healthy WPEs will increase their organizations well-being and long-term sustainability through their people.

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INTRODUCING DIGITAL TECHNOLOGY TO A PHYSICAL THERAPIST EDUCATION PROGRAM

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Abstract

There is an increase in the remote delivery of healthcare, including physical therapy. With the increase in telehealth services, there is an increased demand for educational programs to address online delivery of care and improve the knowledge of technological acumen across all healthcare disciplines. The primary purpose of this study is to investigate the perceptions of clinicians and faculty about the need for digital physical therapy in the clinic and in physical therapist education programs. The secondary purpose is to propose ways to include digital physical therapy practice in physical therapist education programs.

A survey was designed and administered to Doctor of Physical Therapy (DPT) faculty and clinicians throughout the United States to gauge their perceptions on the need to add digital physical therapy subject matter to the physical therapy education curriculum and identify what topics should be included. As a result of this survey, 92.7% of the respondents identified and supported the need for teaching digital physical therapy in physical therapist education programs. Physical therapist entry level program curricular changes, which include financial, administrative, systems, and technique topics, are suggested based on the survey results.

Keywords: digital physical therapy, telehealth, physical therapy, telerehabilitation, pedagogy, graduate education

INTRODUCTION

The Covid-19 pandemic, not to mention the Information Age, has impacted the world like never before. Addressing the affairs of business, education, and healthcare in this viral world, using technology-based systems, is radically evolving. Even without considering the addition of a pandemic on a global scale, the problems pertaining to cloud-based systems, cyber security, software operating systems, data management, application design, and social media platforms are numerous, complex, and constantly evolving.

Telehealth services are not new and can be traced back nearly 100 years to deep in the Australian outback where "the Reverend John Flynn, a roving outback missionary, realized that two inventions - the airplane and the radio - might be able to save lives" (Stephens, 2014). Hence, the early beginnings of telehealth. While the world has certainly advanced, a new set of telehealth factors have manifested themselves that must be weighed and considered.

Within the telehealth literature, it shows evidence of significant development and increased utilization (Heuer, 2019). Within the physical therapy literature, there is evidence that digital physical therapy can be cost effective while producing outcomes equal to those of traditional physical therapy (Cottrell et al., 2016; Schröder et al., 2018; Levy et al., 2015; Kloek et al., 2018; Turner, 2018; Van Egmond et al., 2018; Sarfo et al., 2018) within select patient populations. However, information on best pedagogical practices for including digital physical therapy in a physical therapist education program is missing. Within the physical therapy literature, three significant themes can be found: financial implications, technology, and administrative challenges. Each of these subject areas need to be considered in integrating digital physical therapy in clinical practice and potentially in a physical therapist education program.

First, financially, cost savings are beginning to be realized (Cottrell et al., 2016; Schröder et al., 2018; Levy et al., 2015; Kloek et al., 2018; Turner, 2018; Van Egmond et al., 2018; Sarfo et al., 2018). For example, one study found "an average cost savings of $2745 per patient for those who received virtual physical therapy with clinical oversight compared to usual care with traditional physical therapy" (Bettger, 2018). Although there is proof that digital physical therapy can save costs for both patients and payers, the clinician or practice may have to spend a start-up fee to acquire the technology (Marzano, 2017). The financial factors and related features are broad and depend upon the scale and kind of physical therapy practice being considered. In general, the demand for remote care across the overall healthcare industry is growing. "Consumer adoption of such technology and a firmly established consumer mindset are expected to grow the telehealth market from $572 million in 2014 to $2.8 billion by 2022" (Gagliano, 2020).

Next, it's essential to set up information systems and integrate them with the remote provision of physical therapy services (Richmond et al., 2017). Overby (2017) stated that "There are no data or guidelines for describing effective teaching methods for telepractice." Students or practitioners who will deliver services via telepractice must demonstrate an understanding of technology systems and maintenance; appropriate selection of clients, examination, and intervention techniques; cultural variables; knowledge about security and privacy protections (Overby, 2017). Practitioners must be able to combine technology systems with delivery of physical therapy for successful digital physical therapy practice.

