McNair Scholars Program

Complete the Spectrum with McNair:
Passion, Plan, & Pursue

2020-2021 • Volume 26

WICHITA STATE UNIVERSITY

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The Journal of Research Reports
is published annually by the
Wichita State University
McNair Scholars Program
1845 Fairmount
Wichita, Kansas 67260-0199

TRIO

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From the Director

It is with honor that I present Volume 26 of the Journal of Research Reports, "Complete the Spectrum with McNair: Passion, Plan, & Pursue." The articles featured in this journal represent the work of Program participants from the 2021-2022 grant year. As one reads these articles, the breadth of research interests is as diverse as the students served by our Program. The McNair staff and I could not be more pleased with the efforts that went into producing this meaningful and scholarly body of work.

The Program can only achieve the accomplishments with the support of university faculty, staff and administrators. Through the guidance of research mentors who have been able to inspire our Scholars in completing research projects despite any obstacles they may have encountered and to reach such great heights. We applaud their dedication to making undergraduate research a reality and supporting the students from the McNair Scholar Program. It has been said, "it takes a village to raise a child," you are our "village," Thank You.

Within this journal, you will find the work of fifteen (15) undergraduate students whom we are showcasing for the work they have done and their commitment think outside of the box and perform outside of the classroom. There are full manuscripts, summaries and extended literature reviews. These research activities serve to cultivate and develop research skills, provide experience navigating the research process and to create and develop relationships with faculty that could potentially assist students in applying, being admitted and enrolling into graduate programs. The high impact activity of conducting scholarly research is supported to assist our Scholars by leveling the playing field in their pursuit and completion of doctoral studies.

A special thank you is given to the staff for their dedication to the Program and the students that we serve. Mrs. Kristina Nulik, research coordinator. Ms. Olivia Gonzalez who served as writing tutor. Ms. Ashley Cervantes, program counselor and student confidant. Ms. Neshia Greene, senior administrative assistant and all-around Program support. Lastly,Ms. Deltha Q. Colvin, Associate Vice President for Special Programs; who provides unending support for me and the staff as a whole.

Finally, I congratulate the students for a job well done; their efforts do not go unnoticed. They have taken this opportunity to share their brilliance with the academic community. These scholars are the future of America and I thank them for the opportunity to serve as their director.

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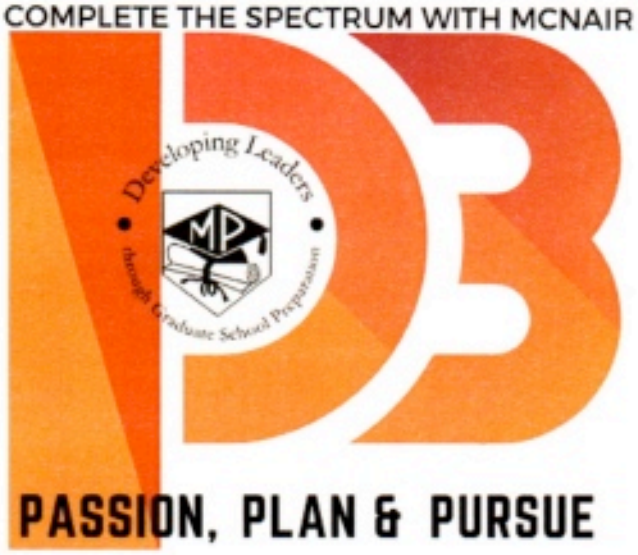

Research Manuscripts

A Quantitative Study of Reactions to Disabled Individuals

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Abstract

The term inspiration within a disability framework represents the aspect of overcoming an obstacle that can be deemed extraordinary. While this may acknowledge achievement in the disabled community and create representation and inclusivity through disabled role models, it often does not rise to the level of true inspiration. Inspiration should require more than everyday activity, such as brushing your teeth or driving while being disabled (Young, 2014). The primary objective of this study was to experimentally examine the concept of inspiration porn. Participants watched either a video of a non-disabled individual or a disabled individual driving (a mundane task) and rated their experiences of inspiration and affect (i.e., positive, negative, mixed, and meaningful affect). Sixty-eight participants from a pool of Wichita State University students completed the online study via Qualtrics (34 were randomized to the disability video clip and 32 to the non-disability video clip). Scores on the inspiration scale (the primary dependent variable) were significantly higher in the disability video group ($M= 17.85$, $SD= 4.33$) than the non-disability video group ($M= 12.24$, $SD= 7.50$), $t(51)= 4.4$. $p<.001$. Participants who watched the video of the disabled individual also reported significantly higher levels of positive, negative, mixed, and meaningful affect following the video. The results provide preliminary evidence for the construct of "inspiration porn" using an experimental design.

Introduction

Inspiration within the disability community has been explored and analyzed for its social, political, marketing, and stereotypical implications. Such platforms have led many academic scholars and members within the community to label inspiration as a concept that has been "overused" and "one that has insufficient empirical research." To further this discussion, Stella Young, a disability advocate, coined the concept "inspiration porn" (Young, 2014). Despite its unconventional name, inspiration porn describes the objectification and representation of people with physical disabilities for the benefit of non-disabled people. In other words, inspiration porn encompasses the idea that people with physical disabilities are seen only as inspiration for able-bodied people, regardless of how mundane or extraordinary the task is at hand.

Given the number of people that live with a physical disability, it is vital to understand how inspiration porn can affect the perception and sociocultural barriers of the disabled community. However, because inspiration porn is a novice term, there is still a need for quantitative and qualitative research. Therefore, the purpose of this paper is to simply demonstrate that there is a gap in the literature for a concept that is seen in almost every platform such as education, media, politics, advertisement, and sports. The direction of this paper is as follows: (a) attempt to define inspiration, (b) examine the role of inspiration within the disability framework, and (c) describe how inspiration porn fits within the discussion and dialogue of disability studies. The scope of this review is limited. Most literature on inspiration porn is either master's theses or dissertations. Nevertheless, it provides a framework for future academic research on inspiration porn.

Definition of Inspiration

The concept of inspiration has been labeled an ambiguous term. Without a clear universal definition or measurement, the concept of inspiration would remain a theoretical construct. In other words, the diverse application of inspiration has created a barrier between everyday use and scientific inquiry. Recognizing the need for a validated measurement and definition, Todd Thrash and Andrew Elliot created a measure of inspiration that could be used in diverse research settings. This is a validated measurement for inspiration that also "drew upon the core commonalities of diverse literature" (Oleynick et al., 2014, p.1). Previous scholars recognize the importance of having a definition that encompasses more than one lens of inspiration (Oleynick et al., 2014; Chadborn & Reysen, 2018).

Thrash and Elliot Definition of Inspiration As a Psychological Construct

The Thrash and Elliot definition of inspiration consists of an understanding of three core characteristics (evocation, transcendence, and approach motivation), component process: "inspired by" and "inspired to", and the Thrash & Elliot transmission model (2003). Thrash and Elliot (2003) understood inspiration as being "evoked" by a stimulus or object. Furthermore, they also made a distinction between "inspired by" and "inspired to." Simply stated, "inspired by" means that the value of an object or stimulus is fully understood or admired; "inspired to" means

to act. To put these in perspective, "inspired by" includes the terms evocation and transcendence because when an individual is inspired by a painting or music, they fully admire and respect the beauty and creative process of such arts, which helps them surpass their prior knowledge of the subjects. However, when an individual is "inspired to" they are inspired to make a change or act because of the evoked stimulus or object (Thrash & Elliot, 2003). Given this universal and neutral definition of inspiration, Thrash and Elliot created the Inspiration Scale (IS). To further the discussion of inspiration as a psychological construct that can be empirically tested, Thrash and Elliot continued to publish studies in state and trait inspiration.

For example, in 2004, Thrash and Elliot provided further evidence for their three core characteristics (approach motivation, evocation, and transcendence) of inspiration by asking participants to write about an experience they had in which they felt inspired. In the study, Thrash and Elliot operationalized the three core characteristics of inspiration with activated positive/negative affect, responsibility, spirituality, and meaning. The results from the first study found that inspiration is associated with a high level of activated positive affect and with a low activated negative affect (Thrash & Elliot, 2004). In 2010, Thrash and Elliot continued their understanding of inspiration with positive affect. In this study, they concluded that sometimes people can be inspired by a stimulus without being inspired to make a change or act (Thrash & Elliot, 2010). It is important to know why the inspiration narrative does not tackle the sociocultural barriers withing the disability community.

Inspiration Within the Disability Framework

One of the main indicators that inspiration has been applied to a narrative of disability is the "feel good" and "heartwarming" sensation that non-disabled individuals experience when viewing disabled individuals (Grue, 2016). Grue (2016) states that words like "overcoming," "challenging" and "obstacles" play a role in the inspiration non-disabled individuals feel when viewing disabled people. This is the case when applied to Paralympics sports.

According to Bartsch and colleagues (2018), athletes, in general, represent endurance against any challenge; therefore, sports spectators receive a sense of purpose and meaningfulness from watching athletes compete. In the case of para-athletes, their physical disabilities represent endurance as well as the hardships that come with having a physical disability. Sports spectators receive a sense of eudaimonic appreciation (an existential feeling that results in motivation and inspiration from an experience with a deeper meaning) while watching athletes compete (Bartsch et al., 2018). Eudaimonic appreciation enhances the spectators' interest while creating a positive shift in attitude towards people with disabilities. A study found that elevated levels of empathy and interest can be seen when people watch the Paralympics, which in turn can influence the attitudes and perceptions the media and non-disabled people have about disability because it can result in more positive attitudes towards disabled athletes.

To further support the positive attitudes towards disabled athletes, Suggs and Guthrie (2017) found in their study that people who

viewed Paralympic athletes had a more positive perception about disability overall and were less likely to express or feel pity towards someone with a physical disability. Bartsch et al. (2018) and Suggs & Guthrie (2017) examined inspiration as a positive prosocial attitude by drawing attention to the empathic feelings people have towards disabled individuals. However, pity can be both positive and negative to the disabled community because it can reinforce stereotypes as well as act as a motivation for other people. Hence, how para-athletes are portrayed in the Paralympics is a critical aspect of inspiration because inspiration associated with disability has only been researched in the scope of sports and the media. It also demonstrates the fact that spectators and the media believe it is sufficient to show a one-dimensional representation of disability (inspiration) because it demonstrates a positive attitude towards disability.

Perspectives of Para-Athletes

Cottingham and colleagues (2015) studied the perception non-disabled individuals have of athletes who play power soccer (a Paralympic sport designed for wheelchair users) and found that opinions about inspiration differed depending on the level of closeness people felt towards disability and the power soccer players. The study also found that perceptions of inspiration "were based on three themes: greater challenges, lower expectations, and athlete-to-athlete" (Cottingham et al., 2015, p.70). Although this study demonstrates that opinions about inspiration differ depending on the relationship to disability, this study suggests that individuals (spectators and event organizers) still focus on the inspirational aspect of the sport rather than the athleticism that exists in power sport. As a result, the world of Paralympic sports is "media-driven" and therefore, the attention that surrounds the para-athletes' world is keen to only focus on the disabilities of the athletes, rather than the abilities para-athletes provide as professional athletes that spend hours and months training for Paralympic events. Essentially, the media, as well as Paralympics events, benefit and profit from the exposure of the inspiration narratives that para-athletes provide.

The Media and Disability

Even though narratives about the athlete's background and endurance are common in the Olympics, the media advertises disability under three messages 1) individuals with disabilities are capable of accomplishing exceptional triumphs, 2) individuals with disabilities are capable of overcoming their disability with the help of technologies, and 3) individuals with disabilities are seen as victims of their own disability and need help (Shelton, 2017).

The first message (accomplishing exceptional triumphs) is seen more often in the form of "supercrip." This term encompasses the idea that disabled individuals are seen as an inspirational story because they have defied their disability to accomplish the impossible such as becoming a para-athlete. It can be argued that this perspective of disability is encouraging and positive for the "self-identity" and "confidence level" of the disabled community; however, the "supercrip" representation creates the idea that disabled people must surpass their disability to achieve success, and therefore, as a result, unrealistic representations are created. Despite

the unrealistic representation, the media applies the concept of "supercrip" because it amplifies "the emotional ethos of competition high and feeds the sports business industry" (Silva & Howe, 2012, p. 181). In other words, the media uses this compelling storyline to manipulate and profit from the supercrip message.

With the second message (overcoming disability with the help of technologies), the pattern of overcoming a physical disability is seen; in this case, technology is applied to enhance physical abilities. Adding technologies such as prosthetics or exoskeletons is theorized to offer a new perspective on the physical abilities and limitations of disability. However, in 2018, it was found that disabled people that use technology to enhance their physical abilities are viewed as less "competent" than non-disabled individuals but more "competent" than other disabled individuals without bionic technologies (Meyer & Asbrock, 2018). Furthermore, this study also examines the perception of technological enhancement. Results suggest that the aspect of sympathy and pity still lingers on despite the bionic technology.

The third message is the idea that disabled people are victims of their own disability and therefore need help. This is most often seen in the form of the medical model and the social pathology model. The medical model implies that individuals with disabilities depend on medicine and doctors in order to endure or survive their disability. Furthermore, the social pathology model implies that people with disabilities depend on social resources "to gain unfair access to privileges and accommodation" (Zhang & Haller, 2013, p. 321). In other words, under this rationale, disability is beneficial because it rewards disabled people with access to resources. To further analyze the concept of "supercrip," the medical model, and the social pathology model, a study in 2013 found that among all three models, "supercrip" was the least "stigmatizing" for the disabled community. The study also found that when the media demonstrate disability as supercrip, it strengthens the confidence level and self-identity of disabled people (Zhang & Haller, 2013).

While all three messages are a part of the inspirational aspect of disability, only the supercrip message is defined by overcoming a physical disability without any help from others or technology. Nonetheless, these three messages reduce a disabled individual to an inspirational story for others without addressing the sociocultural barriers that exist in the disabled community, such as lack of education, employment, and disabled services. According to Chrisman (2011), the media "distorts disability by making it a burden, or a metaphor for inspiration." Although the inspirational narrative of disability has pushed the conversation away from the perspective of tragedy and victim, inspiration as a whole "sensationalizes" disability, which as a result, leaves out the social injustices that affect the disabled community (Chrisman, 2011). In the end, the above studies help enhance the reasons for refining the idea of inspiration when applied to physical disabilities, as well as introduce the concept of inspiration porn to the discussion.

Inspiration Porn

The term inspiration within a disability framework represents the aspect of overcoming an obstacle that can be deemed extraordinary.

While inspiration porn acknowledges achievement in the disabled community and creates representation and inclusivity through disabled role models, it often does not rise to the level of true inspiration. Inspiration should require more than everyday activity, such as brushing your teeth or driving while being disabled (Young, 2014). When Young presented her TED Talk, *I'm not your inspiration, thank you very much* (Young, 2014), she announced to her audience that inspiration and mundane tasks should not go together. With these words, she simply stated that non-disabled people get "inspired" simply by watching a disabled person do an ordinary and mundane task. Inspiration porn encompasses the idea that people with physical disabilities are seen only as inspiration for able-bodied peoples, regardless of how mundane or extraordinary the task is at hand.

Even though inspiration porn is a novice term, it can be seen in the media and advertisements. For example, one study examined the commercial, *We're the Superhumans*, with the aim of understanding inspiration from a mundane task (writing without hands and buying groceries with a wheelchair) to an exceptional task (playing an instrument). The study found that while participants did not find the commercial inspirational, the participants pointed out that it objectified disabled people when they were doing a mundane activity (Cameron, 2018). Although this study did not fit perfectly with Young's inspiration porn concept, it helped highlight the idea that objectification of people with a disability does happen even with a routine task.

Furthermore, from an advertisement perspective, strong emotions such as happiness, sadness, and inspiration can influence the effectiveness of an advertisement and increase "brand recall, recognition, and purchase preference" (Shelton and Waddell, 2020, p. 4). Using prior research on customer satisfaction and spectatorship, Shelton and Waddell (2020) did a study to examine whether inspiration porn invokes feelings of inspiration within non-disabled consumers. By doing this, they wanted to examine the effectiveness of inspiration porn in advertisements. The study uses images of athletes with and without a prosthetic leg doing a physical activity with a challenge (climbing a mountain) or without a challenge (standing). When the participants were exposed to the images of the physically disabled person, they had a higher level of meaning affect (indication of feeling emotional) compared to the images of the non-disabled person. This suggests that the participants felt more "emotional," "touched," and "inspired" with the images portraying the disabled athletes.

However, the study did find that an increase in the intensity of activity (from standing with a prosthetic leg to climbing a mountain with a prosthetic leg) did not appear to show an increase in the positive reaction (i.e., emotional, touched, compassionate, inspired, and tender) of the participants in the study. This supports Young's argument for inspiration porn whether it was standing (mundane task) with a prosthetic leg or climbing a mountain (exceptional task) with a prosthetic leg, the participants reported no difference in the level of inspiration. Meaning that the physical disability of the athletes was one of the main factors for inspiration in the participants.

Cameron (2018) and Shelton & Waddell (2020) present two different results in their studies, but they demonstrate that there are still many limitations (such as how to differentiate between inspiration porn and inspiration in general) to consider with inspiration porn. Thereby, these studies establish a need for more quantitative and qualitative research on inspiration porn. Although the term inspiration porn is a continuation of inspiration within the disability community, the limited literature suggests that more research needs to be conducted in order to evaluate the perception of disability, and its effectiveness to address the impact inspiration porn has in advertisement, the media, and society as a whole. Given the limited research to date, the current study sought to experimentally examine the concept of inspiration porn in a preliminary way.

Methodology

Design

This study was a pilot study with a between-subjects design. The independent variables were two video clips (Non-Disability Video Clip and Disability Video Clip). The dependent variables were the participants' experiences of inspiration and affect (any experience of feeling or emotion, ranging from suffering to elation). The affect variable consisted of positive, negative, mixed, and meaningful affect.

