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With admiration for your commitment to knowledge and discovery,

Co-Editors-In-Chief

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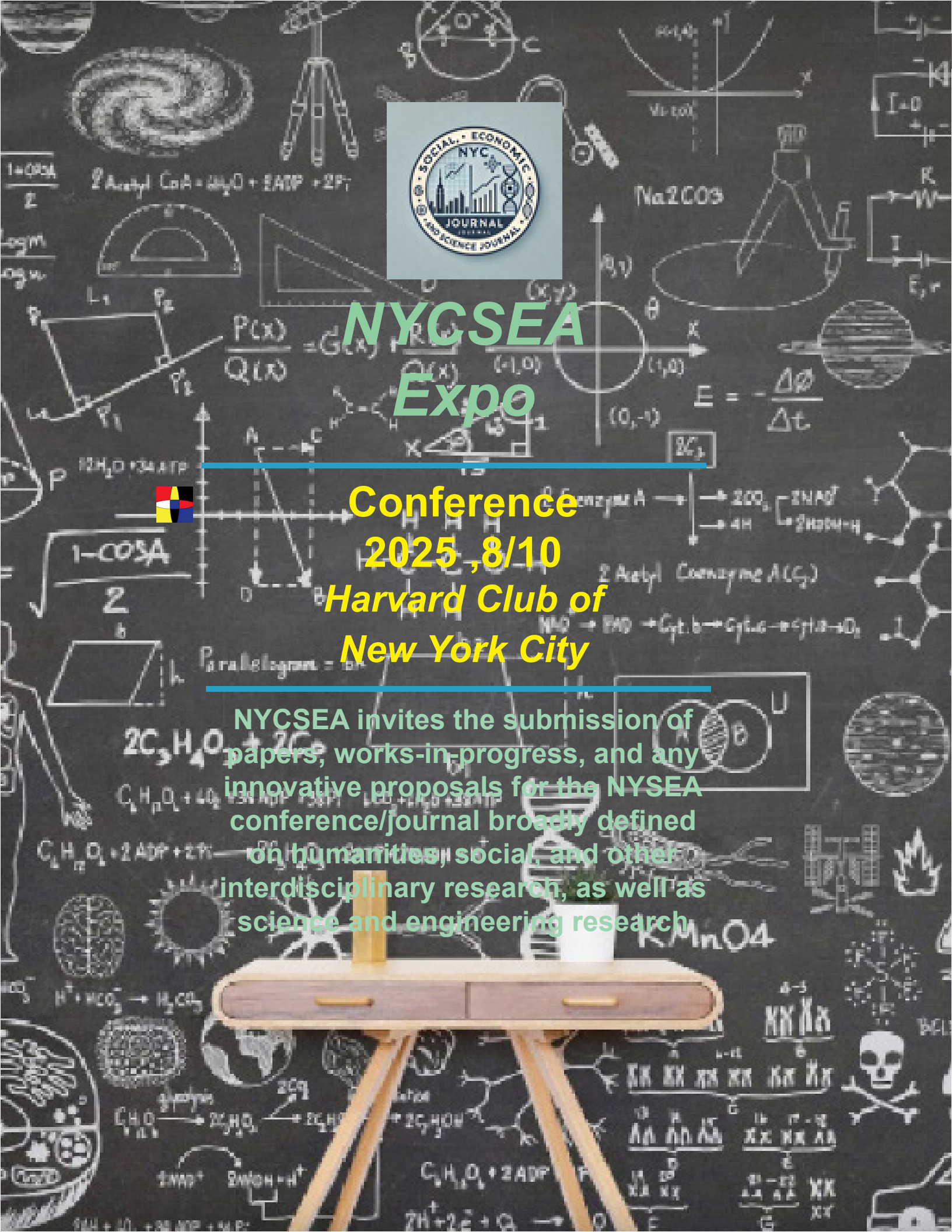
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The Efficacy of Chitosan on the Construction and Function of Compostable Wind Turbine Blades

Cathrine Sakin

Abstract - Recently, publications displaying landfills dominated by wind turbine blades, composed primarily of composite materials, have caused public anxieties to rise. Though there has been much research analyzing the benefits of thermoplastic alternatives, such substances, though preferable, are limited by long degradation rates. Though biodegradable plastics have been a topic of discussion, many produce greenhouse gasses as they degrade, further harming the atmosphere. Compostable plastics, a subcategory of biodegradable plastics, have been largely overlooked as wind turbine blade material alternatives. The following research filled this gap through the creation of chitosan-based compostable wind turbine blades. Chitosan is a chemical present in the shells of Brachyura (crabs) including the invasive *Hemigrapsus sanguineus* (Asian Shore Crab) species. In addition to these shells, chitosan supplements, glycerin, vinegar, and distilled water, was used in the creation of three batches of two identical blades. A small-scale wind turbine was produced in addition to a wind tunnel. These blades were tested for voltage production (with the wind turbine and tunnel produced) and minimum tensile strength. This research resulted in the creation of an environmentally ideal, industrially applicable, compostable wind turbine blade material alternative while providing a purpose to the otherwise harmful and invasive Asian Shore Crab species.