Finally, there is the administrative element, or the legal and regulatory issues (Richmond et al., 2017). This area too is broad and far reaching with the healthcare industry. The rules and regulations vary by state and payer and are frequently changing (Bierman et al., 2018). Providers must understand where to find this information and how to apply it.

The literature frequently examines digital physical therapy; nevertheless, it lacks information on the optimal pedagogical approaches for integrating digital physical therapy into a program for training physical therapists. The questions developing a pedagogy to enhance an entry level doctor of physical therapy (DPT) program include:

- Do current clinicians and faculty members see a need for digital physical therapy (d-PT)?
- Should d-PT be an area of instruction to students in physical therapist education programs?
- What should be included in the curriculum?

The authors hypothesized that both clinicians and faculty members would recognize a need for digital physical therapy practice and believe it is a topic that should be added to physical therapist education.

The purpose of our study is: 1) to investigate the perceptions of faculty and clinicians on the need for digital physical therapy in practice and including digital physical therapy content in physical therapist education and 2) to propose a pedagogical approach for teaching the delivery of digital physical therapy.

Methods

A quantitative non-experimental study was conducted to determine the perceptions of faculty and clinicians.

A survey was designed by the study's investigators after exploring similar research conducted (Overby & Baft-Neff, 2016), in the field of speech and language pathology. The investigators were content experts in physical therapy education and business planning. This study was reviewed and approved by the University's Institutional Review Board.

The survey first asked respondents to identify their primary role as either a physical therapy clinician or faculty member of a physical therapist education program. The subsequent questions focused on the following topics: 1) Is there a need for digital physical therapy? 2) In what areas of physical therapy practice should it be implemented? 3) Is there a need for digital physical therapy content in entry level physical therapist education? and 4) What should be included in the curriculum? Faculty were asked if digital physical therapy content currently exists in their curriculum? (See Appendix A – Survey)

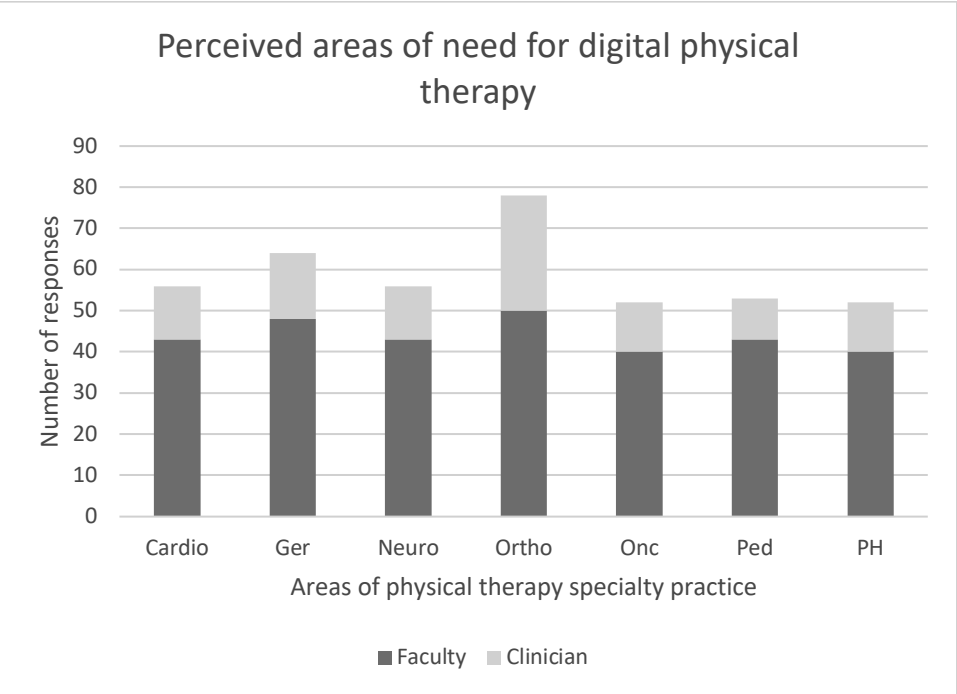
Participants included licensed, practicing physical therapists and faculty in doctor of physical therapy programs within the United States. Snowball sampling was used in this study over a period of three months. All recruitment and surveys were distributed electronically via list serves, emails, and electronic newsletters through special interest groups of the American Physical Therapy Association. The survey itself was on a web-based platform, Google Forms.