Participants

A total of 68 students from Wichita State University (WSU) participated in the research study (57% White, 13% Asian/Asian-American, 9% African-American, 9% Bi/Multiracial, 7% Hispanic-American/ Latinx, 2% Indigenous-American). The participants ranged in age from 18 to 62 with a mean age of 27.13 (SD = 10.7). 57% of the participants were female, and 43% of the participants were male. Also, 13% of the participants identified as an individual with a disability or long-term health condition and 78% of the participants did not identify as an individual with a disability or long-term health condition. Furthermore, 34 of the participants were randomly assigned to the disability video clip and 32 to the non-disability video clip. Lastly, recruitment was supported through the use of WSU email. Participants received no compensation for their time.

Materials

A modified version of the Elliot and Thrash (2004) inspiration scale (IS) was used to measure inspiration after watching the video clips. The IS has excellent psychometric properties with a Cronbach's α of 0.90 or greater. The reliability (internal consistency) of the modified inspiration scale in this study was 0.96. Examples of the inspiration questions within the survey consisted of "I experienced inspiration" and "Something in the video inspired me." The questions concerning inspiration were scored on a seven-point scale from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). All four questions on the IS were summed to create a total score, with higher scores indicating higher levels of reported inspiration.

Affective responses (i.e. positive, negative, mixed, and meaningful affect) were measured using a scale constructed by Oliver and colleagues (2012). Participants were presented with a list of 15 affect terms and asked to rate how much they

felt each affective response after watching the video, using a seven-point Likert scale from 1 (*Not at all*) to 7 (*Very much*). Examples of affect terms included *touched* (indicative of meaningful affect), *cheerful* (indicative of positive affect), and *gloomy* (indicative of negative affect). The affective response scale has three factors, all with excellent internal consistency within this study: *meaningful affect* (α = .95), *positive affect* (α =.95), and *negative affect* (α =.95). The final score for each subscale was calculated by averaging the items within each factor. *Mixed affect* was the degree to which participants experienced a range of both positive and negative affective responses. This scale was calculated for each participant by using their lowest average score item on either the positive or negative affect scales.

Procedure

The study was approved by the WSU Intuitional Review Board. An email was sent to a group of WSU students (randomly sampled from a database) explaining the purpose of the research study. After consenting electronically and answering if they were 18 years or older, participants were asked to watch a brief video and complete a survey through Qualtrics. If the participants did not consent or were not 18 years or older, Qualtrics would redirect the participants to a page that thanked them for their participation. Three reminders were sent out for students to participate in the study.

The research study took approximately 10 minutes to complete. Participants were randomly assigned to the disability video clip or the non-disability video clip. One video clip consisted of a non-disabled individual in his car explaining how to drive with only one hand. The non-disabled individual demonstrated how to steer, drive, and how to correctly position the body and hands in order to drive safely. The other video clip consisted of a disabled woman driving with her left hand. As the disabled individual explained how she drives with only one hand, she also explained how she became disabled and the struggles she faced learning to drive with only one hand. After watching the video clips, participants were asked to complete several questions concerning inspiration and the different affective responses.

Results

Table 1 consists of the means, standard deviations, *t*-tests, and *p*-values for all of the dependent variables.

Inspiration

To examine differences between experiences of inspiration after watching the video clips, an independent samples *t*-test was conducted. However, the assumption of homogeneity of variances was violated (F = 14.7, p = .00), so degrees of freedom were adjusted. Scores on the inspiration scale were significantly higher in the disability video group (M =17.85, SD = 4.33) than the non-disability video group (M =11.24, SD = 7.50), $t(51) = 4.4$, $p < .001$.

Meaningful Affect

An independent samples *t*-test was used to examine differences between experiences of meaningful affect among the participants in the non-disability video group and the disability video group. The assumption of homogeneity

of variance was also violated ($F = 5.7$, $p = .02$), and degrees of freedom were adjusted. The results from the independent samples *t*-test found that participants who watched the disability clip reported significantly higher feelings of meaningful affect ($M = 3.82$, $SD = 1.39$) than participants in the non-disability video group ($M = 1.47$, $SD = .89$), $t(56) = -8.27$, $p < .001$.

Positive Affect

An independent samples *t*-test was used to examine differences between experiences of positive affect among the participants in the non-disability video group and the disability video group. In this case, the assumption of homogeneity of variance was not violated ($F = 0.87$, $p = .355$). The results from the independent samples *t*-test found that participants who watched the disability clip reported significantly higher levels of positive affect ($M = 3.73$, $SD = 1.44$) than participants in the non-disability video group ($M = 1.79$, $SD = 1.15$), $t(63) = 5.97$, $p < .001$.

Negative Affect

An independent samples *t*-test was used to examine differences between experiences of negative affect among the participants in the non-disability video group and the disability video group. The assumption of homogeneity of variance was violated ($F = 14.5$, $p = .00$), and degrees of freedom were adjusted. The results from the independent samples *t*-test found that participants who watched the disability clip reported significantly higher feelings of negative affect ($M = 1.74$, $SD = 1.36$) than participants in the non-disability video group ($M = 1.15$, $SD = 0.40$), $t(39) = -2.41$, $p < 0.05$.

Mixed Affect

Finally, an independent samples *t*-test was used to examine differences between experiences of mixed affect. Similar to other dependent variables, the assumption of homogeneity of variance was violated ($F = 10.24$, $p = .002$), and degrees of freedom were adjusted. The results from the independent samples *t*-test found that participants who watched the disability clip reported significantly higher feelings of mixed affect ($M = 1.48$, $SD = 0.98$) than participants in the non-disability video group ($M = 1.10$, $SD = 0.35$), $t(42) = -2.1$, $p < .005$.

Discussion

This study sought to explore the concept of inspiration porn. It adds to existing literature by examining the relationship between emotional reactions to a disability status and the perception of inspiration. However, this study is among the first to examine inspiration porn within the contexts of an experimental design. The main hypothesis was supported: significant differences between the two groups were found in all dependent variables. Results indicate that slightly higher levels of inspiration and affect averages were reported in the disability video group more so than in the non-disability video group.

Surprisingly, participants that watched the disability video clip reported slightly higher levels of negative affect averages (*Sad, gloomy, depressed, and melancholy*). This could suggest that other factors (outside the scope of this study) such as the tone of voice, disability explanation,

physical appearance, and the visible disability condition (only one arm) might have played a role in the reaction of the participants in the disability video group. Although the results of the disability video group were statistically significant, both groups reported low scores of negative affect averages, indicating overall low levels of negative affect. Furthermore, the results could also indicate the perception people have about disabled individuals. If this is the case, then the concept of inspiration porn aligns with other disability models, such as the supercrip model and the social pathology model.

Limitations

Several limitations to this study should be mentioned. First, this study is a pilot study, and therefore, conclusive results cannot be inferred. Second, the sample size was small, although large enough to conduct parametric tests. Perhaps relatedly, several of the *t*-tests failed the assumption of homogeneity of variances, so the degrees of freedom were adjusted. However, despite this adjustment, all tests remained statistically significant. Third, although the two videos were randomized, the disability video clip had more factors that could have played a role in the inspiration and affect responses of the participants. Fourth, it is worth noting that the majority of the participants were White, which limits the generalization of the study. This study also used self-report measures which can result in social desirability. Lastly, since inspiration porn is a relatively novice term, more information is needed to support a causal relationship. Despite these limitations, this study serves as a preliminary introduction for future research studies.

Future Research Studies

In order to further explore the concept of inspiration porn, future research studies should prioritize the quality and implications of the video clips to control for outside factors that influence the results. In addition, future research should consider comparing more than two groups such as disability video clip, disability video clip with inspiration, non-disability clip, and non-disability video clip with inspiration. Future research should also focus on examining the social implications of inspiration porn within and outside the disability community.

Conclusion

It has been seven years since Stella Young introduced inspiration porn to the public, and while it remains a novice term, prior research on supercrip, the medical model, social pathology model, bionics, and the world of Paralympics has demonstrated the need for change in the way inspiration interacts with disability. An increased focus on words like "overcame," "challenging," and "obstacles" has dominated the perception of disability in advertisements, media, and Paralympic sports. However, research shows that disabled athletes and non-disabled individuals are slowly transitioning away from this one-dimensional mindset, to a better understanding of the disabled community, and the sociocultural barriers that encompass disability.

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Table 1

Affective Responses to the Disability Versus Non-Disability Driving Video Clip

	Condition					
	Disability Video		Non-Disability Video			
Affective Responses	M	SD	M	SD	*t*	*p*
Inspiration Scale	17.85	4.33	11.24	7.50	4.40	.00
Meaningful Affect	3.82	1.39	1.47	.89	-8.27	.00
Positive Affect	3.73	1.44	1.79	1.15	5.97	.00
Negative Affect	1.74	1.36	1.15	0.40	-2.41	.02
Mixed Affect	1.48	0.98	1.10	0.35	-2.11	.04

Starch in Deflocculation: The Effects of Calgon on Ancient Starch Recovery

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Abstract

Calgon, or sodium-hexametaphosphate, is a rapid and inexpensive way to clean artifacts that have recently been recovered from an archaeological site. Soaking artifacts or sediment samples in Calgon is the most common deflocculation process, especially within ancient starch analysis. Calgon baths have been used in the deflocculation stage of starch analysis for decades, most often with a 5% solution. While Calgon is still used in laboratory and field settings today, research suggests that the deflocculant may cause granule damage, changes in morphology, and reduction in starch quantity. The following study tested the effects of Calgon on starch sample size by soaking a mixture of Lycopodium tracer spores and common cornstarch in a 5% deflocculant solution for the rinse, 1-hour, and 24-hour periods. Preliminary results suggest that Calgon can reduce starch recovery by over half through long soaking episodes.

1. Introduction

1.1 Starch Formation and Identification

To better understand how ancient starch is used to interpret diet, behavior, food processes, and more about past civilizations, starch composition and formation must first be examined. Starch granules are polysaccharide polymers that are formed directly in the chloroplasts of both higher and lower plants (Mercader et al., 2018). Starches are produced in plants as a means of immediate food reserve to be used when excess energy is needed. The two starches most important for archaeological analysis are transitory (transient) starch and storage starch. Transitory starches are short-term forms of carbohydrate storage that are produced only when a plant is photosynthesizing; these starches are not as widely available or useful in archaeological analysis because they are very small, lack diagnostic features, and are mostly confined to the leaves of the plant

(Haslam, 2004). Storage starches are often produced in underground storage organs (such as tubers, corms, and bulbs, along with seeds and fruits) to create energy other than that created by photosynthesis.

During photosynthesis, plants produce carbon sugars that are transferred to the amyloplasts, a specialized organelle in higher plants, and converted into amylose and amylopectin, two kinds of polysaccharides. Amylose–a a straight-chained molecule–accounts for roughly 20% to 35% of the mass of starch, though the amount may vary depending on the plant species or breed, while amylopectin–a heavily branched molecule–makes up the backbone of the starch. Together, amylose and amylopectin create the semi-crystalline structure known as the starch granule (Henry, 2020). However, these patterns vary from plant to plant-based on genetic control, creating the variations that allow the identification of starches through morphological features.

The patterns of formation begin at the nucleus, or hilum, with sugar chains laid down around it in concentric layers (Haslam, 2004). As starches grow, carbohydrate chains can be deposited evenly in all directions, creating a starch granule with a centric hilum, or preferentially to one side, creating a starch granule with an eccentric hilum. The sugar layers of the starch alternate between high and low crystallinity, which are visible as darker and lighter bands also known as lamellae in some plant species. It is the alternating layers of sugar chains that create the appearance of the extinction or polarization cross, one of the most important diagnostic features of starch granules, which can be viewed under cross-polarized light (Barton and Fullagar, 2006). Additionally, continual growth within the plant cell can determine shape, surface features, and whether the starch will be a simple or compound structure. Variations related to the presence of lamellae, positioning of the hilum, shape, size, surface features, and more allow for taxonomic discrimination among different plant species (Arráiz et al., 2016).

1.2 Extraction Techniques

Varying techniques and methods may be used to extract starch granule residues from their source materials. While there exist commonly accepted extraction techniques among dedicated ancient starch researchers (Torrence and Therin, 2006; Cuthrell and Murch, 2016), studies continue to test the efficiency, cost-effectiveness, and accuracy of particular extraction techniques against others (Horrocks, 2005; Korstanje, 2006; Louderback et al., 2015). Starch granules may also be extracted from a variety of source materials including, but not limited to, ceramics, stone tools, and sediments. The source material from which the starch residues must be recovered influences the extraction technique and various procedures that may be used. The most common extraction techniques, those involving sonication or deflocculation, are still being tested and revised with multiple source materials in order to retain the largest amount of in-tact ancient starch granules for analyses.

In the process of deflocculation, sediments that contain ancient starch residues are soaked in a strongly charged ion solution, such as Calgon (sodium hexametaphosphate) or sodium polytungstate, to release microbotanical remains from clay particle aggregates (Cuthrell and

Murch, 2016). Exposing clay-rich sediments to the process of chemical deflocculation causes the clay particles to bond to the ions, neutralizing the electrical charges that cause the particles to attract one another and form aggregates. In disaggregating the sediment particles, microbotanical residues are released and separated from the sediment sample through size fractionation. Deflocculation is most commonly used to recover ancient starch residues from sediment samples but may have the potential to recover microbotanical remains from porous artifacts under the right conditions.

Deflocculation is a common technique among ancient starch researchers and has been well documented in numerous studies and experiments. Torrence and Therin (2006) published a study in which multiple chemical solutions were used as deflocculants to find the ideal method for extracting starch from sediments. Using the heavy density liquids caesium chloride, sodium polytungstate, and sodium hexametaphosphate. Torrence and Therin deflocculated sediment samples in each solution for a week. Sampling and analysis were repeated at multiple time intervals, allowing for a more accurate recording of possible changes in starch morphology. The results showed that sodium polytungstate does not appear to have a corrosive effect on starch at normal room temperature while caesium chloride and sodium hexametaphosphate both damaged starch morphology and quantity. Of the two, sodium hexametaphosphate was shown to be the most corrosive, with only 35% to 59% of original starch granules remaining after just 5 hours in the solution. Given these results, Torrence and Therin suggest that the potentially destructive effects of chemical deflocculation be balanced against the benefits of the process.

However, several other studies, including that of Cuthrell and Murch (2016), have utilized deflocculation with significantly less loss to starch samples and less damage to granule morphology. In the case of Cuthrell and Murch, exposure to a 4% sodium hexametaphosphate solution for 24 hours did not consistently cause detectable changes in the morphology of potato or wheat starches. While maize starches used in the experiments recorded an increase by about 0.2% in convexity and 1.4 to 1.9% in shape factor, it was suggested the physical changes resulted from experimental treatment rather than the deflocculation process itself. Conflicting conclusions regarding the deleterious effects of deflocculation widen the gap in ancient starch literature and must be addressed further.

1.3 Use of Calgon

Calgon, or sodium hexametaphosphate, is a rapid and inexpensive way to clean artifacts that have recently been recovered from an extraction site. Popularized as an inexpensive and quick way to process samples in the 1970s, Calgon baths have been used in the deflocculation stage of starch analysis for decades, most commonly with a 5% percent solution. The most standard procedure is as follows: fill buckets or other containers with 40 grams per liter aqueous solution of Calgon; place artifacts into the bath and let soak for 12 to 24 hours, depending on size; strain the artifacts from the solution, and rinse the materials with pure water (Neumann and Sanford, 1998).

While Calgon is still commonly used in

laboratory and field settings, some research suggests that the deflocculant causes granule damage, changes in morphology, and reduction in starch quantity. A study of the effects of different chemical solutions on the morphology of various starch types conducted by Cuthrell and Murch (2016) revealed Calgon did not consistently cause morphological damage to potato or wheat starches but may have had minimal effects on the size of maize starches. Contrastingly, a publication from Kaur and Fanourakis (2018) concluded that Calgon significantly decreased the percentage of clay-size material when used as a dispersing agent for hydrometer analyses. Though this study does not pertain to ancient starch analysis directly, it exposes a gap in the ancient starch literature: different concentrations of Calgon should be tested to better understand the effects it may have on starch granule morphology. The commonly accepted 5% solution of sodium hexametaphosphate has caused "no noticeable" damage in some studies while also causing "detectable" and "significant" damage in others (Cuthrell and Murch, 2016; Neumann and Sanford, 1998); the discrepancies between these results will be further explored to strengthen the findings and conclusions of numerous studies and publications.

2. Methods

Eight *Lycopodium* tracer spores, each containing 19,855 spores/tablet, were dissolved in a 10% hydrochloric acid solution. The dissolved *Lycopodium* tablets were then centrifuged at 3300 rpm for 3 minutes, decanted, and vortexed. The Calgon-Starch solution was prepared by mixing 0.2g of commercial cornstarch (Argo, Inc) with 100 ml of a 5% weight-by-volume Calgon solution. The *Lycopodium* tracer spores were added to the Calgon-Starch solution, signaling the start of the timed soakings. 5ml of the Calgon-Starch-*Lycopodium* solution was immediately added to seven separate test tubes to designate the following soaking periods: rinse, 5-minute, 10-minute, 30-minute, 1-hour, 2-hour, and 24-hour. Each test tube was centrifuged at 3300 rpm for 3 minutes at its respective timestamp, then decanted and vortexed. Slides were prepared following a 1-to-1 ratio of the sample solution and glycerin. For this preliminary study, only the rinse, 1-hour, and 24-hour samples were included in data collection due to starch density and time constraints. The remaining 5-minute, 10-minute, 30-minute, and 2-hour samples will be counted and further interpreted alongside current data.

Slides were analyzed under brightfield and polarized light microscopy with an OMAX Lab LED binocular microscope at 200-600x magnification. Starch and *Lycopodium* spores were counted simultaneously, with at least 100 *Lycopodium* spores counted in each sample, to understand the ratio of starch to control spores over soaking time in Calgon. Data was collected manually with the human eye and a mechanical counter.

