

**Comprehensive Study of Disabled Individuals and Their Access to The Field of
Cybersecurity**

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I.D.S. 300W: Interdisciplinary Theory and Concepts

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November 23, 2024

Abstract

What are the methods and technologies that can help physically disabled individuals to study and work in the field of cybersecurity and what are the challenges they may face? As cybersecurity is an increasingly evolving field with new innovations, it is also a field in need of acclimation, accommodation, adjustment, and conditioning. While there are a variety of marginalized groups to consider, disabled individuals experience significant hardship. Their challenges can comprise of cognitive, physical, and social challenges that may be among other challenges. Cybersecurity workers are often expected to have strong mental capabilities, baseline physical capabilities, and are expected to work long hours sitting in front of a personalized work computer. Significant problems arise when researching challenges that disabled individuals face when entering the cybersecurity field through individual disciplines like computer science, kinesiology, or biomedical engineering. However, fourth-dimensional prosthetic printing, augmented reality technology, and physical therapy are some resources that could potentially have extraordinary impact on the work performance of disabled individuals. Another important resource to consider is the Laevo Exoskeleton. “This production line forms the backdrop for the introduction of the Laevo Exoskeleton: a wearable piece of technology which mechanically supports the hips and trunk, reducing strain on its users’ back muscles and spine” (Grijseels, 2021, p. 10). This paper discusses the role that computer science, biomedical engineering, and kinesiology have in comprehensively understanding the challenges disabled individuals have when attempting to enter the field of cybersecurity and the technologies available to them.

Keywords: prosthetics, computer science, disability, cybersecurity, physical therapy

Introduction

Disabled individuals often face multifaceted challenges in the workplace that involve lack of personalized training to complete tasks, lack of accommodations as a result of physical or cognitive disabilities, and a lack of recognition of their needs by employers. Disabled individuals are in drastic need for assistive technologies and physical therapy that is needed to help disabled individuals study and work in the field of cybersecurity. “Among these, physical therapy is one of the most prevalent types of rehabilitative treatment provided after a stroke” (Shahid et al., 2023, p. 2). This may raise questions regarding the specific challenges disabled individuals face in the workplace. What are the methods and technologies that can help physically disabled individuals to study and work in the field of cybersecurity and what are the challenges they face? Furthermore, what may occur after drastic incidents like a stroke or event happens that leaves them with the need for accommodations to maintain their jobs? Computer science is necessary to understand the requirements of cybersecurity and assistive technologies available. Biomedical engineering is increasingly important to providing helpful technologies to disabled individuals to increase their work performance. Physical therapy is a discipline that can be used to understand the importance of specialized training for disabled individuals. Physical therapy and biomedical engineering are especially relevant to providing reasonable and appropriate accommodations to be made within the workplace consisting of disabled individuals. This phenomenon can be comprehensively understood through an interdisciplinary approach to research as its complex nature requires versatile points of different disciplines. Relevant disciplines can provide unique insights to come to a more comprehensive understanding of the issue and possible solutions. This is research that must be done to provide a more inclusive environment that is open to marginalized groups within the cybersecurity field.

Computer Science

“Active involvement of physically disabled individuals in the design and development of Metaverse platforms is crucial for promoting inclusivity” (Radanliev et al., 2023). Computer science encompasses a variety of different tools, resources, and assets that can be used for the benefit of disabled individuals. The internet, sometimes referred to as the metaverse, is one example as it can provide opportunity to promote disabled individuals to collaborate with others on developing within the metaverse. Furthermore, the internet provides much opportunity for remote learning and remote working for physically disabled individuals. “Specialized cybersecurity positions such as penetration testing, threat intelligence and research, and management-focused positions often have much higher education and experience requirements than other cybersecurity positions” (Ramezan, 2023, p. 10). Cybersecurity is an increasingly demanding field with arduous requirements. Penetration testing, threat intelligence and research, and management-focused positions all require specialized capabilities. It is important to consider the arduous requirements and expectations for cybersecurity workers and the need for assistive technologies disabled individuals need to properly work and study in the field of cybersecurity. While computer science is a demanding field, it is also a highly relevant discipline to the issue. It can help indicate the areas of concern in cybersecurity that may prompt employers to establish accommodations for disabled individuals.