Descriptive statistics were used for data analysis to meet purpose number one for the research study.

Results

Data collected from the survey were analyzed using the Statistical Program for Social Sciences (IBM) software program (version 26). A total of 99 respondents completed the survey, three were excluded due to incomplete responses. Of the 96 surveys used for analysis, 32 (33.3%) were completed by individuals who identified themselves as clinicians and 64 (66.7%) identified as faculty. A total of 87 (90.6%) of the respondents felt there was a need for digital physical therapy in

FIGURE 1
PERCEIVED AREAS OF NEED FOR DIGITAL PHYSICAL THERAPY



Note. The number of faculty (blue) and clinicians (orange) who see a need for digital physical therapy in the areas of physical therapy specialty practice, based on the survey responses. Abbreviations: Cardiopulmonary (Cardio); Geriatrics

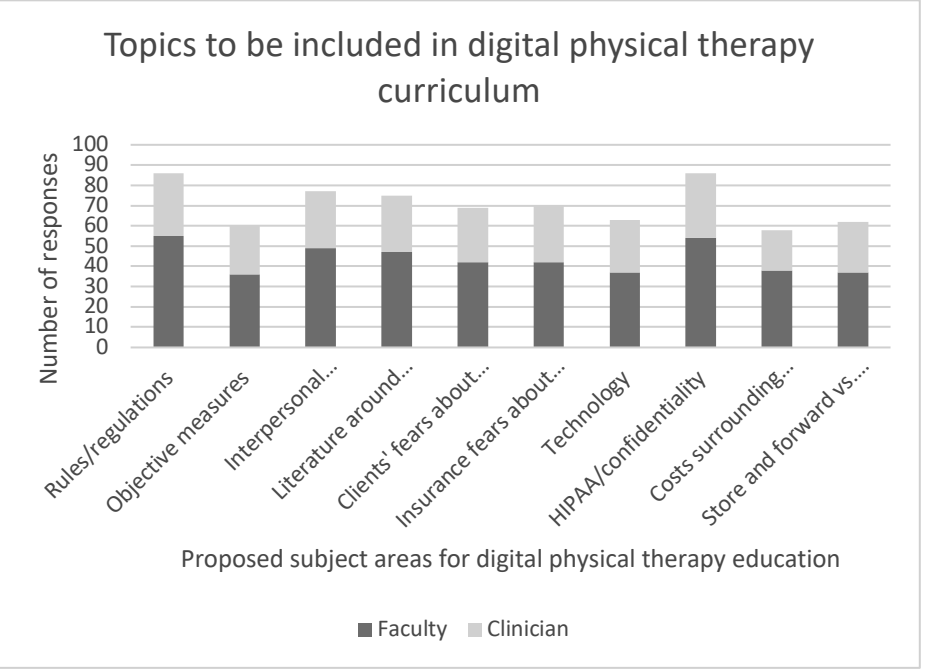
(Ger); Neurological (Neuro); Orthopedics (Ortho); Oncology (Onc); Pediatrics (Ped); Pelvic Health (PH)

practice. Of the 32 clinician responses, 31 (96.9%) reported perceiving a need for digital physical therapy practice. Of the 64 faculty members who responded, 56 (87.5%) reported they believe there is a need for digital physical therapy practice. One clinician and eight faculty members reported no perceived need for digital physical therapy in practice.

Both faculty and clinicians, who believe there is a role for digital physical therapy in practice, suggested d-PT has the greatest role in orthopedics. Of the 87 respondents who recognize a need for d-PT in clinical practice, 78 (89.7%) believe d-PT can be used for orthopedic conditions. The response rate for the other areas of specialty practice can be seen in Figure 1.