3. Results

Results indicate that starch recovery can decrease by over half when soaked in Calgon for a 24-hour period. 624,056 starch granules were counted in the rinse sample, along with 310 *Lycopodium* tracer spores, resulting in a starch:*Lycopodium* ratio of 2,013.084. The 1-hour sample had 120,659 starch granules present and

Lycopodium spores were counted to 106, creating a starch:*Lycopodium* ratio of 1,138.292 – nearly 50% less than the rinse period. The final sample from the 24-hour soaking contained 84,857 starch granules with 100 counted *Lycopodium* spores, producing a starch:*Lycopodium* ratio of 848.57 – more than half fewer than the rinse. Table 1 summarizes the results from each of the samples with their respective starch, *Lycopodium*, and ratio numbers. Figure 1 depicts samples of the starch:*Lycopodium* ratios from the rinse sample in 10x magnification. Figure 2 depicts the same sample in polarized light.

Table 1

Time (h)	Starch Quantity	*Lycopodium* Quantity	Starch-*Lycopodium* Ratio
Rinse	624,056	310	2,013.084
1	120,659	106	1,138.292
24	84,857	100	848.57

Figure 1

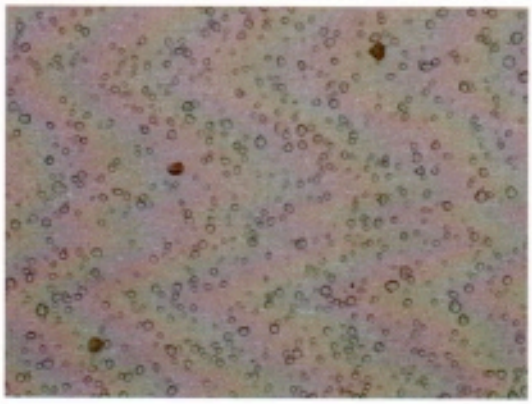
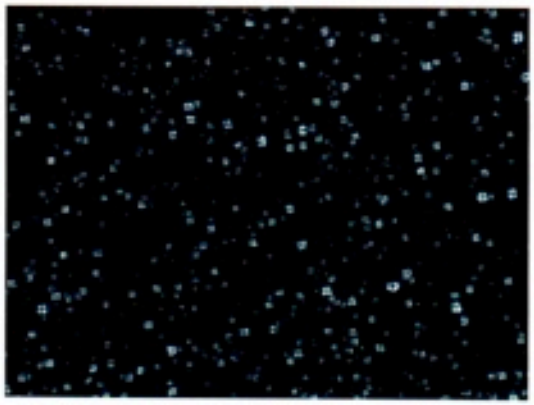


Figure 2



4. Discussion

The amount of time in which starch is left to soak in Calgon affects recovery. Results from the experiment show that starch sample sizes may decrease by over half when left in Calgon for 24-hours, an amount of time common for deflocculation in the field of archaeology. The significant decrease in starch recovery from the rinse to the 1-hour samples suggests that ancient starch researchers hoping to extract as many starch granules as possible should soak source materials in Calgon for less than 1 hour. The continual decrease from the 1-hour to the 24-hour further suggests that prior deflocculation with Calgon for the standard 24-hour period has harmed starch recovery in previous experiments and studies.

Starch density in this experiment was incredibly high, with granules unevenly dispersed across slides and a human-based counting system utilized; as such, granule abundance and human error may have impacted data collection. To further understand the effects of Calgon on starch recovery, additional studies should be conducted with more controlled measures of starch distribution and more efficient data collection methods. Further research should also observe other starch taxa, such as potato or wheat starches, to test varied reactions of starch to Calgon.

5. Conclusion

Deflocculation with Calgon has previously proven to be an inexpensive and efficient way of cleaning specimens recovered from archaeological sites. However, experiment results suggest that soaking artifacts or sediment samples in Calgon for 1 hour to 24 hours can significantly reduce starch recovery, implying potential reduction of starch quantity in previous ancient starch research. To better understand the effects of Calgon on starch recovery and the consequences of timed soaking periods, further data will be collected from soaking samples under the 1-hour mark, such as the 5-minute, 10-minute, and 30-minute samples.

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The Impact of Youth Sports on Physical Fitness into Adulthood

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Abstract

Childhood sports are not available to all youth, and sports education is not prominent in many schools. Failure to promote childhood sports may lead to higher health risk factors in adulthood (i.e., cardiorespiratory disease, obesity). This study aimed to determine the long-term impact of participation in childhood sports on the continuation of physical activity and cardiorespiratory performance into adulthood. The hypothesis stated that adults with a youth sport(s) background will have a higher VO_2 max than adults with no sport(s) background. A total of 34 healthy young adults, age 18 years and older (M=22.94 + SD=4.07) participated and were grouped, (1) Non-sport youth, (n=15, age (yrs)(m=22.93 +sd=3.79) and (2) Sport youth (n=19, age (yrs)(m=22.94 +sd=4.38), based on an activity questionnaire and then completed a 1.5-mile run/walk submaximal VO_2 test. A one-way ANOVA was administered and determined young adults who played youth sports (m=38.20 + sd=9.56) have a significantly higher submaximal VO_2max, $F(1,32)$= 9.68, p= .01, ηP^2= .23, observed power= .85, compared to young adults who did not participate in youth sports (m=28.79 + sd=7.59). A Regression Analysis further indicated participation in youth sport was a moderate predictor, R= .64, p= .01 of an adult's continuation of physical activity. The findings suggest that participation in childhood sports may have a beneficial impact on continued physical activity and cardiorespiratory fitness into adulthood. Further research is necessary to identify the resources available as well as barriers relating to participation in youth sport. Establishing a better understanding may also be beneficial in the promotion of health into adulthood.

Introduction

Engaging in sport and fitness may reduce the likelihood of disease and other health issues. Sport and fitness have been shown to reduce health concerns such as obesity while stimulating cardiac function.[1,2] To promote such healthy benefits, participation in 150 minutes of physical activity per week is recommended,[3] and sports are a popular way of exercising.[4] Engaging in sports is fun and team-building in nature.[5] Unfortunately, not every child has access to sports participation from a young age due to monetary limitations, time constraints, or other factors. Prior studies have shown that lifestyle habits formed as a young child (e.g., smoking, nutrition) often influence lifestyle habits into adulthood.[4] However, few studies have investigated whether engagement in sport and fitness in youth creates a long-term commitment to fitness as an adult.

The purpose of this study was to determine the long-term effect of participation in childhood sports of physical activity and cardiorespiratory fitness in adulthood. The following review of literature further explores the impact of youth sports in general, while outlining similarities and differences between those with different fitness backgrounds.

Assessing Cardiorespiratory Fitness

Cardiorespiratory fitness (CRF), as defined by Raghuveer and colleagues (2020), provides the body with oxygen to produce the energy needed during physical activity via the circulatory and respiratory systems. CRF affects physical well-being, mental health, and educational attainment, especially in youth.

CRF is a useful measure of one's overall long-term health and can be used to estimate mortality rates in adults.[6] This is important because cardiovascular disease is the leading cause of mortality worldwide.[2] To measure CRF, heart rate is typically one of the biofeedback measures monitored because it has a linear relationship with exercise intensity.[6] For example, as exercise intensity increases, one's heart rate typically increases. However, the more physically conditioned an individual becomes (e.g., healthy CRF system), the heart rate increases slowly compared to an intensity that is unconditioned of similar age.[2] Prior studies have also shown that an individual's resting heart rate is often associated with CRF levels. A physically conditioned person commonly presents a lower resting heart rate than an unconditioned person.[2] Meaning, an unconditioned person's heart, at rest, must beat more times per minute (higher resting heart rate) in order to meet the oxygen demands of the body.[2] During exercise, heart rate response leads to a greater demand on the heart and the entire system as a whole.

Assessment of VO2max Compared to Submaximal VO2max

Each individual has a maximum amount of oxygen they can "uptake during intense exercise"[7] that is measured through a VO2max test. "The higher a person's VO2max, the more aerobically fit the person is".[7] A VO2max test is the most accurate method of assessing CRF. However, a submaximal VO2 test can be used to estimate VO2max and determine CRF level.[6] It does not require exercise at maximum intensity, but rather, a submaximal or lower intensity.[6] A submaximal VO2 test is capable of predicting performance

capacity while reducing the increased risk of angina and other health issues.[8]

The 1.5-mile run/walk test is a submaximal VO2 test that is commonly used because it allows a person to perform at one's own comfort level and introduces little risk. A person is permitted to walk, jog, and run as desired with the understanding that the goal is to complete the 1.5-mile run/walk in as short of time as possible.[6] Additionally, the 1.5-mile run is an accepted staple in the assessment and training protocol of many athletes, particularly when focusing on cardiorespiratory-based performance.[6] Compared to other assessment methods used for calculating the submaximal estimated VO_2max (e.g. step test, stationary bike test), the 1.5-mile run is more relevant because running longer distances is prominent in many sports. To calculate a person's estimated VO2max a standard equation is used based on time lapsed along with maximum heart rate at completion.[6] The final value calculated is a prediction of one's VO2max and correlates to overall CRF status.

Impact of Fitness Habits on Health

In addition to the benefits exercise has on resting and exercise heart rate as previously discussed, exercise has a beneficial impact on a person's cholesterol levels, specifically high-density lipoproteins (HDL), and low-density lipoproteins (LDL).[9] Chronic high cholesterol is linked to coronary heart disease. Specifically, high levels of LDL-C indicate a surplus of lipids in the blood which increases the risk of cardiovascular disease. The risk of a heart attack and ischemic stroke are greatly lowered with reductions in LDL-C, which can be attained with healthy fitness habits such as exercise.[9] LDL's are impacted most by exercise, particularly when combined with nutrition and weight loss.[9] Physical activity is also shown to increase HDL-C levels. Higher HDL-C levels indicate a healthy cardiovascular system. HDL-C transports unwanted LDL-C and VLDL-C lipids to recycling and disposal, and aerobic exercise can help improve the presence of HDL-C levels.[9]

A Review of Impact on Sport in Youth

Measuring Physical Activity Levels

Dennison and colleagues aimed to determine any predictors in children that affect their physical activity level and exercise habits as adults. Using the Youth Fitness Test results of 740 boys from the Baltimore County Public School system, they were able to compare those results to a follow-up study.[11] The Youth Fitness Test consisted of a 50-yard dash, the standing broad jump, maximum sit-ups, maximum pull-ups, the shuttle run, and a 600-yard run. Participants were aged 10 to 18 at the time of their fitness test and aged 23 to 25 at the time of the follow-up study. Only 453 completed the follow-up questionnaire. Based on their questionnaire answers, the adult groups were either categorized as physically active or inactive. Those who reported they exercised twice a week for two or more hours were categorized as physically active, and those who reported they exercised less than twice a week were considered inactive.

Through statistical analysis, Dennison et al. found that the physically active adults tended to have higher standardized youth fitness scores than the inactive adults, specifically in the 600-yard run as it has a strong correlation to cardiorespiratory

fitness. They also found that there was not a significant difference in participation in high school sports for the two adult groups. However, 70 percent of youth drop out of sports by age 13 according to the National Alliance for Youth Sports.[12,13] It also did not take elementary and middle school sports into account. While the paper concludes that physically active children are more physically active as adults, there is not enough evidence to conclude youth sports play a role in this.

A similar study measuring youth fitness from Cohen et al. used accelerometry and direct observation to examine the physical activity levels of children playing youth sports and how it may reduce childhood obesity rates. The participants were 167 children from two organized youth soccer programs aged seven to thirteen years old.[5] The accelerometry devices they used were the ActiGraph's GT1M and GT3X motion sensors. These sensors were worn on an elastic waist belt and measured physical activity in counts and recorded when the children were participating in high-intensity exercise. Researchers directly observed the coach and a median of five children per practice for 10 minutes per player. Incomplete observation periods occurred when behavioral issues, injuries, and other interruptions happened. Researchers found that much of the children's time spent during practice was sedentary for one reason or another, such as spending a large amount of time receiving instruction or discipline. While they conclude that youth sports are active, Cohen and colleagues suggest improvements should be made in coaching styles that can better motivate children and develop a longer-lasting commitment to fitness to reduce trends of obesity.

Coaches of organized youth sports teams can help children increase their long-term commitment to fitness and reduce obesity. Children with obesity are more at risk of being obese as adults, but good time management during practices can help prevent this.[14] The studies from Dennison et al. and Cohen et al. were similar in that they measured children's physical activity levels, but they did so by using different methods. The former measured how the children performed six specific exercises and the latter measured the frequency and intensities of physical activity. Both methods were valid in obtaining data and results for their respective studies.

Another study by Dohle and Wansink surveyed 712 healthy U.S. males who passed a rigorous physical exam meant to screen potential soldiers for WWII in the 1940s. The original random sampling included 7,500 potential participants, but the vast majority were unable to complete the questionnaire. Due to death and incapacitation, the mean age of the participants was 78 years old. This study aimed to determine the temperaments and upbringings that predict if a "healthy 25-year-old would become a fit 75-year-old."[15]

Participation in varsity sports and the number of packs of cigarettes smoked monthly in 1946 were the most significant predictors related to physical activity. Participants were also asked the number of times they visited their doctor in the last year. Individuals who played high school varsity sports reported 50 years later that they visited their doctor less than others. These participants maintained the same level of fitness into adulthood that they did in their youth, so

they had fewer overall health issues in older age. This assumes that the participants continued to be physically fit even after graduating from high school and varsity sports. On the other hand, heavier smokers visited their doctors more often due to poor health management.

Fraser and colleagues' follow-up study had the goal of figuring out "the extent to which muscular fitness phenotypes of strength and power track from youth to adulthood."[16] Unlike Dennison and colleagues' study, which used mainly cardiovascular measures to calculate fitness levels, this study used strength and power measures. The researchers analyzed the public information containing the field results of Australian youth aged 9, 12, and 15 years old from 1985. In 2006, 623 of them, with a mean age of 19 years old, attended the follow-up to remeasure their data. They completed another muscular strength fitness test, along with BMI, and waist circumference measurements.

With the use of a dynamometer, the 623 participants' grip strength of each hand was measured, in addition to shoulder and leg strength. These five measures were adjusted according to body mass, age, and sex of the participant. On average, males have more muscular phenotypes than females in youth and adulthood. They had consistent results for leg strength in youth to adulthood, while females had more consistent results in all upper body strength measures. This data suggests that youth with good muscular strength will likely have good muscular strength in adulthood. It may also be correlated with a commitment to youth sports because of the expectation to be at a high level of muscular strength. It can be said that if muscular strength tracks strongly from youth to adulthood, the physical benefits from playing youth sports also tracks strongly to adulthood.

Sports Specialization and Health Status

Youth sports are known to have a wide variety of physical benefits into adulthood, but they can also be detrimental in some cases. Brenner et al. analyzed the sports programs' models of policies surrounding sports specialization and competition-specific training. Specialization is focusing on only one sport, often year-round in the hopes of achieving an elite level. Athletes typically start young, and up to 27 percent of youth specialize in one sport, according to the 2008 National Council of Youth Sports.[17] Sports specialization that occurs before puberty is often the result of parental and coach influence which is likely due to the goal of achieving a sports scholarship or pursuing a professional career.[13] This may be detrimental to an athlete's future health because 46 to 50 percent of athletic injuries result from overuse.[18] Intensive youth training within a specialized sport may cause issues in musculoskeletal development, nutrition, and maturation. These variables directly affect adult health. Brenner and colleagues suggest that, if implemented properly, youth sports can provide great benefits. Early diversification in sports, for example, increases motivation. Children are allowed to select the activities they enjoy rather than just training specifically to compete. In addition, sports dropout rates are lower if youth are given the chance to play multiple sports. This may further encourage them to continue their healthy physical habits into adulthood.

Brenner et al. compiled data from the American Academy of Pediatrics (AAP) and

the National Collegiate Athletic Association (NCAA). Their analysis of different models helps to explain the effects of youth sports on adult health when they are implemented in different ways. Provided that athletes remain consistent in their participation in sports throughout their youth, they will tend to report higher levels of physical activity over the years. Logan et al. examined how participation in organized sports affects the health status of young adults. They conducted a follow-up study after 12 years based on a prior study with the 1243 subjects.

Only a partial number of participants fully completed the survey that asked questions about health history, school sports participation, when they stopped playing sports, and sport and non-sport-related injuries. The original study also contained information about the children's "body mass index (BMI), waist circumference, systolic and diastolic blood pressure, total cholesterol and high-density lipids (HDL), low-density lipids (LDL) and triglycerides, fasting glucose, and insulin."[18]

The results provide evidence that participation in sports from middle school to college is associated with a lower BMI and waist circumference as well as higher HDL cholesterol levels as compared to individuals who did not play organized sports at all. Since there is a strong association between BMI and cardiometabolic risk, youth sports may reduce the risk factors which are more prominent in adulthood. In the follow-up study, participants who reported playing organized sports throughout their school years also reported significantly higher physical activity levels as adults.

The studies from Brenner and colleagues and Logan and colleagues go hand-in-hand; the former predicts that late specialization in sports reduces dropout rates, and the latter provides evidence that participants who do not stick with their organized sport have lower levels of physical activity and higher cardiometabolic risk.

Purpose

This study's purpose was to determine if there was a significant difference in submaximal VO2 between adults who played youth sports and adults who did not play youth sports. The study further sought to determine if participating in youth sports impacted participation in physical activity in adulthood.

Significance

Cardiovascular fitness is not only important for sports but also to maintain active daily living and a state of health. Exercise is associated with higher HDL-C levels, improved cardiac function, and lower blood pressure, which reduce the risk of developing cardiovascular disease—the leading cause of mortality worldwide.[2] Establishing a better understanding of whether the promotion of youth sport influences healthy lifelong behaviors may beneficially impact overall societal health. For example, the risk of obesity may be reduced which may reduce mobility issues and the number of hospital visits per year. While youth enjoy more physical and social skills such as teamwork, adults are more likely to maintain their independence.