Biomedical Engineering

“The emergence of 4D printing, a technology that combines 3D printing with smart materials that can change shape or properties over time in response to external stimuli, has opened new possibilities for creating dynamic structures in biomedical engineering” (Ramezani & Ripin, 2023, p. 1). The insights of biomedical engineering can be used to form appropriate

remedies to the challenges disabled individuals face when seeking employment in cybersecurity. Many disabled individuals suffer from injuries on their organs and limbs that negatively affect their ability to work in cybersecurity workplaces. Fourth-dimensional printing is a biomedical engineering technology that offers significant potential for inclusive opportunities. “Non-toxic, noncarcinogenic, chemically inert, stable, and mechanically robust biomaterials must be sufficient to resist repeated life forces. Tissue engineering remains a relatively new technique in the research phases” (Javaid et al., 2023, p. 2). While biomedical engineering provides health benefits for disabled individuals and significant opportunity for inclusivity, it is still a developing discipline. It has significant complications for it to be normalization to promote workplace inclusivity for disabled individuals. For example, finding materials used for printing prosthetic tissue is a delicate process. “One of the most challenging things the biomedical engineer can do is select acceptable material to insert in the body of the human body” (Javaid et al., 2023, p. 2). Because of the delicate nature of biomedical engineering, it should be promoted as a solution to workplace inclusivity on a case-by-case basis. “This production line forms the backdrop for the introduction of the Laevo Exoskeleton: a wearable piece of technology which mechanically supports the hips and trunk, reducing strain on its users’ back muscles and spine” (Grijseels, 2021, p. 10). The Laevo Exoskeleton is a prosthetic technology useful for minor disabilities aiding spinal movement. In addition, the Laevo Exoskeleton should also be for minor disabled individuals in the workplace in a case-by-case basis. Unfortunately, not all disabled individuals have the capability to study and work in the field of cybersecurity. However, the insights of biomedical engineering may offer satisfactory opportunity for some individuals.

Kinesiology

Proper training and orientation of disabled individuals in the workplace can offer greater mobility, function, and work ethics among disabled individuals of a workplace. Physical therapy may increase the effect that prosthetic technology can have on workplace inclusivity by strengthening the physical body. Furthermore, proper understanding of human movement can provide meaningful insight of the daily struggles disabled individuals may face. “On the other hand, given that most people work several hours a day and several days a week, the workplace can provide a suitable environment for health promotion” (Ordudari et al., 2023, p. 2). The workplace can be a great place to promote healthcare, physical therapy, reasonable disability accommodation, and the utility of kinesiology. “Studies claim that if conventional physical therapy is started after six to eight months following a stroke, it leads to remarkable walking skills, independence, and improved gait” (Shahid et al., 2023, p. 12). Physical therapy and human movement is the foundation for human movement improvement and is often a necessity for disabled individuals suffering from side effects due to strokes to be able to function daily. Insights from this discipline provide information regarding human movement as the human body can be thought of as a slowly degrading asset needing to be strengthened. Disabled individuals are common practitioner of physical therapy. This discipline offers the marvelous opportunity for gradual improvement over time that can lead to employment in the cybersecurity field.

Common Ground

There are three major findings found as a result of conducting interdisciplinary research regarding the research question. First, new technologies are available to benefit disabled individuals in finding employment in the cybersecurity field but are often relatively new technologies. For example, fourth-dimensional printing is an insight produced by biomedical engineering research that provides significant opportunity for disabled individuals. However, it is

still being developed and the materials used in that process need to be carefully selected to be put in or on the human body. “Augmented reality is an interactive and flexible technology that is being used in educational settings to improve the learning experience and outcomes. Augmented reality combines the physical with the virtual environment by integrating and embedding virtual objects and information into the real world” (Lampropoulos et al., 2023, p.2). In addition, computer science offers a resource like augmented reality as a result of years of advancements in technology. Disabled individuals could utilize augmented reality to engage in virtual collaboration from the comfort of the home if physical collaboration in a classroom is limited due to a physical disability. “However, the number of studies that explore the combination of gamification and serious games with augmented reality and examine its use in computer science education still remains small” (Lampropoulos et al., 2023, p.2). Augmented reality, like fourth dimensional prosthetic printing, is a relatively new technology that needs further development to be successfully incorporated into the lives of disabled individuals. Secondly, the challenges disabled individuals face daily are hard to solve, the disciplines give limited remedies. For example, the severity of each disability can vary. A slight spine mobility disability can be very accurately treated with physical therapy stretches, exercise, and with the use of a Laevo Exoskeleton. However, disabled individuals that are paralyzed from the neck down can be challenging to help. Computer science resources devices with augmented reality features offers limited help as cybersecurity requires basic human body mobility like finger, hand, and arm mobility. Unfortunately, physical therapy is also limited in its effectiveness in paralyzed individuals. Thirdly, the need for personalized training can positively affect disabled employee work performances in a cybersecurity workplace. Computer science is an evolving field needing frequent training of its employees on cybersecurity best practices. Kinesiology is a necessary

aspect to be incorporated for the success of disabled employees. Physical therapy should be provided for disabled individuals in the workplace along with cybersecurity training. Exercise and stretching can be done from the comfort of one's own office space that should be allowed in a workplace from time to time. In any case, specialized training is needed in a workplace with disabled individuals. Without the integration of interdisciplinary research, these findings would not have been found due to each individual discipline providing limited relevant information on the research topic.