Of the 96 people who responded to the survey, 89 (92.7%) recognize a need to educate the Doctor of Physical Therapy (DPT) students about d-PT practice. In

FIGURE 2
TOPICS TO BE INCLUDED IN DIGITAL PHYSICAL THERAPY CURRICULUM



Note. The number of faculty (blue) and clinicians (orange) who suggest adding the noted subject areas into physical therapist education programs.

both the clinician and faculty groups, the respondents who reported recognizing a need for digital physical therapy in clinical practice, also believe digital physical therapy should be part of the doctor of physical therapy curriculum. Digital physical therapy is not necessary in practice, according to one physician and one faculty member, but it should be taught in the Doctor of Physical Therapy (DPT) programs.

One hundred percent of the clinicians responding to the survey believe digital physical therapy subject matter should be included in the physical therapist education program curriculum. Fifty-seven (89.1%) of the faculty who responded believe digital physical therapy should be included in the curriculum. Of the responses, from both clinicians and faculty, who reported a need to educate DPT students on content surrounding digital physical therapy, 97.8% believe we should add rules and regulations and HIPAA and confidentiality as seen in Figure 2.

Thirteen (20%) of the sixty-four faculty members who responded to the survey reported their DPT program currently includes education around digital physical therapy curriculum. To make the topics memorable for educators, the authors grouped the curriculum topics into four categories: Financial, Administrative, Systems and Techniques (FAST). The FAST factors enable the practitioners to adapt and to apply the key services deemed applicable to d-PT. The four factors are multi-faceted, each with a differing set of components that are necessary in the delivery of d-PT and thus should be addressed in education. Of those whose programs include this education currently, nine reported their program spends between 1 and 5 hours on digital physical therapy topics, two reported they spend between 5 and 10 hours and the remaining two reported spending greater than 10 hours.

Discussion

The data show that those who responded to this survey recognize a need for digital physical therapy practice and inclusion of this subject matter into physical therapist education programs. The majority of faculty responded to the survey in a physical therapy education program whose curriculum does not include digital physical therapy. Faculty within physical therapy education programs and coordinators for continuing education should be aware of this need and provide education to prepare physical therapists and physical therapy students to practice in the digital space.

The published literature on digital physical therapy focuses on financial, administrative, and technology considerations along with patient outcomes. The survey results show that the participants' feel that the curriculum should include all 4 topics. The financial factor has several components - level of initial investment to develop and deploy remote healthcare services, the tailoring of a specific type and kind of payment structure, measurements of profit-loss impacts and operational or business unit costs associated with eCommerce of healthcare in

general. These financial factors are in addition to the overarching financial considerations of any business enterprise. In other words, a face to face manual physical therapy practice has a typical financial framework; however, introducing a new unit to the practice that deals with remote delivery of services takes on new financial considerations. More understanding may be required to handle the intricate financial structure for remote online therapy because physical therapists may not be as comfortable with fundamental accounting and finance concepts.

Next, there is the administrative factor. This factor includes licensing and regulation that is required to oversee the practice of physical therapy to insure a safe and compliant practice. Digital physical therapy delivery is limited by state rules and regulations as well as insurance reimbursement and these factors are continuously evolving.

The systems factor has several different yet related components to deliver services and care online. Components of this area include: hardware and software compatibility requirements (of operating systems at both ends of the remote communication), cyber security and managing data and information appropriately. Independent of the level of care and the circumstances, the system's factor is at the center of digital care delivery and its success. Practitioner or patient inexperience with technology can hinder optimum care.

Finally, there is the technique factor. This subject area will define the physical therapy examination components and interventions that will be delivered remotely. Redesigning or simply modifying the traditional examination procedures and interventions to a remote mode of delivery will be required by physical therapist education programs or in post-degree continuing education programs. Furthermore, developing clinical decision making for who will benefit from d-PT, traditional face to face care, or a hybrid of both should be addressed in education.