Exercise is beneficial because it helps to manage stress which is known to contribute to health problems such as high blood pressure or heart disease.[19] With further research, support

may be provided to identify additional resources for promoting youth sport and increase the education about its importance in maintaining healthy levels of fitness across a lifespan. It will also support the encouragement of youth sports and promote a more active lifestyle in adulthood for a better quality of life and reduced risk of disease.

Methods

Participants

Thirty-five healthy young adults, aged 18 years and older, were recruited for this study. Flyers, technology-based communications, and word-of-mouth were used as recruitment strategies. Each volunteer completed a WSU IRB-approved informed consent form prior to participation followed by the completion of a Physical Activity Readiness Questionnaire (PARQ+). If a participant met any of the exclusion criteria such as a neurological, muscular, orthopedic, or cardiovascular condition that may negatively impact performance, they were dismissed from participating. Participants were grouped, (1) Non-sport Youth (n=15, age (yrs)(m=22.93 +sd=3.79) and (2) Sport Youth (n=19, age (yrs)(m=22.94 +sd=4.38) following the completion of a Fitness Questionnaire (see Appendix C). The fitness questionnaire included self-reported responses regarding one's level of physical activity and participation in sport-related events as a youth and now. Although all thirty-five participants were included and participated in the study, one participant withdrew during the 1.5-mile run/walk assessment due to fatigue.

Procedure

Data collection was administered in the Wichita State Human Performance Laboratory and the Heskett Center Gymnasium/Track. After completion of the intake questionnaires, the participant's age, gender, height, and weight were recorded. A polar heart rate monitor chest strap was fitted to record the participants' heart rate at rest, during exercise, and post-exercise recovery. Each participant completed a series of dynamic stretches including buttock kicks, toe-touch kicks, over-under steps, and knee hugs for 3-5 minutes to warm up and reduce the risk of injury. Following the warm-up, the participant was asked to complete a 1.5-mile run/walk test in the fastest time possible. The 1.5-mile run/walk test consisted of a total of 11 full laps in lane 6 on the Heskett Center indoor track. The participant's duration of time to completion and his/her heart rate at the end of the 1.5-mile run/walk test was recorded. Following the test, the participant was asked to cool down while being monitored for 15 minutes to assure proper recovery prior to leaving. This study was a one-time session that lasted approximately 1-hour per participant.

Measurements

The recorded duration of time it took a participant to complete the 1.5-mile run/walk test was used to calculate his/her estimated VO_2max. The following is the standardized equation used for this test:

Estimated VO_2max ($ml \cdot kg^{-1} \cdot min^{-1}$) = 3.5 + 483 / (time in minutes).

Statistical Analysis

Statistical analysis was conducted using the Statistical Packages for the Social Science (SPSS) version 23.0 with a level of significance set at a ≤ 0.05 and a confidence level of 95%. All test variables were evaluated for normality of distribution.

A one-way analysis of variance (ANOVA) was administered to determine whether there was a significant difference in the dependent variables (estimated VO_2max) between individuals who participated in physical activities and sports in youth and individuals who did not participate in physical activities and sports in youth. A regression analysis was also administered to determine whether participation in youth sport was a reliable predictor of an adult's continuation of physical activity. The critical alpha level for all analysis was set at $p \leq 0.05$.

Results

The one-way ANOVA with homogeneity assumed reported on average that the sport youth group had significantly higher estimated VO_2max measures $F(1,32)= 9.68$, $p= .01$, strong effect size $\eta P^2= .23$, and observed power ($\beta=.85$) than the non-sport youth group as shown in Table 1.

Table 1. Group *Sum of Participants (N), and Means and Standard Deviations* of Sport Youth and Non-Sport Youth Estimated VO_2max

Group	N	Mean ± SD
Sport Youth	19	38.20 ± 9.56
Non-Sport Youth	15	28.79 ± 7.60
Total	34	34.05 ± 9.84

A bivariate regression analysis further revealed that participation in youth sport was found to be significant $F(1, 32)= 22.45$, $p= 0.01$, with a moderate relationship, $r= 0.64$ on predicting the continuation of physical activity into adulthood. The regression prediction equation is as follows:

Adult physical activity= -0.642(youth activity) + 2.44

With 41% of shared variance, $r^2= 0.41$, Figure 1 indicates an individual that participated in youth sports was more likely to continue with physical activity in adulthood compared to an individual that did not participate in sports in youth.

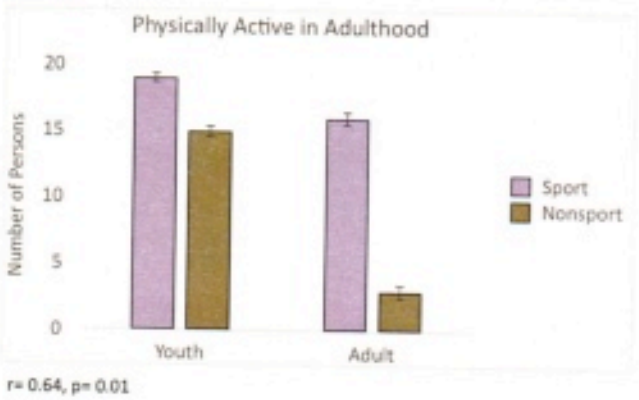

Figure 1. *Number of Physically Active Adults Based on Youth Sport Participation*

Discussion

The purpose of this study was to explore whether adults with a sport or a non-sport background in youth had significantly different estimated VO_2max measures. Additionally, the study sought to determine the long-term impact of participating in youth sports on an adult's continuation of physical activity and general cardiorespiratory fitness.

The findings, as shown in Table 1, supported

the expected outcome that adults with a youth sports background had a higher average VO_2max than adults without a youth sports background. The average score differed by almost 10 ml · kg^{-1} · min^{-1} and can be generalized by stating that participating in youth sport(s) beneficially influences cardiorespiratory fitness in adulthood. In addition, the regression analysis found that sports youth were more likely than their non-sport counterparts to be physically active as an adult. There were some non-sport youth who later became physically active as adults, but the number of sports youths who remained in physical activity as adults is greater. The findings of this study align with those from a study by Frech's which found that healthy habits learned in childhood are more likely to be continued in adulthood.[4]

Our findings indicate that involvement in youth sport benefits overall cardiovascular health as well as one's continuance of cardiovascular fitness as an adult. This is important because poor cardiovascular fitness is commonly used to estimate morbidity rates in adults.[20] By encouraging physical activity and fitness from youth, the risk of disease may be reduced and quality-of-life improved. The prevention of illness is preferred over intervention because it is more difficult to treat a disease than to take the precautions to prevent it.[21] Furthermore, comorbidities such as type 2 diabetes or high blood pressure are reduced if action is taken early on.[5]

Based on the findings of the current study, promoting the importance of youth sport through school education, sports teams, and health professionals is essential for efforts of disease prevention. In addition, the skills learned from youth sports such as teamwork and motivation carry into adulthood and may provide life-long health benefits.[17] It is a common belief that health benefits do not differ based on the age one starts exercising, but the benefits are shown to be far greater when beginning in childhood.[18] Childhood sports are important because people learn to build dedication to their teams and to themselves in these early settings. From here, adults can build on this commitment by maintaining healthy fitness habits.

One limitation of the current study was the measurement of VO_2max. The gold standard for assessing VO_2max is treadmill or cycle ergometer testing with a pneumotach flow meter or Douglas bags to determine oxygen consumption and basal metabolic rate.[22] This equipment, though costly, delivers the most accurate output measures. Additionally, VO_2max testing will take an individual to their maximum intensity threshold, while the submaximal VO_2 1.5mile run/walk test used in this study required only a submaximal intensity level. This submaximal VO_2 test, however, is a reliable and validated method of assessing VO_2max,[23] and it can be assumed that the results of the current study will be a close estimate to one's true VO_2max because of the study's high confidence level.

Conclusion

In order to promote youth sports with the purpose of improving physical health and continuing fitness into adulthood, coaches and health professionals should advocate in schools for the importance of staying physically active and emphasize health benefits. Before and after

school activities can be structured to provide more opportunities for learning as well as resources to promote movement and activity. Since youth sports have been found to impact healthy VO_2max measures in adulthood, various sports may also be introduced to stimulate interest and encourage participation in organized sports. Programs should encourage participation and nurture relationships to show that physical activity is enjoyable and gratifying. Fun experiences during youth sports encourage greater physical activity into adulthood.[5] With time, exposure to sports and physical activity will lead to healthier cardiorespiratory fitness measures and improved quality of life as an adult.

In conclusion, participation in youth sports is shown to beneficially impact an individual's cardiovascular fitness into adulthood. Furthermore, actively participating in sports as a youth is influential to the likelihood of remaining physically active as an adult. These findings may help to establish a better understanding of the importance of sport in youth for the promotion of health in adulthood.

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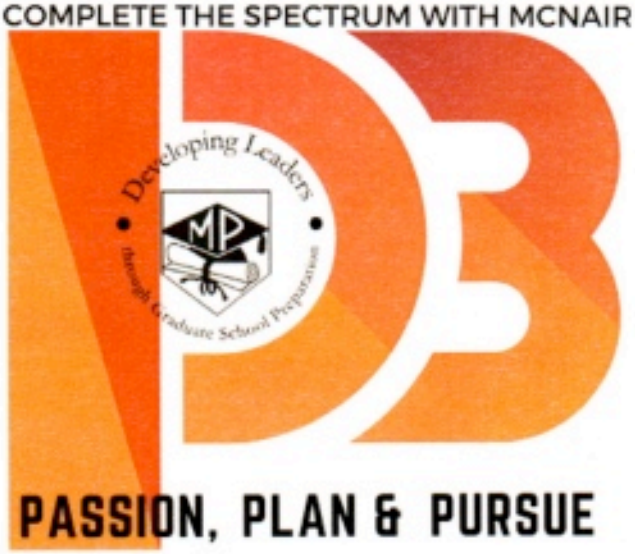
COMPLETE THE SPECTRUM WITH MCNAIR



PASSION, PLAN & PURSUE

Research Summaries

Preparation and characterization of multifunctional nanofibers containing Polyacrylonitrile and Polyethylene Glycol

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Introduction

In 2020, numerous natural disasters such as the Australian and California fires were linked to global warming. Carbon dioxide is one of the main gases that provoke global warming due to the absorption of sunlight and solar radiation. There is an increasing amount of CO2 being emitted worldwide, particularly in cities experiencing economic growth. In order to decrease the amount of CO2 in the atmosphere, and create a more sustainable way of producing fuel, this project is focused on the absorption of carbon dioxide in the atmosphere through multifunctional nanofibers using the electrospinning method. The capture of greenhouse gases such as CO2 has been studied extensively. However, there is a lack of scholarly research that discuss how to store CO2 for later use or how to convert it into biofuel.

Conversion of CO2 into Biofuels

Overcoming the market for fossils and batteries is a challenge. The idea of converting greenhouse gases into fuel is innovative, yet there are a lot of industries opposed to it. Sources of energy like batteries and fossils will not be replaced anytime soon because they are accessible in one form or another in almost all regions of the world; second, humankind has learned how to use them effectively to provide energy for a myriad of applications at every scale; third, they are without equal hard to replace as fuels for transportation because they are portable and contain a considerable amount of stored chemical energy.

After considering these variables of factors, it becomes apparent that our energy supply for the foreseeable future will be based on fossil-derived hydrocarbon fuels, with the unavoidable production of CO2 (Jiang, Z. *et al, 2010*). Our biggest challenge is realizing that we will not be able to eradicate greenhouses emissions in a near future, but rather this would be a long-term solution. It is also important to realize that if we want to mitigate the deterioration of our climate, we need support from big corporations and governments.

A beneficial scenario that could utilize a considerable fraction of the captured CO2 would be to convert it into a fuel for transportation, provided efficient methods for carrying out the conversion via a renewable energy source can be developed (Leung, D. *et al, 2014*). The potential to convert renewable energy from carbon dioxide is limitless. Our hope is that we can develop a plan where this can be done on a larger scale soon.

This research paper presents the FTIR, Water Angle contact test, and SEM test for different compositions of nanofibers composed of Polyacrylonitrile (PAN) and Polyethylene glycol (PEG) made with electrospinning technology.

Significance

Climate change is directly affected by the number of gases trapped in the atmosphere, which is growing consistently as economies grow. According to NASA, there are 0.03 percent greenhouse gases in the atmosphere which include carbon dioxide, methane, and ozone (Buis, A., 2019). Scientists and engineers are coming up with new ways to reduce these greenhouse gases, and one of them is by capturing carbon dioxide before it is released into the atmosphere.

One research study conducted by ACS (American Chemical Society) Sustainable Chemistry & Engineering found that in the reduction of CO2 into methanol there are kinetic and thermodynamic challenges, such as electrocatalyst is required that enhances the selectivity to get CH_3OH and suppresses the HER (Zaman, W. *et al*, 2015). HER (Hydrogen Evolution Reaction) affects the formation of methane because this is related to the levels of pH in electrolytes. This research is the first step towards the creation of a biofuel that does not present as many challenges.

This project utilizes the electrospinning technique to fabricate nanofibers and has proven to improve toxic gas detection due to the high specific surface area and small pore size. These characteristics provide higher storage capacity (Meraz-Dávila et al 2021). The fibers made in this project are made up of PAN and PEG; PAN has been widely used to produce electrospun nanofibers because of their porosity and large surface area (Shi, Xiaomin, et al, 2015) which facilitate the capture of CO2. Figure 1 shows a schematic of how the electrospinning process is set up. Aluminum foil was used as the receiver of the nanofibers after it was ejected from the needle at 2ml/hr and charged with a 25kv voltage coming from the Direct Current (DC) supplier.

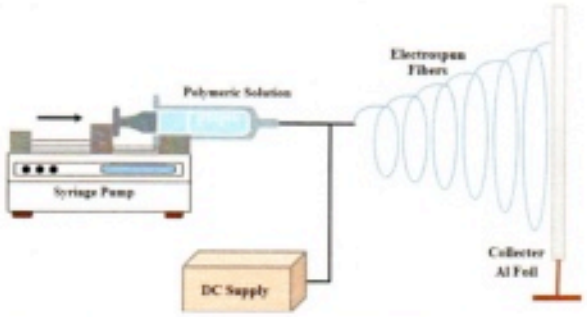

Figure 1. Electrospinning process (R. Asmatulu, 2016)

Methodology

Preparation of nanofibers

Synthesis of the PAN/DMF solutions was mixed for 3 hours at 50 degrees Celsius. After mixing, the solutions were transferred to syringes with a 20G size needle. The solution was electro-spun at 2 ml/hr. and a voltage of 25 kV. The receiver was a layer of aluminum paper. Once the nanofibers were obtained, they were left to dry out overnight at ambient temperature.

For this research, a quantitative approach was followed. Two samples of each solution were made to measure data.

Each sample went through the following tests:

1) Fourier Transform Infrared Analysis
2) Water contact angle tests
3) Scanning Electron Microscope

Results

Fourier-transform infrared spectroscopy (FTIR)

Fourier-transform infrared spectroscopy (FTIR) is a procedure that uses an infrared spectrum of absorption for solids and, in some cases, liquids and gases. The purpose of this test was to find out how much light a sample can absorb for a different array of wavelengths. Figure 2 shows the stacked view of the FTIR test for each nanofiber composition. The left axis of the graphs represents the percentage of transmittance versus the wavelength number at that point.

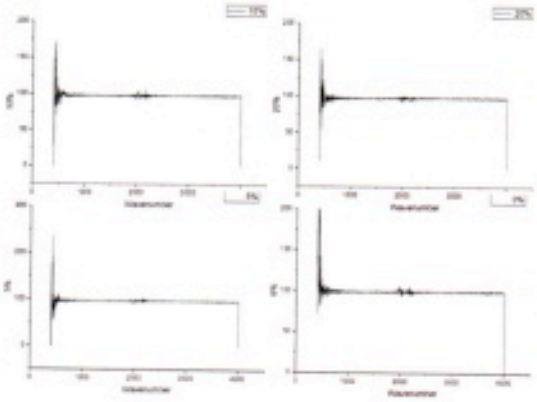

Figure 2. Stacked view (left to right, top and bottom) of FTIR test for 10, 20, 5, 0 % weight PEG in respect to PAN.

The FTIR absorption spectra of PAN without any inclusions — 1 gm of PAN was dissolved in 10 ml of Dimethylformamide. This composition showed strong peaks in the 500-800 regions which correspond to alkanes (C-H bonds) and the functional group of nitriles (C-N bonds), respectively. There are medium peaks in the 3500-4000 which correspond to N-H bonds.

The FTIR spectra for a solution composed of 1 g of PAN, 10 ml of DMF, and 0.05 g of PEG (or 5% PEG) showed peaks that demonstrated carbonyl bonds C-O, nitriles C-N, N-O, alkane methyl group C-H, and bending alkene C-C.

The FTIR spectra for a solution composed of 1 g of PAN, 10 ml of DMF, and 0.05 g of PEG showed strong peaks in the 500-800 region; this means there are aromatics present in the nanofiber. There is also a presence of nitrogen groups N-N-N, nitriles C-N, N-H, and alkanes C-H.

The FTIR spectra for a solution composed of 1 g of PAN, 10 ml of DMF, and 0.1 g of PEG showed strong peaks in the 500-800 region mean there are aromatics present in the nanofiber. There is also a presence of nitrogen groups N-N-N, nitriles C-N, N-H, and alkanes C-H, similarly to PAN + 10% PEG.

Water Angle Contact Test

Water Angle Contact Tests were conducted in at least one of the two fibers in the presence or absence of PEG at 0, 5, 10, and 20% weight in respect to PAN. Figure 3 shows the schema for determining the absorptivity in surfaces used to determine the type of surface each solution had.

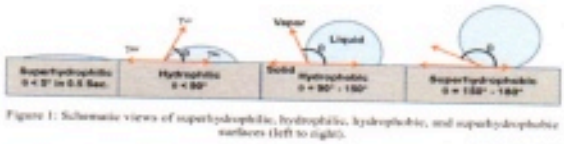

Figure 3. Schematic views (from left to right) of superhydrophilic, hydrophilic, hydrophobic, and superhydrophobic surfaces.