Disciplinary Conflicts

A major interdisciplinary conflict regarding the three disciplines, in relation to the research question, involves the priority computer science places on system performance rather than kinesiology or physical therapy in the workplace. This problem can leave disabled individuals continually not included in employment opportunities in the cybersecurity field due to lacking work performance compared to non-disabled workers. In addition, Cybersecurity workplaces are often based on maintaining a business rather than allowing specialized time for physical therapy to be incorporated into the workplace. "Therefore, interventions in the workplace including physical exercise during work hours and in the presence of colleagues can be helpful to those who are less motivated to do sports" (Ordudari, 2024, p. 2). Physical therapy interventions and kinesiology activities can have a positive effect on workplace relationships. The priorities of both computer science and kinesiology may have different focuses and have conflicting insights as a result.

Ch. 12: "Constructing a More Comprehensive Understanding or Theory"?

Through a horizontal integration, a much more comprehensive understanding can be made regarding the modern developments of technologies that can help disabled individuals study and work in the field of cybersecurity and their lack of inclusivity in the workplace. For example, disabled individuals have a relationship or association with lack of employment in the cybersecurity field. A theory regarding computer science can be made to explain this relationship by considering how it is a complicated field with multifaceted skills needed to be employed in that field. This explains the cybersecurity side of the issue. A biomedical engineering theory may be established to explain this relationship considering how biomedical engineering is a newly made field with limitations in how prosthetic technologies can help severe cases of disabled people. Furthermore, a theory regarding kinesiology and physical therapy may explain this relationship as a physical therapy mainly focuses on improvable physical movement like the movement of limbs. While these three theories offer limited understanding and solutions to the issue it is important to acknowledge the common ground regarding these theories or insights. Specialized cybersecurity training for disabled individuals, specialized physical therapy training, and biomedical engineering technologies are needed for disabled individuals to elevate to fully functioning workers able to perform in the cybersecurity field. Unfortunately, some groups may not be helped as well as others due to differences in socioeconomic groups and their access to technology. However, this comprehensive understanding of the need of insight from each of these disciplines can be used to help the general public. “These divides refer to disparities in technology access and internet connectivity among different socioeconomic groups” (Radanliev, 2023, p. 1).

Ch. 13: “Reflecting On, Testing, and Communicating the Understanding or Theory”?

In order for disabled individuals to study and work in the field of cybersecurity, there must be specialized physical therapy training, personalized cybersecurity training, and the integration of biomedical engineering technologies like prosthetics. Business, specifically business administration, may be a fantastic option to further understanding and testing the theory of what disabled individuals need to study and work in the field of cybersecurity. Support from businesses administration within a business or organization is needed to enact policies allowing disabled individuals to join the workplace with necessary accommodations like specialized training and prosthetics to complete work tasks. It could prove to be beneficial for educational programs to incorporate different types of training to prepare both students and professionals for versatile positions available in the cybersecurity field discipline based on the insights provided by the analysis (Ramezan, 2023).

Conclusion

The research has revealed multifaceted aspects to the relationship disabled individuals have with employment in the cybersecurity field. Computer science is a complicated field that requires versatile skillsets in solving technological problems, having attention to detail, the ability to speak, the ability to listen, and the full use of limbs to interact with devices. Kinesiology is field providing physical therapy insights designed to improve the physical capabilities of physically disabled individuals. Biomedical engineering provides technological advancements in prosthetics that can be used to help individuals accomplish daily tasks. These disciplines confirm the need for organizations to promote specialized cybersecurity training, personalized physical therapy training needed in the workplace, and approval of the use of prosthetics to achieve a more inclusive workplace. However, much biomedical engineering technology like fourth-dimensional printing and artificial tissue application are delicate processes that are not developed sufficiently

to accurately apply those technologies to more severe cases of disability. Furthermore, augmented reality, provided as a resource by the computer science discipline, is also relatively new and nearly untested in academic institutions. Furthermore, Physical therapy and biomedical engineering have their limitations on effectiveness on severe cases of disability like on paralyzed individuals. Proper business administration is needed in the workplace to implement specialized cybersecurity training, personalized physical therapy training, and approving the use of prosthetics in the workplace. Disabled individuals face arduous challenges to enter the cybersecurity field. However, fourth dimensional printing of prosthetics, workplace accepted physical therapy, and accommodations in cybersecurity training are all potent possibilities that may prove to be worth investing in for the future success for disabled individuals in the cybersecurity field. Future studies may find success implementing business administration as an important discipline to research when researching the employment ventures of disabled individuals in the cybersecurity field.

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