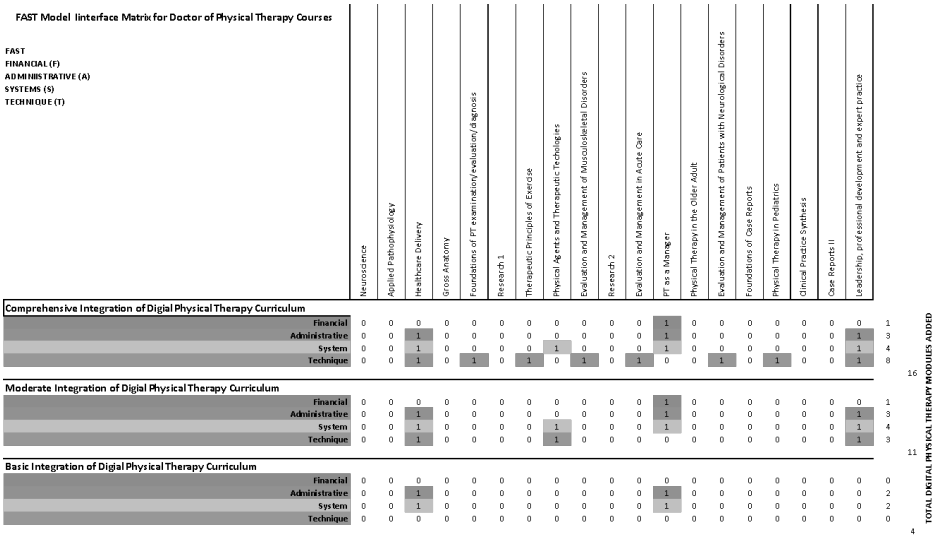
Proposed Pedagogical Model

Every physical therapist education program has required elements to earn the accreditation status. This proposed pedological model used one university's accredited, entry level, physical therapist education program and its curriculum to demonstrate where curricular changes can be implemented within the required elements. This didactic program was matrixed against the FAST factors and where appropriate digital physical therapy content was inserted into the course as a recommendation in Figure 3.

The content of any accredited DPT program is already quite thorough and rigorous, not to mention demanding logistically (e.g., semester load, scheduling, quality level, etc.). Care must be taken by faculty in determining what should be added to an existing program to cover digital physical therapy. This study used one academic program (as noted above) and considered enhancements for three integration levels: comprehensive, moderate, and basic. The FAST model features

were inserted in certain courses, based on subject matter and varied in frequency, as seen in Figure 3. The authors are suggesting the FAST factors would be covered as a module within the designated classes.

FIGURE 3
FAST MODEL INTERFACE METRICS FOR DOCTOR OF PHYSICAL THERAPY COURSES



FAST Model Interface Matrix for Doctor of Physical Therapy Courses	Neuroscience	Applied Pathophysiology	Healthcare Delivery	Gross Anatomy	Foundations of PT examination/evaluation/diagnosis	Research 1	Therapeutic Principles of Exercise	Physical Agents and Therapeutic Technologies	Evaluation and Management of Musculoskeletal Disorders	Research 2	Evaluation and Management in Acute Care	PT as a Manager	Physical Therapy in the Older Adult	Evaluation and Management of Patients with Neurological Disorders	Foundations of Case Reports	Physical Therapy in Pediatrics	Clinical Practice Synthesis	Case Reports II	Leadership, professional development and expert practice	
Comprehensive Integration of Digial Physical Therapy Curriculum																				
Financial	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Administrative	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	3
System	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	4
Technique	0	0	1	0	1	0	1	0	1	0	1	0	0	1	0	1	0	0	1	8
																				16
Moderate Integration of Digial Physical Therapy Curriculum																				
Financial	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Administrative	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	3
System	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	4
Technique	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	3
																				11
Basic Integration of Digial Physical Therapy Curriculum																				
Financial	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Administrative	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
System	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
Technique	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
																				4

FAST
FINANCIAL (F)
ADMINISTRATIVE (A)
SYSTEMS (S)
TECHNIQUE (T)

TOTAL DIGITAL PHYSICAL THERAPY MODULES ADDED

Proposed models for adding digital physical therapy curriculum to an accredited entry level physical therapist education program.

The comprehensive integration level suggests that almost every course in a program should include instruction in digital physical therapy. In Figure 3, the authors suggest adding the technique factors into every practice management class. Covered in this matrix, technique content is inserted into all classes that include laboratories and psychomotor skills for delivery of physical therapy services.

The moderate integration level suggests adding the same FAST factors to the program but with less curricular changes than the comprehensive integration level. While fewer courses might be enhanced at this level, every factor from the FAST model would be woven into the curriculum.