Figure 4 shows the water angle contact for a nanofiber composed of only PAN. PAN by itself is not as hydrophobic as when it is combined with polymers such as PEG. Figure 9 was taken 0.6 seconds after the droplet was released.

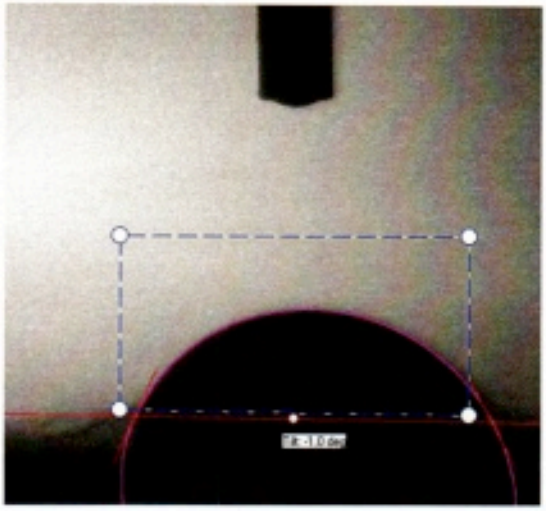

Figure 4. Water contact angle test image of PAN nanofibers

The water angle contact test for a nanofiber composed of PAN and 20% PEG showed that the fiber was superhydrophilic. The water droplet was absorbed in less than half a second. It was very difficult to capture the water contact angle as the nanofiber quickly absorbed the liquid. Multiple samples of the same composition were tested until a clear picture was obtained.

From this test, it can be confirmed that the nanofibers were superhydrophilic. As we increased the ratio of PEG to PAN, the nanofibers absorbed the water droplet at more rapid times.

Discussion

The FTIR test showed Figures 5–7 have peaks in the 2000-2500 region which indicates there is PAN in the nanofiber. The fibers had been left to dry over a couple of nights and were exposed to environmental changes in temperature and humidity due to natural circumstances; this might have affected the peaks in the FTIR test. However, the bonds found in this test were similar to bonds found in a nanofiber composed of PAN + 32% PEG (Alamair, M. A., 2010).

The water contact angle is a method to measure if a surface is hydrophilic or not, but results were limited due to complications in testing. We can infer that the fibers are superhydrophilic from the timeframe in which the water droplet was absorbed, which was less than 0.5 seconds.

Scanning Electron Microscope Test

Scanning Electron Microscope test is a process that uses electron beams to magnify the picture of the fiber to get a morphologic analysis of it. Figure 5 shows a SEM picture of the fiber composed of 20% PEG weight in respect to PAN. Some fibers were merged causing non-uniform cross-sectional fibers. There was also a formation of beads, and this is believed to have been produced by the higher PEG concentrations. The lighter spots on the picture might have been caused by charged fibers, or the addition of a different chemical (PEG) to the nanofiber.

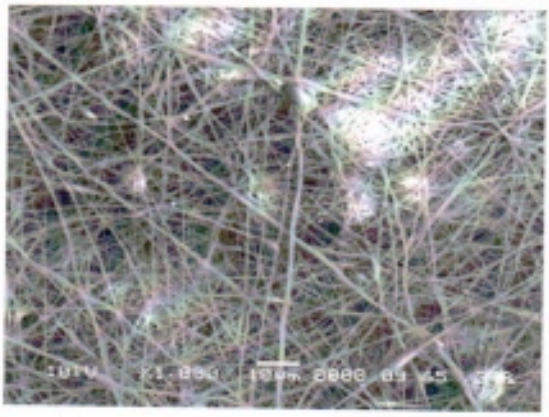

Figure 5. SEM image of PAN + 20% PEG

Conclusion

Capturing and storing CO2 is an expensive process because it requires a lot of energy and resources. More research in this field is needed. Funding from the government or fuel companies that are interested in developing new technologies should be procured to find more environmentally friendly ways to produce energy. From the FTIR tests, we can infer that there a C-N bonds which belong to the nitrile functional group in the nanofibers containing PEG and PAN, and that they can be used to capture carbon dioxide. We can also infer from the SEM test that since there is a presence of PEG in the fibers, they can be used to capture carbon dioxide as PEG is known to be efficient in the sequestration of carbon dioxide molecules since C-N bonds are present in the nanofibers.

For now, materials to be used in the research are still not accessible to the public since the price of MOFs ranges between 300-1000$ per gram. We hope to determine MOF structures that are less expensive but still efficient to capture and store carbon dioxide. In addition, we hope to successfully convert the captured carbon dioxide into biofuels so they can be used as an alternative for fossil fuels.

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Stability and Immunogenicity: Investigating the Role of Domain 4 of the Anthrax Protective Antigen

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Introduction

Bacillus anthracis is the agent of anthrax—a common disease of livestock and, occasionally, humans—as well as the only obligate pathogen within the genus *Bacillus*. This disease can be classified as a zoonosis, causing infected animals to transmit the disease to humans. *B. anthracis* is a gram-positive, endospore-forming, rod-shaped bacterium, with a width of 1.0–1.2 μm and a length of 3–5 μm. The anthrax toxin protective antigen is the major immunogenic component of the anthrax vaccine. Anthrax-toxin-neutralizing antibodies are primarily directed at Domain 4, the domain responsible for binding to host cellular receptors (CMG2 and TEM8), and prevents further toxicity. The central role of Protective Antigen (PA) in the pathophysiology of anthrax makes it an excellent therapeutic target. This allows vaccination with the PA-based human anthrax vaccine or purified PA results in the generation of a protective immune response. Previous studies by Williams et al. (2009) and Brown et al. (2010) delve into the binding of Domain 4 as well as the safety and immunogenicity of an anthrax vaccine in which a recombinant *Escherichia coli*-derived, *B. anthracis* protective antigen is the principal antigenic component. The hypothesis of this study was that the reduced immune response to PA when CMG2 is bound is caused by CMG2 blocking a key epitope or epitopes within Domain 4. As such, removal of Domain 4 should elicit a significantly weaker immune response compared to a full-length PA; that is, the majority of the immune response to PA is because of Domain 4.

Methods

Exponential Amplification (PCR) was used to cut out Domain 4 of the DNA sequence, then KLD treatment was done on the PCR product made by using 1 uL of PCR product formed from the previous thermocycler process. It was then mixed with 5 uL of 2X KLD Reaction Buffer, 1 uL of 10X KLD Enzyme Mix, and 3 uL of nuclease-free water. After adding these items, the solution was mixed well by pipetting up and down; then it was incubated at room temperature for 5 minutes. During the transformation process, NEB 5-alpha Competent E. coli cells were thawed on ice. After thawing, 5 uL of the previously made KLD mix was added to the tube of thawed cells and flicked to mix the solution. The mixture was put on ice for 30 minutes and then heat-shocked at 42 degrees Celsius for 30 seconds. At that point, it was put back on ice for another 5minutes.

Afterward, 950 uL of room temperature SOC was pipetted into the mixture and then incubated with shaking at 37 degrees Celsius for 60 minutes in an incubator shaker. When that process finished, the cells were mixed thoroughly by flicking and inverting the tube containing the mixture. 50 uL was spread onto a selection plate and allowed to incubate overnight at 37 degrees Celsius. Following that, the plate was put in the refrigerator to preserve the bacterial colonies.

To grow Delta D4-less PA83, we started with a 5mL culture that was incubated for 12hrs, then inoculated into 100ml solution consisting of 100uL ampicillin, 200uL CaCl2+MgSO4, and 1ml grown culture (for 12 -14hrs). The next step consisted of inoculating 600ml solution (600uL ampicillin, 1200uL CaCl2 and MgSO4) with 10ml bacterial culture at 32 c. OD until reaching around 2.5, then added IPTG (final conc 1milliM) at 26 c (1x600ml flask = 143mg IPTG). We let it grow until OD reached 5 (around 3hrs) at 26 c, spun at 3000rpm for 10 min until a pellet formed at the bottom of the container. Pellet was resuspended in 20% sucrose, 20milliM Tris pH 8.0, and 1milliM EDTA at room temperature for 15 minutes. Centrifuged at 8000rpm for 15min at 4 c, pellet was resuspended in 5milliM MgSO4 at 4 c for 15min. Before centrifuge, Tris pH 8.0 was added to make the solution conc. 20mM tris pH 8.0, then centrifuged at 8000rpm for 15mints at 4 c. Supernatant was eluted through Q-COLUMN (pre-equilibrated with buffer B [1M NaCl, 20milliM tris pH 8.0]) and buffer A (20milliM tris pH 8.0). Protein was then eluted from the column using buffer gradient (150mL length and 30% target B). Protein eluted around 15% B. Fractions were then collected and solution concentrated and eluted through the size column using 15% B (150milliM NaCl in 20milliM tris pH 8.0). Fractions were collected with concentrated solution and stored at -20 Celsius.

Results and Discussion

The gel filtration experiment was performed first, showing that it still has the capability to bind to Domain 4, but did not bind to CMG2, and thus had lost all specificity towards it, unlike the wild-type PA. This was significant because the importance of Domain 4 is shown with it being the main mediator for the binding of PA to the surface of cells via CMG2. The circular dichroism experiment was then performed, and the structure of the mutant PA and the wild-type deviated only in the missing Domain 4.

This reinforces the structural differences resulting from the absence of the domain is the cause for the other key differences seen when looking at temperature on the protein stability. When put through increasing temperatures in the circular dichroism spectrometer, varying differences showed in the unfolding of the two proteins and the stability of the structure at high temperatures. The circular dichroism experiment shows that the mutant PA has several of what we believe to be unfolding of different domains of the structure before the final unfolding of the whole protein. Also, the mutant PA exhibits an increased temperature stability, where it can experience higher temperatures before denaturing. Overall, the stability of the mutant PA structure is verified and shown to function comparatively to the baseline of the wild-type PA even without Domain 4 being present and affecting the other domains.

Conclusion

Overall, the study's goal to investigate the role of Domain 4 in producing an immune response will help in the formulation of a new vaccine. Any gained information about the properties that Domain 4 gives to the overall PA structure will help with understanding the antibody/epitope interaction in Domain 4. The findings from this study show that DeltaD4 PA still has the capability to bind to WT-Domain 4, which suggest that the structure is intact and that deltaD4 PA has lost all specificity for CMG2 due to Domain 4 being deleted from the structure. The CD spectrum results show that DeltaD4 PA has comparable stability as WT-PA as well as an identical secondary structure. Future directions based on this study will include fluorescent tagging of the mutant PA to track its interaction with the immune system of a living model, such as a rat, and looking at its heptamer forming ability and if Domain 4 is needed to elicit that structure formation.

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Developing a More Efficient Transition Metal Supercapacitor: Exploring Materials and Shapes

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Increased fuel use contributes to climate change and global pollution and results in fast depletion (Li et al., 2020). Potential solutions to this global crisis include new and improved lithium-ion batteries and other electric sources. Supercapacitors have garnered interest as an energy storage device due to their higher capacitance, environmental compatibility, and fast charge/discharge cycles (Liang et al., 2021). However, they sometimes have low conductivity and low energy densities.

The objective of this study was to explore size and shape effects on nanoscale transition metal oxides in energy storage devices to create more efficient technology for supercapacitors. These supercapacitors have applications for the transportation industry in aircraft and motor vehicles and in wearable devices. To investigate these material and shape combinations, an in-depth literature review was conducted within the context of transition metal supercapacitors. Literature came from academic journals and previous research studies.

Twenty research articles were identified that addressed common topics of transition metal supercapacitors, focusing on manganese oxide and hybrid supercapacitors. Articles were also chosen that provided comparisons between 1D, 2D, and 3D supercapacitors and their shapes as well as insight into the history of supercapacitors and how they originated. Abstracts were examined before selecting each article.

A common category classification for supercapacitors is based on shape with two-dimensional and three-dimensional supercapacitors being the most common. Most two-dimensional supercapacitors are in the form of ultra-thin two-dimensional sheets, which provide improved energy densities, improved utilization of surface area, superior electrochemical performance, and superior charge storage capability

(Low et al., 2019). They're especially popular for use in the wearable technology industry.

Three-dimensional supercapacitors are similar in shape to a lithium-ion battery but have much more efficient and rapid ion transportation than two-dimensional supercapacitors, as well as exhibiting improved energy densities and electrical conductivity.

Supercapacitors can also be sorted by material composition including transition metal oxides, transition metal hybrids, and carbon-based materials. Carbon-based materials were used in many of the earliest supercapacitors and were efficient for their intended purposes due to their high power density and long cycle life. However, they have low specific capacitances and are much lighter weight, leading to lower energy densities (Liang et al., 2021). Because of these constraints, carbon-based supercapacitors have limited practical applications.

In comparison, transition metal oxides are much heavier, which provides higher energy densities. Previous research suggests that transition metal oxides, such as manganese oxide, may be among the most effective materials to be used for supercapacitors. They also have better cycling stabilities and are more affordable. However, most transition metal oxide supercapacitors have poor conductivity (Liang et al., 2021). One transition metal oxide that has been heavily researched in the past is ruthenium oxide, which performs well under standards of specific capacitance and energy density. However, it is slightly toxic to the environment, expensive to purchase and rare to find (Low et al., 2019). Contrastingly, manganese oxide is much more cost-effective, environmentally compatible, and naturally abundant while still providing a high theoretical capacitance (Lv et al., 2017). Other metals and hybrids have also been studied, such as iron oxide which has a high specific capacitance, is abundant, affordable, and creates less pollution than ruthenium products. There are also manganese-nickel and manganese-cobalt hybrids, which create high redox activities, variable valence states, and higher electrical conductivities (Low et al., 2019).

Overall, supercapacitors are a viable option for an innovative and renewable energy source with their environmental compatibility helping combat climate change and global pollution while still being cost-effective and efficient. After reviewing the selected studies and scholarly journal articles, manganese oxide appears to be the most promising material to use for transition metal oxide supercapacitors in the future due to its lower cost, environmental abundance, and compatibility as well as its electrochemical advantages and high theoretical capacitance. Iron-oxide and manganese hybrids had promising results as well. Flexible 2D shapes have been most researched and successful thus far, but the advantages of 3D shapes are worth further investigation due to the positive results already discovered. The knowledge obtained in this literature review will inform my future laboratory study in the fall of 2021 with the goal to improve supercapacitor technology.

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Creating an Optimal Learning Environment and Expanding Access for Foreign language learning to All Students in The United States

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The United States is becoming increasingly linguistically diverse due to changes in population demographics. Additionally, there is a need to participate in a global society. However, there is a lack of support and recognition of the value of foreign language learning. This lack of support and funding make it difficult to develop programs that fit the needs for learners of all ages and abilities. This research demonstrates the ways in which instructional practices can be tailored to better suit learners from diverse age groups and backgrounds. This is done by identifying the benefits of creating optimal environments for language learning, as well as the non-linguistic benefits, and addressing the need for change in the United States foreign language (FL) programs.

Optimizing the language learning and instruction of different age groups, particularly older learners, requires consideration and understanding of the different approaches that are necessary. It should be noted that older learners are just as capable of learning a foreign language as younger learners, but there are non-linguistic benefits to learning foreign language early, including cognitive development, academic achievements, and socio-affective benefits. Huang, in her review article, "A Synthesis of Empirical Research on the Linguistic Outcomes of Early Foreign Language Instruction," discovered favorable effects of FL instruction on how students perform in academic subjects, and on their confidence and positive attitudes (269). A study by Kissau et al. also builds upon prior research about how early language learning has benefits for confidence, positive attitudes, enhanced motivation, and reduced anxiety (297). Research by Judith Shrum and Eileen Glisan indicates that learners between the ages of 7 and 12 have a stronger acceptance of other cultures (110-112). Lambert and Klineberg (1967) identified the crucial period in forming attitudes towards other cultures as the age of ten. Health

benefits have also been noted. Bilingualism may delay the onset of Alzheimer's by four to five years (Moeller and Abbott). The non-linguistic benefits of early FL instruction may even be equally or more important than the linguistic benefits (Huang 269).

Foreign Language education requirements are not under federal jurisdiction in the United States, therefore states and local school districts determine the requirements and access to world languages in school (O'Rourke et al.). With around 20% of K-12 students in the United States studying foreign languages in 2017 (Rambur 58; Moeller and Abbott), it can be inferred that requirements and opportunities for foreign language learning are not being met by local school districts and states. With FL enrollment of 7.5% and a ratio of 5:1 of postsecondary students in introductory to advanced level courses in 2016 (Rambur 58), it is evident that American students are not being prepared with the necessary language skills to compete and participate on a global level. More research is needed to explain how to expand foreign language education in schools across America. Although research indicates that early foreign language instruction has benefits, these classes are often not offered in the United States until middle or high school (Regalla and Peker 619). Learning a foreign language in two years during high school is not an adequate way to acquire a foreign language (Rhodes 123). For older learners' greater motivation, second language input and instruction that are effective, and their language aptitude may allow them to mirror the levels younger learners easily achieve (Shrum and Glisan 110). A customized approach to teaching a second language could lead to an optimal way of language instruction (Birdsong). Introducing various methods and approaches to teaching foreign languages and addressing the needs of diverse populations and their different abilities crafts an optimal environment for individual students to enhance and grow their language skills. As educators and FL departments move towards adapting their curriculum to accommodate a diverse learner population, being aware of and seeking new and innovative instructional techniques could have a positive impact on learners' and the programs' success.