Keywords: Compostable plastic, *Hemigrapsus sanguineus,* Brachyura, chitin, wind turbine blades, voltage production, tensile strength

Introductory Information

Research Question

Can *Hemigrapsus sanguineus* invertebrates and alternate Brachyura shells be utilized in the creation of compostable, structurally sound, and energy-efficient wind turbine blades?

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Hypothesis

The *Hemigrapsus sanguineus* (Asian Shore Crab) invertebrate and alternate Brachyura shells will aid in the production of structurally sound, energy-efficient, compostable wind turbine blades; providing a superior alternative to common, non-compostable, glass and carbon fiber situated blades whilst providing a purpose to the invasive Asian Shore Crab species.

Literature Review

The Wind Industry and Compostable Plastic

The demand for renewable energy has increased precipitously over the past decade, as society has become more environmentally conscious. This is evident in the inclining rates of wind power utilization globally. According to the University of Michigan, "The U.S. wind capacity increased by 166% between 2010 and 2020, a 10% average annual increase" (Center for Sustainable Systems, 2020). In addition, within a single year, "Total capacity for wind energy globally [in 2019 was] over 651 GW, an increase of 10 percent compared to 2018" (GWEC, 2020). Evidently, the wind industry has gained much traction, and understandably so; "The main advantages [of wind energy] include an unlimited, free, renewable resource (the wind itself), economic value, [relatively low] maintenance cost, and [simple] placement of wind harvesting facilities," allowing such mechanisms to rise in global preference (Lloyd, 2014). Though wind energy is an environmentally superior alternative to fossil fuel and finite energy reliance, an analysis into the construction of wind turbines uncovers a significant, negatively impactful flaw.

The majority of wind turbine blades, primarily composed of composite materials similar to, and including, glass and carbon fibers, prove arduous to recycle. Due to this lack of reprocessing capability, there are multiple landfills hosting such blades; wind turbine blades are typically replaced every 10-20 years, and the most common blades are formulated of plastics with decomposition durations of 200-400 years (Image 1).

Image 1

Comparison of predicted degradation profiles for HDPE pieces with the same mass, density, and SSDR but different shapes (thin film, fiber, and bead)

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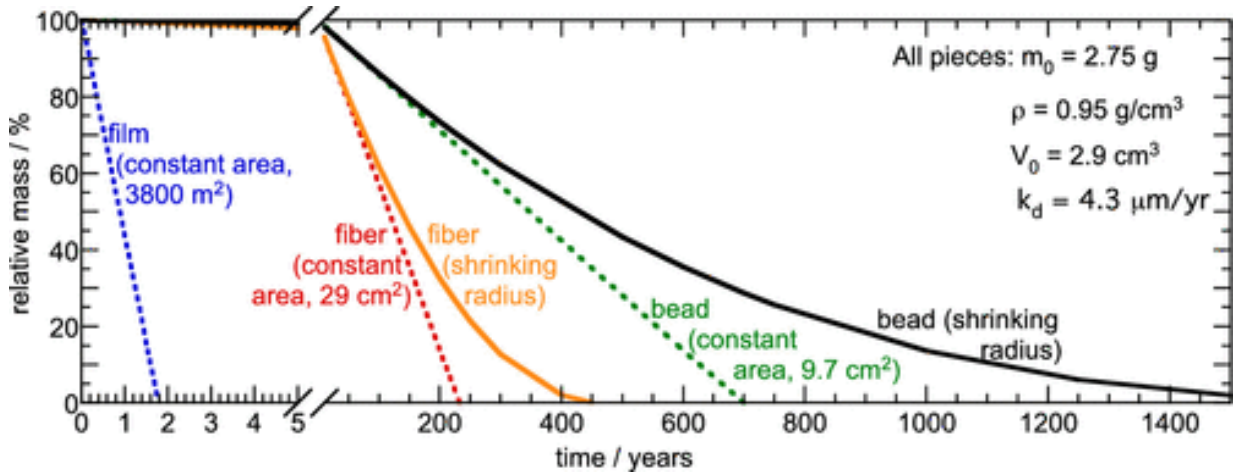

Note: Chart by Scott, S. L., Suh, S., Chamas, A., Moon, H., Zheng, J., Qiu, Y., . . . Abu-Omar, M. Published February 3, 2020. As is evident, for plastics composed of fibres (glass and carbon), the duration of decomposition may range between approximately 200 and 400 years .

This problem has made headlines in recent years within reputable publications such as NPR and BBC News. Researchers globally have instigated scientific inquiries pertaining to possible solutions and prevailing disposal options. One of the most popular innovations is the development of thermoplastic-situated wind turbine blades. These blades are easily recyclable, and simplicity in repairs proves economically viable. Though such solutions aid in the recyclability and longevity of the wind turbine blades, this does little to lessen the duration of deterioration. Even with the superior recyclability and durability of these blades, replacements must occur.