The basic integration level contrasts the comprehensive and moderate integration levels significantly. The basic integration level curriculum change reflects only those subject matter areas deemed most important by survey respondents. This proposed change would reduce the time dedicated to digital physical therapy and thus the time to make curricular changes, while still introducing this type of practice to student physical therapists.

These proposed curriculum changes, in all three integration levels, exclude integrated and full-time clinical education. The authors suggest that similar to the practice of orthopedics and neurological physical therapy, digital physical therapy should be part of clinical education where available. In the clinical experiences, students would have the opportunity to practice remote examination and intervention skills and provide answers to the patients' or caregivers' questions or concerns via a digital format.

Current entry level, physical therapist education programs are content heavy. Many programs span 3 years, including didactic work, labs, and clinical experiences. While many schools are examining their programs to reduce academic bloat, the curriculum needs to reflect current and future practice needs. Content can be added within the existing curriculum to introduce digital physical therapy practice to students, give them resources pertaining to rules and regulations, and expose them to the technology used in this practice. From there, students can investigate this practice model in clinical placements, with mentors, or via continuing education. It's also critical to recognize that there may be potential for multidisciplinary education in the fields of telehealth and digital physical therapy; these would include the cooperation of various business and healthcare educational programs.

Our sample of clinicians and faculty was small and limited. We had 99 responses to our survey, in a country where we have over 200,000 licensed physical therapists. However, to the best of the authors' knowledge, this is the first survey to investigate the perception of practicing clinicians and faculty on where digital physical therapy can be used in practice and inserted into physical therapist education programs' curriculum.

Although the sample size was small, this initial study demonstrates that clinicians and faculty see a need for digital physical therapy services in our communities. The COVID-19 pandemic that touched citizens globally also provides evidence that digital physical therapy will play a role in the future of healthcare in the United States. If the healthcare system and its customers see the value in digital physical therapy services, entry level practitioners should have a basic understanding of this type of care delivery.

Limitations exist in our data beyond the small sample size. We did not ask at what institution faculty work, therefore it is possible there is overlap in our numbers. The number of faculty responding to the survey does not guarantee we had 64 entry level physical therapist education programs represented. In addition, some faculty may not be aware of the full curriculum and may not be able to accurately answer the questions asking if digital physical therapy is taught in their curriculum and how much time is devoted to the topic.

CONCLUSION

The data collected from this survey demonstrates the need for digital physical therapy services in the community beyond the COVID-19 crisis. The data also supports the inclusion of digital physical therapy into the curriculum for physical therapist education programs. Proposed digital physical therapy content falls into four categories: financial, administrative, systems, and technique. Clinicians and faculty report that information in the administrative and systems subsets of digital physical therapy are most important to include in the physical therapist's education. Three potential pedagogical frameworks to implement digital physical therapy content are identified.

The Implications for Rehabilitation include:

- Emerging evidence demonstrates digital physical therapy can produce positive patient outcomes and be cost effective
- Clinicians need to be prepared for the remote delivery of physical therapy
- Small or large curricular changes are possible in the physical therapist education program to prepare entry level practitioners for digital physical therapy practice

Additional investigation is needed in the field of digital physical therapy. Clinical effectiveness, best practices for providers and associated costs require more investigation. Best practices for curricular changes should be explored for entry level education. Outcome measurement and analysis of curriculum changes will be important in determining the effectiveness of the instruction.

Keywords Definitions:

Digital Physical Therapy: The use of digital technologies and online platforms to deliver remote physical therapy services, monitor patients' progress, and enhance rehabilitation exercises and treatments.

Telehealth: The remote provision of healthcare services and consultations through digital communication technologies.

Physical Therapy: Medical treatment that helps restore, maintain, and improve physical function and mobility through exercises, manual therapy, and other interventions.

Telerehabilitation: Remote rehabilitation services provided via digital communication technologies, allowing patients to receive therapy and support from healthcare professionals at a distance.

Pedagogy: The method and practice of teaching, especially as an academic subject or theoretical concept.

Graduate Education: Advanced academic and professional instruction beyond the undergraduate level, typically leading to master's or doctoral degrees.

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