An article by Nancy Rhodes about the lessons learned in elementary foreign language teaching mentions a successful foreign language program should include demonstrating to the public how efficient one-way and two-way immersion programs are for students (124). The opportunity to attend a school with these programs should be available to all students in every school district (Rhodes 126). The lack of support and recognition of foreign language learning across the board makes it harder to place foreign languages in the curriculum and restricts adequate funding for these programs (Rhodes 127). Gathering support from parents and top officials in the United States is integral to establishing widespread and successful early language learning programs (Rhodes 128). Many myths and misperceptions permeate the opinion of stakeholders and the general American population in regard to foreign language learning in K-12. An overwhelming common misperception is that learning a foreign language is nearly impossible and requires extensive years of study (Moeller and Abbott). Due to a lack of articulation across the K-12 levels, there has been an inadvertent effect on the perceptions of students, parents, and administrators regarding LF misconceptions are: "foreign language learning

really began with high school courses" (Moeller and Abbott). The usefulness, or lack of, even though the need for a more globally prepared workforce has been shown. The myths that early language learning "could damage a child's language and cognitive development" when initiated "too early" as well as the idea that, in order to successfully acquire language, an individual must be "special[ly] talent[ed]" finally dominate the minds of those against expanding foreign language education (Moeller and Abbott). These myths and misconceptions possibly result from a lack of foreign language learning opportunities. This results in decrease understanding of the benefits and the process involved in acquiring a second language. Changing the attitudes that Americans have towards foreign languages and other cultures is also key to expanding early language learning programs (Rhodes 128).

To combat the misperceptions on the usefulness and value of foreign language learning, a "selective approach to language education" has been suggested and could alleviate some of the major hurdles in expanding foreign language education (Brecht). It is assumed that a selective (only offering critical languages as defined by the Department of State), rather than universal (any language), approach could reduce the costs of such a reform by focusing on critical languages that "would demonstrate the viability of a national foreign language education system." It won't receive the support of Congress due to the desperate need of critical language speakers by government agencies (Brecht). It can be seen that the Department of State recognizes the value and necessity of learning a critical language by looking at the Critical Language Scholarship opportunity for university students (American Councils for International Education: ACTR/ACCELS). This scholarship funds the travel and education of students in a foreign country to learn these critical languages, which conveys the federal government's willingness to fund these foreign language programs.

Considering that a significant portion of the studies used in this review are approaching 10 years from their publication date, this previous research is out of date and updated studies are needed. In addition to providing current data on these topics, a specific focus on Kansas and the Midwest area of the United States would add a much-needed perspective on this underrepresented area in foreign language education research. The global pandemic in 2020 has potentially created and reinforced the negative views of Americans on foreign countries, their languages, and cultures. The fundamental discussion on the effects of current events regarding the importance and value of foreign language education to the public and students should be included in future research. Understanding public support for and challenges against expanding access would highlight crucial developments and considerations of how to create successful, sustainable programs within diverse communities. This review was done to provide a solid foundation for knowledge on this topic; further research will be conducted in my 2021-2022 project that will contribute data from a mixed-methods study.

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The Impact of Manufacturing Work Experience on Shoulder Muscle Activation Utilizing a Shoulder Passive Exoskeleton

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Introduction

Work-related musculoskeletal disorders (WMSD's) of the upper limbs are a challenge in the workplace where workers perform repetitive and forceful motions. The repetitive overhead work, awkward postures, and forceful exertions that lead to shoulder disorders often occur in automotive, aerospace, and other manufacturing work settings. Workplace injuries in the upper limbs accounted for about one-third of all nonfatal injuries and illnesses in the United States that involved days away from work (BLS, 2016). Shoulder injuries accounted for a median of 26 days away from work in 2018 in the United States (BLS, 2016). Common shoulder injuries include tendinitis, rotator cuff tendinitis, and bursitis.

A relatively new device that manufacturing industries are considering is exoskeletons. The interest in these in the workplace lies in the hope of reducing upper limb injuries. An exoskeleton can be described as a wearable mechanical structure that assists a human by supporting the external loads on a body part(s) (de Looze et al., 2016).

As interest in upper limb exoskeletons rises, studies are being conducted to assess the effectiveness in reducing the mechanical loading on the shoulders while performing overhead work. Studies (Kim & Nussbaum, 2019; Maurice et al., 2020) executed in laboratory settings showed a significant reduction in anterior deltoid muscle activation with exoskeleton use compared to no exoskeleton use. Maurice et al. (2020) indicated an average of 54% reduction in anterior deltoid muscle activation while twelve inexperienced male participants (mean age: 23.2 years) performed overhead drilling. In a laboratory study with twelve gender-balanced subjects (female mean age of 22.3 years and male mean age of 26.7 years), Kim & Nussbaum (2019) found a 32% to 60.6% reduction in muscle activity of the

right anterior deltoid across several work tasks that were performed at different shoulder level and overhead heights.

Although progress is being made to discover the effectiveness of exoskeletons, there are voids in the research literature regarding the implementation of exoskeletons in the workplace. There is an absence of studies investigating the effects of exoskeleton use on experienced workers and how they may differ from inexperienced workers. A worker's experience may impact the biomechanical loading and muscle activity for tasks the worker has grown familiar with while an inexperienced worker may tend to increase biomechanical loading for unfamiliar tasks due to the lack of motor control (Marras et al., 2006). Thus, the purpose of this study was to investigate the impact of a passive shoulder exoskeleton on muscle activity for three different overhead simulated drilling postures on inexperienced and experienced participants.

Methods

A sample of 25 participants (10 females, 15 males) was recruited for observation in the experiment. Participants included 13 individuals (6 females, 7 males) with manufacturing experience from a local aircraft company. The mean (SD) manufacturing work experience for the females and males was 13.8 (14.3) and 20.9 (10.2) years, respectively. Twelve inexperienced university participants were also recruited (4 females, 8 males).

A height-adjustable workpiece was utilized to simulate the drilling. Three overhead simulated drilling postures were performed by each participant using a hand drill (mass=0.5 kg) and load cell to measure the force being exerted upward. Posture 1 was set at an elbow angle of 90 degrees and a shoulder flexion angle of 45 degrees. Posture 2 was set at an elbow angle of 90 degrees and a shoulder flexion angle of 90 degrees. Posture 3 was set at an elbow angle of 135 degrees and a shoulder flexion angle of 135 degrees. Participants completed a trial for each posture with the exoskeleton and without the exoskeleton. Each trial involved six two-second drilling push exertions with a one-second rest in between drilling exertions. Completing the drilling exertion required the participants to exert an average force of 20-30 lbs.

Electrical muscle activity data was collected during the drilling exertions using surface electromyography (EMG). Noraxon dual Ag/AgCl electrodes were placed over the dominant anterior and medial deltoid muscles based on standardized electrode placement procedures (Zipp et al., 1982). Normalization of the EMG signals was done by performing isometric maximal voluntary contractions (MVC's) on the dominant arm of each subject for each muscle.

The normalized percent MVC value was calculated by dividing each experimental EMG by the maximum MVC EMG value. The percent MVC difference was calculated by subtracting the no-exoskeleton condition percent MVC from the exoskeleton condition percent MVC. Statistical analysis consisted of an independent samples t-test performed for each posture and muscle combination with a significance level of α=0.05.

Results

Inexperienced participants in posture 1 showed a 1% MVC difference for the anterior deltoid while experienced participants showed a -19.3% MVC difference. From the t-test, this concludes a significant difference in the anterior deltoid muscle activity between inexperienced and experienced participants ($p=0.023$). Inexperienced participants in posture 1 showed a 1.4% MVC difference for the medial deltoid while experienced participants showed a -6.2% MVC difference. The t-test determined there was no significant difference in percent MVC differences between inexperienced and experienced participants for the medial deltoid in posture 1 ($p=0.210$).

In posture 2, inexperienced participants showed a -3.8% MVC difference for the anterior deltoid while experienced participants showed a -16.3%. T-test results determined there was a significant difference between the two MVC differences ($p=0.046$). Inexperienced participants in posture 2 showed a -4.0% MVC difference for the medial deltoid while experienced participants showed a -8.0% MVC difference. There were no significant differences in the percent MVC difference between inexperienced and experienced participants in posture 2 for the medial deltoid ($p=0.464$).

T-test results for posture 3 showed significant differences between percent MVC differences for inexperienced and experienced participants for the anterior muscle ($p=0.025$). Experienced participants had a -25.7% MVC while inexperienced participants had a -10.7% MVC for the anterior deltoid. For the medial deltoid in posture 3, experienced and inexperienced participants had a -10.8% MVC difference and -16.4% MVC difference, respectively. T-test results showed no significant differences for the medial deltoid ($p=0.571$).

Discussion

The results showed there were significant differences in the mean percent MVC for the anterior deltoid when comparing inexperienced to experienced participants. Anterior deltoid activation was significantly different between inexperienced and experienced participants across all three postures. This correlates with the research literature regarding the impact a worker's experience has on biomechanical loading and muscle activity for tasks they are familiar with.

The participants' work experience likely played a role in anterior deltoid activation while performing the three overhead drilling tasks. The impact work experience had on muscle activation in this study is consistent with the findings reported by Marras et al. (2006) which found that muscle recruitment is influenced by work experience for tasks the worker is familiar with. Furthermore, inexperienced participants have not developed a competent muscle recruitment model for overhead drilling tasks and, therefore, the utilization of the passive shoulder exoskeleton may not be as advantageous.

The results indicated no significant difference in mean percent MVC comparing inexperienced to experienced participants for the medial deltoid. Since the three postures consisted of solely shoulder flexion while exerting an upward force, the role of the medial deltoid may not be as critical as the

anterior deltoid when comparing inexperienced to experienced participants.

Similar to the study by Kim & Nussbaum (2019), the reduction in both the anterior and medial deltoid muscle activity was more substantial in overhead work heights with greater shoulder flexion. Posture 3 incorporated the highest shoulder flexion angle of the three postures and led to the greatest reduction in both the anterior and medial deltoid muscle activity.

The findings of this study suggest that the implementation of exoskeletons in the workplace ought to reflect research that includes an appropriate sample. In order to make results from laboratory studies more transferable to actual work settings, the findings of this study imply the importance of recruiting experienced workers to validate the implementation of exoskeletons.

There are some limitations to acknowledge when considering the findings of this study. First, this study was performed in a controlled laboratory setting where the overhead drilling tasks were a simulation to reflect a workplace setting. Some workplace factors cannot be easily simulated such as the presence of other workers, constrained working space, and interference of manufacturing pieces. Second, the current study investigated the short-term effects of work experience on shoulder muscle activation. This excludes the effect of fatigue that workers may experience during long shifts of overhead work. Future research should focus on long-term performance to determine if the effects of exoskeleton remain consistent as well as performing studies in the actual workplace.

Conclusion

This study found that manufacturing work experience influenced anterior deltoid muscle activation when utilizing a passive shoulder exoskeleton while performing simulated overhead drilling tasks. Experienced participants showed greater reductions in anterior deltoid muscle activation compared to inexperienced participants. This may be due to the skillset experienced workers have to reduce muscular effort in tasks they are familiar with. The findings of this study suggest that future research should reflect the appropriate population of experienced workers in order to provide greater validity when implementing exoskeletons into the workplace.

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Honors Undergraduate Students: Perspective on Diversity and Inclusion, Student Involvement, and Overall Well-Being

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Background

Honors programs offer many opportunities such as alternative curriculums, scholarships, and research opportunities. Honors programs and colleges are present in "60% of all four-year institutions and over 40% of all two-year institutions" (Achterberg, 2005). Despite this commonality, research in honors education is scarce. A common form of selection criteria includes SAT, ACT, and GPA scores. However, the selection and acceptance vary across institutions. Therefore, what defines an honors student cannot be quantified through the usage of academic test scores.

Diversity and Inclusion within Honors Institutions/Programs

In attempt to take a holistic and inviting approach to individuals with diverse life experiences, a few honors programs have opted out of the usage of test and GPA scores to qualify for admissions into their honors programs and colleges. Diversity efforts within academia, specifically within honors institutions/programs, experience various challenges depending on the geographical location. It is important to acknowledge how the experiences and challenges of ethnic minorities differ from their white counterparts. Growing evidence indicates sociocultural and economic differences contribute to the overall graduation gap for black and ethnic minorities (BME) and white graduates. Parker (2017) indicates "[Black and Minority Ethnic Students] students (32.1%) were less likely to come to university to experience university life than their White peers (45.7%) and were less driven (18.6%) to meet new people at university than White students (38.6%)". Due to the natural tendency to compare, students often fall victim to the big-fish-little-pond effect, where students who are equally able will

possess lower academic self-concept or imposter syndrome. Students who exhibit gifted behaviors do not escape the growing pressures of balancing academic, social, and emotional pressures when transitioning to college. The transition to university is a pivotal milestone within the social development of undergraduate students.

Theory of Student Involvement. Alexander Astin conceived the Theory of Student Involvement which focuses on how an institution's environmental influences an individual's development by using an Input-Environment-Outcome Framework. A student's inputs include demographics, background, and previous experiences. The environment is the accumulation of a student's experiences while at college. Student outcomes refer to a student's "characteristics, knowledge, attitudes, beliefs, and values that exist after a student has graduated college" (Astin, 1984). He describes a student's involvement as a culmination of an individual's experiences and the extent to which they become involved to determine development.

Undergraduate Student Wellness

A traditional collegiate experience can be viewed through a negative lens where students show an increase in mental illness as they combat growing pressures of increased independence and integration into a new social and academic environment. Research was conducted at Chicago University in the spring of 2013 to investigate the impact of mental illness intervention through affirming attitudes, discrimination, and treatment-seeking. They were able to conclude that college students showed an estimated prevalence of "depression at 17.3%, panic disorder at 4.1%, and generalized anxiety disorder at 7%" (Eisenberg, 2013). College mental health literature discusses two contributing factors to one's mental health: general population stigma and personal beliefs and endorsement of stereotypes and corresponding prejudices.

Wichita State is a public university and the honors college promotes a variety of benefits including a formal academic curriculum that offers discipline-specific and interdisciplinary courses, research opportunities, small class sizes, and applied learning opportunities. The college aims to increase diversity but has not recently assessed the impact of student involvement. This research assessed honors undergraduate perspectives to understand the impact of academic programming.

Research Design and Methodology

Context of the Study

The study was conducted at Wichita State University's Dorothy and Bill Cohen Honors College. The Honors College was founded in the fall of 2014 with the aims of attracting and retaining academically exceptional and highly motivated students. The College promotes a variety of benefits including a formal academic curriculum that offers discipline-specific and interdisciplinary courses, research opportunities, small class sizes, and applied learning opportunities.

Coronavirus Pandemic

The study was performed during the Coronavirus (COVID-19) Pandemic. In order to reduce physical contact and promote physical health, students were prompted to take virtual classes, conferences, and other events.

Participant Inclusions/ Exclusions

Participants were 18+ and members of the Dorothy and Bill Cohen Honors College

Data Collection

Using Qualtrics Surveying tool, a 20-question questionnaire was given to students with the matching criteria. The questionnaire included demographic information and questions targeting areas of diversity and inclusion, student involvement, and overall student wellbeing.

Research Questions

1. What are the student perceptions of self and others related to wellbeing, student involvement, and diversity and inclusion?
2. How do students describe their impact of the environment on their college experience?
    a. The environment is described as students' experiences in class, extracurriculars, etc.

Data Analysis and Interpretation

Student responses to the open-ended questionnaire were mined and analyzed for rich narratives to understand honors students' experiences. Data was coded and organized into themes with the goal of understanding student perceptions related to the purpose of this research study.

Findings

In regards to diversity and inclusion, many students found that the preparation they were given during their collegiate experience was sufficient in preparing them to collaborate in diverse settings. They stated that experiencing open dialogue in classrooms, along with involvement in student organizations and within the campus environment, facilitated dialogue between diverse perspectives. Students expressed that their involvement impacted their preparedness and overall wellbeing by allowing for active collaboration with members of different backgrounds. Student 18 said: "[a]ttending WSU has prepared me to work in a diverse setting. I work with members of various ethnic backgrounds across many organizations I am involved in on campus. I also have the opportunity to work with people of my same background that have had many different life experiences". However, other students expressed a feeling of discomfort and exclusion at times when participating in organizations and class discussions

due to low ethnic and gender representation.

In regards to overall wellbeing, students expressed varying experiences. A few stated no alterations in their wellbeing due to the change in environment caused by the pandemic and reported overall satisfaction. However, approximately 64% of students stated they had difficulties with their mental health within the past year. Many indicated that, due to required online classes and lack of human interaction instigated by the COVID-19 Pandemic, they experienced low motivation and "poor mental health".

Recommendations

1. **Examine diversity.** Consider incorporating more diverse courses within the required curriculum or offering diversity and interdisciplinary events for students.
2. **Get involved.** Students, try to extend outside of academics and collaborate with your peers through participating in campus activities

Discussion

Our data shows that by increasing opportunities of exposure to students with diverse perspectives, more students report feelings of increased preparedness to collaborate in diverse settings, improved comfort, and increased feelings of inclusion. When participating in extracurriculars, students are given the opportunity to develop interpersonal relationships while also establishing a sense of purpose and identity.

As the pandemic progressed within the academic year, virtual learning became the norm and less time was spent on campus. It is clear that a potential disconnect to student retention and connection to their institution occurred. Students who were involved and more likely to interact with their peers, either in person or virtually, maintained a closer connection to their institution while simultaneously reporting a higher level of wellbeing.

Resources

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Examining Adverse Childhood Experiences among College students and a Comparison of a Midwest Sample of Substance Use Patterns to National Trends

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Introduction

The Adverse Childhood Experiences (ACEs) have affected a great deal of the population. The article, *Adverse Childhood Experiences Among US Children*, states that "in 2016, 34 million children age 0–17—nearly half of all US children—had at least one of nine ACEs, and more than 20 percent had two or more" (Bethell, C.D. et al., 2017). More than 60 percent of adults report having at least one ACEs, with almost 25 percent reporting that they experienced more than three (Merrick MT. et al., 2011-2014).

The ACEs are a type of screening used to determine negative experiences in a child's first eighteen years of life related to their care and upbringing. The screening includes questions pertaining to physical, sexual, or emotional abuse, physical or emotional neglect, and exposure to domestic violence. They also inquire about household substance abuse, mental illness, parental incarceration, separation, and divorce. (Finkelhor, 2018).

ACEs can detrimentally affect college students' performance in school by causing depression, anxiety, risky behaviors, and relationship issues while also negatively impacting parts of the brain that control serotonin and dopamine output emotion and memories. This could lead to a high risk of memory issues as well as an increased risk of depression (Kelifa et al., 2020). Additionally, ACEs affect the way a person handles stress, leading to cognitive issues and great harm to them. When situations become stressful and feel unbearable, people could turn to different types of substance use (i.e., smoking cigarettes, drinking, illicit drug use, engaging in risky sexual behaviors). All of this can cause more mental health issues while being physically dangerous. The more college students engage

in these kinds of activities, the higher the risk is of dropping out.

It is important to reduce the number of people that are affected by the ACEs and, if possible, to implement risk and protective factors as well as prevention and intervention. If this is possible, then the likeliness of the ACEs decreasing is greater than it was before. This study examined ACE scores of college students and compared them to national data.

Research Questions: What were the overall ACEs scores of college students in this mid-sized college campus? Were there differences in gender and white and non-white in this college sample on ACEs scores? How is the college sample of substance use rates compared to the National data of substance use rates?

Methods

Participants and Setting

One hundred fifteen college students participated in this study. The college was located on a midsized Midwestern campus of 15,000 students. There was a total of 84 female participants and 29 male participants. The mean age of participants was 19. The college student age range was 18 to 50 years old.

Instrumentation

The survey was created by the researcher and consisted of 80 questions. Basic questions such as demographics and help-seeking questions were included. The ACEs (10-item) were also used in this study (Ford. D.C et al., 2014). A few sample questions from the ACEs survey consisted of "Did you have parents or other adults in the household often…punch, grab, slap, or throw something at you or ever hit you so hard that you had marks or were injured?" and "Was a household member depressed or mentally ill or did a household member attempt suicide?".

Procedure

This study was approved by the Institutional Review Board (IRB) at Wichita State University (WSU). The survey was created using the Qualtrics platform and distributed through the research participants pool, SONA, through the WSU Psychology Department. Participants were asked to sign a consent form and required to be at least 18 years old and be a student at Wichita State University. The survey took approximately fifteen minutes to complete. To encourage participants to complete the survey, they were offered entry into a drawing to win a $25.00 gift card.

Data Analysis

To answer the research questions, descriptive statistics were conducted, including frequencies, means, and standard deviation.

Results

The first research question examined the overall ACEs scores of college students and how many were affected by ACEs. Twenty-seven percent of the sample reported having no traumatic events during childhood. However, 60% of the sample report having between 1 and 4 traumatic events such as a parent being in prison or violence in the home. Only 13.5% reported having five or more adverse childhood experiences. It is unclear if these results impact the amount of alcohol consumption reported, but it is noteworthy that ACEs have been shown to increase the risk of substance use. The research question regarding differences between white and non-white participants in the ACEs scale was also examined. A chi-square statistical test was performed and there was no statistically significant difference. The research question to compare the National data of substance use rates to the local data of substance use rates, it was found that the local trends were higher for any alcohol use within the last 30 days than the national trends. However, all other trends seemed to be the same or slightly less than the national trends.

Discussion

According to these results, Wichita State University students had a slightly higher rate (59.1%) of alcohol use compared to the national sample (55.8%). Alcohol contributes to many issues on college campuses such as sexual assault and impaired driving. In regards to the adverse childhood experiences that were reported, our sample showed nearly 60% reported having between 1 and 4 ACEs, similar to previous research. Although 27% of the sample reported having experienced no adverse childhood experiences, a large percentage of the sample did experience 1 or more and 13% experienced 5 or greater ACEs. This is an important finding for counseling and prevention services (CAPS) to note so that prevention and interventions can be designed. The alcohol use rates in this sample were higher than national norms and the trauma experienced by this sample is on trend with existing literature. More research is needed to understand the connection between these adverse childhood experiences and substance use.

Limitations

There were several limitations noted in this study, including a small sample size. A technical issue occurred when the survey was launched, and the first 16 participants had to be eliminated from the data set due to a skip logic problem. Another limitation is that the survey is not a standard survey and was created by the researchers. This may have caused issues with questions being interpreted incorrectly due to wording, and this could have affected how the data was interpreted. However, both the ACEs and the substance questions were taken from a standard survey. The last limitation that we thought important to note is the lack of representation of minorities. In the future, we may have to oversample to attain more of a racial and ethnically diverse sample.

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Unjustified Nationalism During the COVID-19 Pandemic

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As countries try to grapple with the COVID-19 pandemic, governments have turned to nationalism as a way to unify people. While this may be one way to use nationalism as a force for good, its use may also cause harm. In the United States and China, nationalism has played significant roles in the daily lives of citizens and has influenced decision-making in the government. Leaders in both countries have repeatedly invoked sentiments of various nationalist ideologies and with that has come harm. In this research, I explore those harms and address the problematic element of a perceived enemy, which is present in the nationalist ideologies being promoted by each country, and the main cause of the harms associated with those groups. I argue that, based on John Stuart Mill's harm principle, these governments' use of nationalism is unjustified because of the harms caused by it. However, if these governments refrain from promoting the interests of groups who aim to act against their perceived enemy, they can be justified in their use of nationalism.

For this research, I used Daniel Weinstock's definition of nationalism as a starting point. Because of the limitations Weinstock placed on his own definition, I will expand on it to create a definition of nationalism that accounts for those limitations. The updated definition is as follows: nationalism is a political ideology that seeks to protect and promote the interests of a nation at times by way of a political doctrine that it is believed by the nation to constitute legitimate ends of government policy, which can include attempts to justify the curtailment of individual rights of those outside of the nation. This definition recognizes that nationalism is not limited to just political doctrine while highlighting the issue of clashing interests. It also accounts for the characteristics of various forms of nationalism in the U.S. and China, both before and during the pandemic.

Nationalism

Nationalism has the potential to cause conflict and division among nations. As different nations prioritize their interests above the interests of others, there are times when those interests conflict with one another. In the COVID-19 pandemic, we are seeing nationalist sentiments being stirred up between the U.S. and China at the national level. The governments of each country are invoking the sentiments of American nationalism and Chinese nationalism. Amid the COVID-19 pandemic, we are witnessing the Chinese nationalism that is anti-western and the American nationalism that is anti-Chinese affect how these two countries engage with each other and how they address the COVID-19 pandemic. From that has come confrontation between leaders, further complication to the trade war, constant criticism of each country's handling of the pandemic. Other types of nationalism such as bio-political nationalism and vaccine nationalism are also being used in combination with American and Chinese nationalism.

Bio-political nationalism is a form of nationalism where countries pride themselves on how they handle the virus while also criticizing other countries' handling of the pandemic.[1] This nationalism has been used in conjunction with the nationalist sentiments of American and Chinese nationalism. In the U.S., Former President Trump fueled anti-Chinese nationalism while also employing bio-political nationalism when he began calling the COVID-19 virus the "China Flu, the kung flu, and the Wuhan virus". He also claimed, with little to no evidence, that the virus was man-made by China in the Wuhan lab.[2] Statements such as these were used to gain support in the U.S. handling of the pandemic.

In China, bio-political nationalism has had a similar effect to the U.S. As they were censoring the media narrative, and other countries' views of the inner happenings, Chinese officials were also responding to the Trump administration with their own counterclaims and accusations. One official claimed that the U.S. military had brought the virus to China.[3] The Chinese Foreign Ministry Spokesperson, Zhao Lijian, also criticized the U.S. handling of the pandemic multiple times while simultaneously comparing it to China's handling of the pandemic. In a press briefing, he said that "the U.S. response to the epidemic can be described as a complete mess and total failure," and that "China served as a crucial line of defense for the world and bought precious time for the global fight against the virus."[4]

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1 Kloet, J. d., Lin, J., & Chow, Y. F. 'We are doing better': Biopolitical nationalism and the COVID-19 virus in east asia. *European Journal of Cultural Studies, 23*, 4 (2020), 635-640. doi:10.1177/1367549420928092

2 Boylan, B.M., McBeath, J. & Wang, B. US–China Relations: Nationalism, the Trade War, and COVID-19. *Fudan J. Hum. Soc. Sci.* **14,** 23–40 (2021). https://doi.org/10.1007/s40647-020-00302-6
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3 Huizhong, Wu. 'China pushes conspiracy theories on COVID origin, vaccines." AP News(January 25, 2021). https://apnews.com/article/china-coronavirus-origin-65c6958bb2d8d22d811bb3d0c90f7418

4 Bloomberg News. "China Blasts U.S. Handling of Virus Pandemic as 'Total Failure', Bloomberg (April 13, 2021). https://www.bloomberg.com/news/articles/2021-04-13/china-blasts-u-s-handling-of-virus-pandemic-as-total-failure

Vaccine nationalism occurs when a country secures vaccines for its own people, prioritizing their use of them above global vaccine access.[5] Like other forms of nationalism, it rests on the idea that doing so is in the best interests of that country and that it takes priority over the interests of other countries. Also, like American and Chinese nationalism, this type of nationalism is happening at a political level and being attributed to entire countries, even if not everyone in the country agrees with it. To accomplish this, countries are making contracts with the companies that make the vaccines to get as many doses as possible, and, in some cases, sole rights to the vaccine.[6] As countries do this, they leave poorer countries, and countries unable to develop their own vaccines, without access to the vaccines, essentially monopolizing their use of the vaccine. Only once a country has secured enough vaccines do they look to send extras elsewhere.

In each case, the nationalist sentiments held and expressed by these two countries have led to conflict, division, and harm. The conflict between these countries was not limited to just them. Vaccine nationalism shows how the divisiveness of nationalism can spread beyond two countries who actively engage in conflict with one another to become an issue for others in the world. This division between the two countries complicated the ability for cooperation as shown by vaccine nationalism. The criticisms both countries had for one another affected citizens with increased attacks on Asians in America and a trade war that threatened people's well-being.

Harm Principal

One way we can challenge the moral legitimacy of nationalism is to subject it to a harm principle. The harm principle is attributed to the work of John Stuart Mill and holds that "the only purpose for which power can be rightfully exercised over any member of a civilized community, against his will, is to prevent harm to others."[7] This principle also expands beyond the individual. In reference to a community, Mill says that the individuals have the "freedom to unite, for any purpose not involving harm to others."[8] Harm principles are often used as a basis for determining the moral legitimacy of a person's action. Applying the harm principle to government use of nationalism allows us to address the issues related to nationalism and gain insight into what is necessary to rectify the issue. I argue that for governments to be justified in their use of nationalism, they must do so in a way that does not cause unnecessary harm, including harms caused by global cooperation being impeded, especially when global cooperation is necessary to reduce harms.

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5 "How 'vaccine nationalism' could block vulnerable populations' access to COVID-19 vaccines." *Down To Earth*, June 17, 2020. *Gale General OneFile*. (https://link.gale.com/apps/doc/A626902046/ITOF?u=ksstate_wichita&sid=summon&xid=74640db8

6 "How 'vaccine nationalism' could block vulnerable populations' access to COVID-19 vaccines." *Down To Earth*, June 17, 2020. *Gale General OneFile* (accessed June 14, 2021). https://link.gale.com/apps/doc/A626902046/ITOF?u=ksstate_wichita&sid=summon&xid=74640db8

7 Mill, John Stuart. *On Liberty*. Kindle Ed, The Walter Scott Publishing Co, New York (2011). 10.

8 Mill, "On Liberty", 13.

Mill's harm principle can be used to assess how a government can exercise power over individuals and groups of people because it aims to limit the justification for one group exerting power or authority over another. With Mill's principle, we can question both the action and the method of justification, which in this case is nationalist sentiments. The use of certain types of nationalism and nationalist ideology in government, as seen with COVID-19, violates the harm principle as do the actions that follow from those nationalist ideologies. The harm principle is being violated in the following ways: First, the nationalist groups might employ government policies that curtail the rights of others. Second, The harm to a person's well-being. Harm to a person's well-being is also violating the harm principle because it is the use of government force over another person that causes harm, yet not intervening to prevent further harm. This is the harm of vaccine nationalism. Taking rights away from others violates the harm principle because rights are often in place to ensure people's well-being. If those rights are taken away, their well-being is no longer protected.

Rather than argue for a ban on the use of nationalist sentiments in government, I argue there is one element to nationalism that should be recognized as a source of the harms associated with nationalism. The common element shared in many forms of nationalism, especially those that would frequently violate the harm principle, is a "perceived enemy," which is often other nations or other countries. The belief associated with a perceived enemy is that if one group is better than the other group or is always in competition with that group, their members are united. It is in that sense of superiority that one nation believes itself justified in harming the other. This is problematic when governments and politicians promote the interest of the nationalist groups acting towards their perceived enemy. Politicians and governments often represent or hold authority over more people than those who are part of nationalist groups. In some cases, their promotion of those nationalist interests could be harming people that they also have a legal obligation to protect. Such as when anti-Chinese nationalist ideology leads to violence against Asian Americans. Additionally, if that perceived enemy is another country, global cooperation is again impeded. So long as governments, utilizing nationalist sentiments, do not promote ideologies that aim to harm other nations or would lead toward actions that harm other nations, their use of nationalism could be considered justified.

The COVID-19 pandemic is another opportunity for countries to invoke nationalist sentiments. While nationalism works to unify nations, doing so in a way that causes harm is problematic for governments. As the U.S. and Chinese governments frequently invoke nationalist sentiments in their dealing with each other and the pandemic, the harms to those considered the "perceived" enemy of those nationalist sentiments, as well as those who are outside those nations, occurred. Though recognizably useful in unifying people in times of crisis, nationalism should not be invoked by governments if it will cause harm. By not promoting those nationalist ideologies whose interests necessitate acting against a perceived enemy, governments can be justified in their use of nationalism.

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Summary of Image Processing Techniques to Analyze Adiabatic Shear Bands in Aluminum 7075-T6 using MATLAB

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Introduction

Material selection is a factor in every engineering decision. However, research is ongoing regarding some material behaviors. Aluminum 7075-T6 is a high-strength aluminum alloy used in aircraft fittings, gears, shafts, missile, lightweight parts, regulating valve parts, worm gears, and aerospace/defense applications [1]. To understand this material, its mechanisms of failure must be understood. One mechanism of failure that needs further research is Adiabatic Shear Bands (ASBs). ASBs occur in a material that experiences a high strain rate which results in an extreme increase in temperature and eventually a fracture. The mechanical equivalent of heat discovered by Joule states that about 90% of plastic work is converted to heat [2]. Cases in which this would occur would be: "Ballistic impacts, torsion Hopkinson bar tests, and industrial processes like machining, forging, drilling, cutting, and shearing" [3].

The goal of this research was to gain useful information about ASBs using an image of a material that has already been tested. However, this research only used a post image of the material after testing, meaning this method will not work as it requires a sequence of images to use the algorithm. This tool is being created for high-speed machining that results in serrated chips. This project aimed to create a fast and reliable tool and to be able to create a method of correlation to traditional Digital Image Correlation (DIC) methods.

Methodology

A. Specimen Preparation

The samples used in this study were Aluminum 7075-T6 obtained from a single manufacturer. Parent samples were taken from a small piece of the aluminum, machined on the lathe at a specific rake angle and speed, and put into epoxy molds. A semi-automatic sander was used to sand from coarse grains to fine grains (80,320,600,1200 grit) and polished on suspended alumina to 1μm. Finally, the specimens were etched in Keller's Reagent which contains Nitric acid, hydrochloric acid, and hydrofluoric acid. This etching solution is specifically used for aluminum alloys.

B. Image Preparation

Images were taken in 20, 50, and 100-times magnification with the optical microscope, Alicona. The images were only taken after etching because the microstructure is shown, and the image processing technique requires that grain lines appear.

C. Features Extracted from Base Images

The main feature extracted from the images were the raw pixels of the image which include the gray-scale intensity of each image. Information of a parent material will be used to determine the average pixel density to correlate the image with the "undeformed" image created in the tool.

D. Main Deformation Procedure

This project used metallographs of aluminum specimens as an input for a MATLAB tool to determine approximate shear band widths. The metallographs consist of chips that exhibit multiple shear bands in the form of a serrated strip. The tool takes a picture of a deformed, machined chip and uses that image to "undeform" the picture and represent the parent material. This is the most important step of the process because it applies a displacement field across the image that represents the deformation that took place during machining. The algorithm is presented below.

1. Load the pre-processed image and get the matrix of the image
2. Manually place points on the image approximately where the ASBs start and finish
3. Fit a curve to the selected points using a 4th order polynomial
4. Looping through each pixel of the image, the closest distance from the curve was found by calculating the Euclidean distance from the point to each curve
5. After finding the closest distance, the magnitude of displacement was calculated based on the energy approach by Shapoa Su [6]
6. This magnitude was then multiplied to a unit vector in the direction of the curve that it was closest to
7. After the vector field was generated, a linear interpolation was used to generate a new "undeformed image"

The current displacement field is applied parallel to the shear band with a magnitude calculated directly from the velocity equation below assuming a fixed change in time:

$$V(y)=Vo*tanh(y/h)/tanh(H/h)$$

In this equation, Vo is the initial velocity of the shear flow, y is the distance from the shear band to the point of interest, h is the shear band width, and H is the slab width of the serration.

Results and Discussion

This research will be continued with the effort to get better results as well as set up methods for correlation, faster run times, and include more material specimens. The current metric that is used to determine if the tool is producing adequate checks is a qualitative check. This includes looking to see if grain boundaries are equiaxed, if the grain boundaries start to line back up, and if the free surface connects back together.

While research is ongoing, some interesting findings that have been discovered. For instance, this method for obtaining these images has provided some good results. Figure 2 shows an image of the parent material that is being used as a qualitative metric to determine image quality from the tool. Figures 3 and 4 show the chip before and after the tool was used. This is where one can see the free surface meet up.

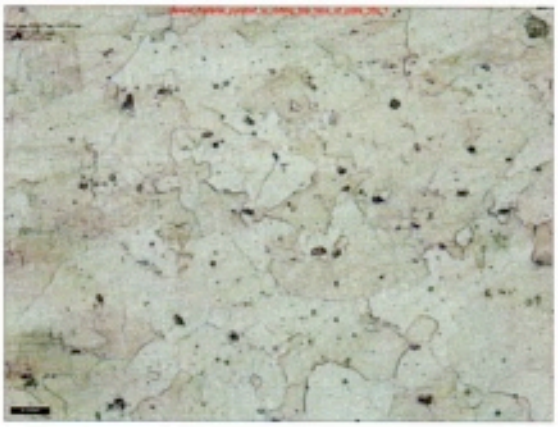

Figure 2: Parent Metallograph

Figure 3: Sample Image Before Tool

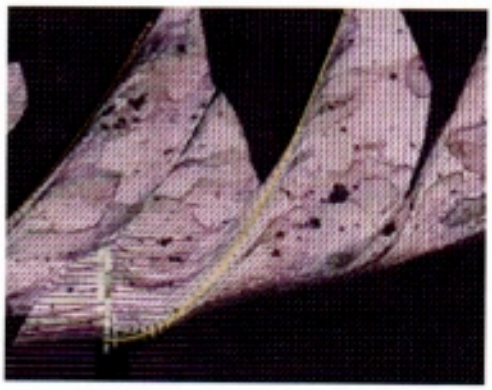

Figure 4: Sample Image After Tool

Figure 5: Multiple Band Issue

These results show mostly that the free surface is reconnected. However, the metric for determining if the grain is equiaxed is still unknown. This is difficult to determine because there is residual or secondary shear strain that does not propagate from the ASBs.

Another important point is that the current tool defines the velocity of each pixel based on the closest ASBs. This is helpful as the run time is shortened; however, applying multiple shear bands to the program will cause the slabs to split in half, as shown in Figure 5.

The speed that the program runs the image is one limitation to this current design. At a resolution of 5000px X 5000px, the program analyzes the picture in approximately an hour. This time is considerably slow and restricts the process's success. However, the code is not fully optimized at this point, so further improvement is still attainable.

When testing this procedure on samples of 7075 T6, the process showed promise, but the software needs more development to be used as a reliable tool in the field of metallography. The displacement field applied to the image does not pass a simple qualitative check to verify similarities to the parent image. This is likely because the displacement field formulation is based on a 1D thermal Couette flow.

Conclusion

These results show promise in creating a new image processing tool for metallography that shows ASBs and provides a technique to either confirm results from an FEA analysis or give good estimations for the shear band width. This method proposes a fast solution to finding critical information about the ASBs such as shear band width and exposure temperature.

However, the tool still needs qualification checks, faster run times, and multiple tests with different materials, as well as being able to have different functionality to automatically run multiple images and obtain average data from them. Currently, the tool requires manual input from the user to define ASBs, which then requires more effort and longer run times. It also makes the program prone to more human error. Overall, this tool has seen some preliminary testing, and, with the results shown, this tool should be developed further to improve functionality as well as improving its accuracy.

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Range Anxiety in Electric Vehicle Owners

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Introduction

Electric vehicles (EVs) are gaining popularity in the transportation sector. The distribution of EVs has increased tremendously over the last decade and continues to increase in response to the clean energy goals proposed by the Paris Climate Agreement as well as industry-imposed standards (U.S. Department of Energy, 2018). EVs have many upsides such as lower greenhouse gas emissions, reduced oil imports, and a lower carbon footprint than traditional gasoline-powered vehicles. EVs also have fewer moving parts resulting in a decreased need for maintenance. They also save the consumer money as the cost for "eGallons" (electric gallons) is cheaper than gas. The US average cost for regular gasoline is $2.11 per gallon while the average cost for eGallons is $1.21, as of November 07, 2020 (Tillemann, 2013). Electric vehicles also convert electricity to motion three times more efficiently than gas vehicles convert gasoline, but charging these vehicles is time-consuming (Kelly, 2020). Another issue with electric vehicles is concern about limited driving ranges and a lack of charging infrastructure, which has led to range anxiety. According to J.D. Power, range anxiety is what an electric vehicle driver feels when the battery charge is low and the usual sources of electricity are unavailable (Wardlaw, 2020).

Range anxiety is not a disorder; it is likely due to high levels of general anxiety bleeding over into the new challenges that come with owning and operating an electric vehicle. General anxiety is the reaction of the mind and body to stressful, dangerous, or unfamiliar situations (Jovanovic, n.d.). People with anxiety disorders frequently have intense, excessive, and persistent worry and fear about everyday situations, rumination, lack of problem-solving, and lack of thinking objectively. Occasional

anxiety is a normal part of life. Though the root cause of anxiety is unknown, there are several risk factors that affect anxiety levels such as intelligence, life experiences, medications, and genetic predisposition. The stress of dealing with electric vehicles can trigger the symptoms of anxiety. This paper hypothesizes that 1) range anxiety will be predicted by general anxiety, 2) range anxiety will be higher in women, 3) range anxiety will not be linked to length of commute.

Methods

Secondary data was used in this study. Primary data was collected by a team of researchers at WSU from the Psychology and Engineering research departments. The study consisted of 186 individuals who owned electric vehicles. The only inclusion criteria were that the participants had to be between the ages of 18-89 years and had to own an electric vehicle. The average participant age was 53.32 years (SD = 18.62 years). Participants were recruited online through the Qualtrics program; there was no direct contact between the experimenters and the participants. Demographically, the sample was composed of 19 African Americans, 137 White (self-identified as non-Latino or non-Hispanic ethnicity), 9 individuals who identified as Latino or Hispanic, 14 individuals identifying as Asian, and 5 biracial individuals. To fit the requirements of our analyses, the participants were dichotomized into the groups White (n = 137) and non-White (n = 47). There were 100 men, 84 women, and two who did not wish to self-disclose their sex.

The Qualtrics survey asked basic demographic questions about the participants' electric vehicle usage, energy consumption flexibility, and anxiety levels. It also included the Depression Anxiety and Stress Scales, a set of three self-report scales designed to measure the emotional states of depression, anxiety, and stress. Descriptive statistics, as well as correlations between the variables, were used to describe the data. Univariate comparisons were conducted to determine eligibility for inclusion in a multivariate linear regression. Chi-square analyses were conducted on categorical variables and ANOVAs were conducted for continuous variables. All variables demonstrating a significant relationship with range anxiety were loaded into a linear regression predicting range anxiety

Results

The high anxiety group was shown to be younger with higher rates of general anxiety and depression (indicated by the Depression Anxiety and Stress Scales, DASS). This group also showed less conscientiousness, less emotional stability, reported lower education, more children in the household, and a longer daily commute. Significance levels were interpreted at $p = .05$. No significant differences were found in empathy quotient or annual household income. Age, depression and anxiety, conscientiousness, emotional stability, years of education, children in household, and daily commute were all significant at $p<.001$. This significance level showed that there was a very strong relationship between these variables and range anxiety. The best predictor of range anxiety was age ($F = 61.90$) then depression and anxiety ($F = 36.62$). We found that the high anxiety group was mainly female

while the low anxiety group was mainly male. However, the Chi test indicated that there was no significant gender difference (sig. 2-sided = .060). It was also found that whites were more anxious than non-whites. Two regressions were examined where a significant association was found between the DASS and range anxiety. However, in the second regression, age emerged significant ($p \leq .001$). When age and number of children were not included, the DASS proved to be significant. However, once age was included in the model, the DASS was no longer a significant predictor of range anxiety.

Discussion

The data results largely supported the first hypothesis that range anxiety would be predicted by general anxiety. Anxiety is non-domain specific (National Institute of Mental Health, n.d.), which means people who tend to be anxious will worry about a multitude of things. It was no surprise that range anxiety was due to the influence of general anxiety, that is, when age is disregarded.

The results did not support the second hypothesis that range anxiety would be significantly higher in women. This came as a surprise because it was not parallel to past literature. In the study by Terlizzi and Villarroel, it was found that women tend to have high levels of anxiety across the board (Terlizzi & Villarroel, 2020). The sample used for this study may not have been ideal and fully representative of the general population.

The third hypothesis of range anxiety not being linked to the length of commute was supported by the data. People tend to want their vehicle to be able to drive a greater distance than their regular daily commute. In addition to driving distances, there is also the fear of not reaching a charging station in time. These fears show that range anxiety is not realistic. New and innovative ways are being sought out every day to extend the power and longevity of batteries. According to Platts Analytics Energy Outlook, the estimated number of public charging stations increased to 75,000 in 2019 and then to an estimated 90,000 in 2020 (Ryser, 2021).

The study had several limitations including the sample size. The sample size was small and may not have been representative of the general population. The ratio of males to females as well as younger to older adults was also not proportionate. Additionally, the discussion of anxiety may have been too sensitive for the participants to disclose confidently. There could have been the concern regarding anonymity, as well as other unaddressed issues or concerns.

Conclusion

According to the results of this study, range anxiety is a limiting factor for EV adoption. Range anxiety was predicted by general anxiety and not linked to length of daily commute. Anxiety was largely impacted by age whereas it decreased as the age of the sample increased. Range anxiety is a concern for individuals purchasing and owning of electric vehicles. However, this should not be a deterrent to buying them. Potential buyers could be fully briefed on the specs and functionality of

EVs prior to them making their decisions. Also, future directions for this study could include getting a large enough sample size that is representative of the general population as well as a sample size with a proportionate age group and gender ratio.

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Strategies Implemented in Speech-Language Services for Bilingual Adolescents

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Introduction

Complex cases of bilingual students can lead to misdiagnosis (ASHA, 2021) and can potentially create confusion with language differences and language disorders. According to the American Speech-Language-Hearing Association (ASHA) when differentiating between a difference and a disorder, clinicians consider all aspects of language including phonology, morphology, morphosyntax, syntax, and semantics shown by the individual. These can be found in many assessment tools utilized during speech therapy sessions. Although there are many standardized assessment options, utilizing the same assessments for the monolingual and bilingual communities could lead to misdiagnosis. School-based speech language pathologists (SLPs) experience challenges when working with students from culturally and linguistically diverse backgrounds because of inadequate access to appropriate assessment tools, low confidence levels, and/or limited knowledge and skills. When a child with speech or language difficulties is bilingual, providing skilled services can be difficult, and the particular reason for this circumstance is because some SLPs may not feel confident in their abilities to best serve the individual. This is an important issue because most SLPs report not being comfortable in the area of service delivery to bilingual children whose first language is Spanish (Scheffner Hammer et al., 2004).

The objective of this project was to explore whether differences in clinical services exist between school-based SLPs and non-school-based SLPs who provide skilled speech-language services for bilingual adolescents (for the English and Spanish language) in Kansas. Adolescents are a relatively neglected group, and speech and language disorders can negatively impact them by leading them to

social, emotional, and behavioral issues. These things can affect their literacy skills and academic success in schools. Since there is minimal research on adolescents, this study will allow SLPs to receive more information on the targeted population.

Methodology

Procedure

To collect data on our aims, we conducted interviews with school-based SLPs and clinical-based SLPs who have experience with bilingual adolescents. These interviews were completed through Zoom, and the goal was to determine how their strategies differ when serving bilingual adolescents identified as needing skilled speech-language services. The participants answered 10 interview questions regarding their experience with bilingual adolescents as well as strategies implemented in their current setting. The questions were classified as seven open-ended questions and two Likert scale questions including a poll and included variables of interest such as prior experience, caseload, student/parent satisfaction, and skilled therapy outcomes when available.

Participants

Participants in the state of Kansas were selected based on their experience working as an SLP in a clinical or school setting as well as being fluent Spanish speakers. Three participants completed an interview via Zoom for 30 minutes, including a poll question. Two participants worked in a school setting and one participant worked in a clinical setting.

Materials

Informed consent forms were used containing information about procedures, benefits and risks of participating, an explanation of the research, voluntary participation, and contact information of the researchers. A form containing all questions was used to allow the participants to not only listen to the interview questions but read them as well. Participants had to have access to a computer and the internet in order to complete the interviews. The researcher used a password-protected drive to securely store all study-related data.

Results

In Table 1, it can be seen that participants whose first language is Spanish feel more confident in their abilities to work with bilingual adolescents. However, the participant with English as a first language feels comfortable working with younger children and is beginning to feel more confident with adolescents. During the study, strategies that work with bilingual adolescents were found. In a clinical setting, doing one session completely in Spanish and one completely in English to target both languages for both home and school has seemed to work more often, as well as letting them have more choices in the session and being transparent with them about their goals and progress. In schools,

Participant 3 had mentioned a strategy used by her was giving students access to English only when it was necessary, this way the SLP could see what skills were available in which language.

After completing this study, it has been proven with these three participants that there is a lack of therapy materials SLPs have available to use to work with bilingual adolescents and with the bilingual population overall. Participant 1 mentioned that this is an area that is lacking, and he wishes more materials were available for adolescents. Although there is a decent amount of evaluation instruments available, additional tools were suggested by the participants as ways to improve the evaluation process.

Table 1: Participants

Participants	Sex	First Language	Years as an SLP?	Currently work in a school or clinical setting?	Years in current setting	Ages of students/ clients served	Number of students/ clients on caseload	Confidence
Participant 1	M	Spanish	10y	clinical	4y	2-18yo	60 per week	Comfortable
Participant 2	F	Spanish	20y	school	13y	3-14yo	40-50 per week	Confident
Participant 3	F	English	1y	school	1y	2-11yo	30 per week	Starting to become more confident with the older school-age population

Discussion

Because of the lack of assessments directed towards bilingual individuals, SLPs have had to use other materials such as parts of different assessments. As Participant 2 mentioned, updated assessment tools that include norms specifically focusing on the English/Spanish bilingual population need to be published. We need more testing materials for the younger population ages 3- to 7-years-old and to evaluate older children. SLPs would like to see the CELF-4 revised, as well as more pragmatic language tests being developed. As the participants continued talking, one of them mentioned the need for more screening tools for children above the age of 7 and adolescents as well as fluency tools and language samples. It is a possibility that with new assessment tools, strategies implemented in each

setting could change. Limitations within this study would be clarification of the word "strategy" in the interview questions. Because of this, the question led participants to explain more about assessments rather than treatment strategies being used.

Conclusion

As seen, new norms for the bilingual population are needed within the field of speech-language pathology. New materials are important for SLPs. When comparing strategies between clinical and school-based SLPs, we can see that although they both utilize both the English and Spanish languages. However, they have one main difference. School-based therapy focuses on the student's curriculum and social life within the school parameters. Therapy provided in a clinical setting may focus on language outside of their curriculum. With the limited number of participants in this project, we can conclude that first-language Spanish speakers feel more confident in their ability to provide therapy for bilingual adolescents.

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Numerical Conformal Mapping and Fluid Flow

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Introduction

This project used numerical conformal mapping in order to compute fluid flow over an ellipse. This built off a previous project in which we utilized Sage in order to plot fluid flow over an airfoil. We expanded upon this idea utilizing MATLAB. The conformal mapping method we used was Theodorsen's method.

We computed potential flows of inviscid fluids in the two-dimensional complex plane where powerful methods of complex analysis and conformal mapping can be used. Those flows provide good approximations of realistic three-dimensional flows in certain flow regimes. Though these methods have been replaced by more general and sophisticated methods of computational fluid dynamics (CFD) in the last few decades, methods using complex variables are still of interest to aeronautical engineers and can provide test cases or initial approximations of realistic methods. In addition, recent work at WSU by Professor DeLillo and colleagues has led to new, more efficient methods for computing the conformal maps [4, 5, 7, 8, 13] and the potential flow [11, 12, 14].

Computing potential flow over airfoils using numerical methods for conformal mapping is a classical method dating back to the work of Theodorsen [21]; in which, the first general method for computing conformal maps was proposed. Other methods, such as the method of Timman/James (see, e.g [16, 10]), were also developed and applied by aeronautical engineers to both single and multiple airfoil configurations [15, 20, 23]. Methods for computing conformal maps with applications to a variety of flow problems were developed by Prosnak [19].

Methods

The methods we were concerned with compute the conformal maps from a "computational domain" bounded by circles to the physical "target" domain; in our case, the exterior of an airfoil. Finding these maps is a nonlinear problem and must be solved by an iterative method. The methods of Theodorsen and Timman/James use successive conjugation and converge linearly. The projection method of Prosnak [19, 22] is also a linearly convergent method. More recent methods of DeLillo et al. [9] and Wegmann [22] are quadratically convergent Newton-like methods. All of these exploit the fast Fourier transform (in the simply connected case) for fast computations of complexity, for N mesh points on the boundaries.

Previous research has found applications of conformal mapping to computing lift, drag, and moments for airfoils from an engineering perspective [2, chap. 5], [3], [17, chap. 6], [18, chap. 18]. Wind tunnel data has also been compiled for a variety of airfoils [1]. We intended to reproduce such calculations for representative examples.

To plot flow over a region, it is important to perform a transformation from the unit disc. Before plotting the transformation, we first plotted the streamlines over the unit disc. Once we had the solution to the streamlines over the unit disc, and we knew the transformation between the unit disc and our chosen region, we utilized this transformation in order to take the streamlines that we plotted over the unit disc and plot the streamlines in the target domain.

Results

Theodorsen's method was used to transform from the unit disc to the elliptical domain. In order to utilize Theodorsen's method, we first found a boundary correspondence. That is, we found . [11] This can be done by finding a Taylor series for the map.

Once we had a boundary correspondence, we could perform Theodorsen's method. We performed complex conjugation, and then once we had this information, we used it to create a conformal map from the unit disk to another region such as an ellipse. For Theordorsen's method to work, the region we wanted to map to had to be analytic and starlike. The eccentricity also could not be too small.

We used an ODE solver to plot the solution curves of the stream function. ODE solvers are predefined functions in MATLAB that help us solve ordinary differential equations. In this case, we used ODE45. Once we plotted these solution curves, we conformally mapped them to the ellipse.
This project was a continuation of another project in which we utilized Sage to compute streamlines over an ellipse after performing a Joukowski transformation from the circle domain to the elliptical domain. In that project, we lacked the ability to add circulation. This problem has been solved by utilizing Theodorsen's method. The results of this project provide an approximation of fluid flow, but more needs to be done to most accurately match our theoretical model with experimental data.

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