There are some who believe that the resolution resides in any biodegradable plastics; the reason being the misconstrued perception that materials under this category are environmentally advantageous in all forms. Though advertised as the global “cure” to pollution, many biodegradable plastics (bioplastics) emit greenhouse gasses during decomposition, further harming natural surroundings. Compostable plastics are a subcategory of bioplastics; these materials not only decompose at favorable rates but also produce beneficial products for the soil after they undergo composting treatments.

According to the Environmental Protection Agency (EPA), in order for plastics to be classified as compostable, “[they must be able to be] broken down by biological treatment at a commercial or industrial composting facility… Decomposition of the plastic must occur at a rate similar to the other elements of the material being composted (within 6 months) and leave no tox-

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ic residue that would adversely impact the ability of the finished compost to support plant growth," (page 3, 2020).

For these reasons, identified by the EPA, compostable plastics are the environmentally superior alternatives to non-recyclable and even most biodegradable materials; proving necessary in modern research, especially for products requiring a vast amount of polymer reliant substances.

Chitin and Chitosan

The foundation of all plastics are polymers, though the same cannot be said about the reverse. Polymers are chains of repeating monomers, and, though all plastics are composed of these chains, certain polymers must be altered to be implemented in plastics; it is significant to note that there are natural and synthetic polymers. Synthetic polymers are derived from petroleum oil to form nylon, polyester, teflon, polyethylene, and similar substances. Natural polymers are very common in many forms, including polysaccharides: "polymer[s] composed of sugar molecules," appearing significant for the survival of many species (Encyclopedia Britannica, 2020). Notably, cellulose is a necessary polysaccharide in animals, starch in plants, and chitin in many crustaceans, including lobsters, isopods, and crabs.

Furthermore, according to Daniel Elieh-Ali-Komi, a senior researcher at Tabriz University of Medical Sciences, and Michael R. Hamblin, professor at Harvard Medical School, "Chitin is the most abundant aminopolysaccharide polymer occurring in nature" and the second most abundant natural biopolymer (2016). Chitin is a significant resource and is gaining popularity in current research inquiries; this is due to its vast presence, in addition to its ease in attainability, as chitin is removable from the shells of crustaceans. Advantageous properties of chitin include biodegradability and a lack of toxicity, making chitin a preferred material in the creation of biomedical devices (Daraghmeh, N., 2011). Chitin is also, however, insoluble. Solubility is an important factor in the creation of plastics. For this reason, those using chitin often alter the polymer into chitosan, a deacetylated derivative of chitin with the ability to dissolve in acidic solutions. This soluble alternative does not alter the biodegradability; the process of chitosan creation involves the removal of calcium carbonate, calcium chloride, and N-acetyl groups. In addition, though many methods of transforming chitin to chitosan include heavy chemicals which may prove harmful to the environment, friendlier alternatives, such as the use of enzymes during deproteinization and deacetylation, should be considered.

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The Asian Shore Crab and Novel Plastics

Long Island and the East Coast of the United States have experienced an increase in the invasive Asian Shore Crab (*Hemigrapsus sanguineus*) population for the majority of the years between 1994 and 2005 (Kraemer, G., 2007). These species are still believed to be a significant issue locally and sightings are encouraged to be reported immediately, according to the New York State Department of Environmental Conservation (2020). Asian Shore Crabs, primarily from East Asia, harm local biodiversity and, often, lessen the native populations. Asian Shore Crabs are known to consume native crabs, including the "*Carcinus maenas* (Green Crab), *Mytilus edulis* (Blue Mussel), and *Littorina littorea* (Common Periwinkle);" also noteworthy, the population of Asian Shore Crabs has been increasing significantly north of Cape Cod, increasing concerns that these damaging and "dramatic changes in community structure may be widespread," or more so than they already are (Bloch et al., 2015).

Asian Shore Crabs are able to withstand tremendous changes in temperature, providing an explanation for their large presence on the East Coast of the United States: Approximately 7,000 miles away from their native settings. This ability of the Asian Shore crabs allows them to survive the grueling journey from East Asia through the Pacific and Atlantic oceans, consisting of temperatures averaging around 3.5°C in the Pacific and 30°C in the Atlantic, tides as strong as 40 feet near Canada, and increasingly powerful winds. These organisms are resilient and, though significantly impactful, laws and reporting sites/methods, such as iMapInvasive and state-specific departments, have limits: namely, the general public's ability to differentiate between species. For this reason, human intervention is an alternative worthy of consideration.

Researchers at the Georgia Institute of technology, on July 23, 2018, published information on their creation of a novel, compostable plastic out of the chitin and derivatives located in crab shells. This creation made headlines, as it proposed the opportunity to incorporate this environmentally superior plastic in the food packaging industry. This research also emphasized the revolutionary ability to incorporate crabs and other crustaceans in the development of compostable plastics for alternate purposes (Brown, 2018). Though there has been much research pertaining to the use of chitin, found in crab shells, in the creation of plastics for food packaging, there has been no research on the use of such crustaceans in the creation of plastic for wind turbine blades specifically; much less research is available investigating the incorporation of invasive crab species in

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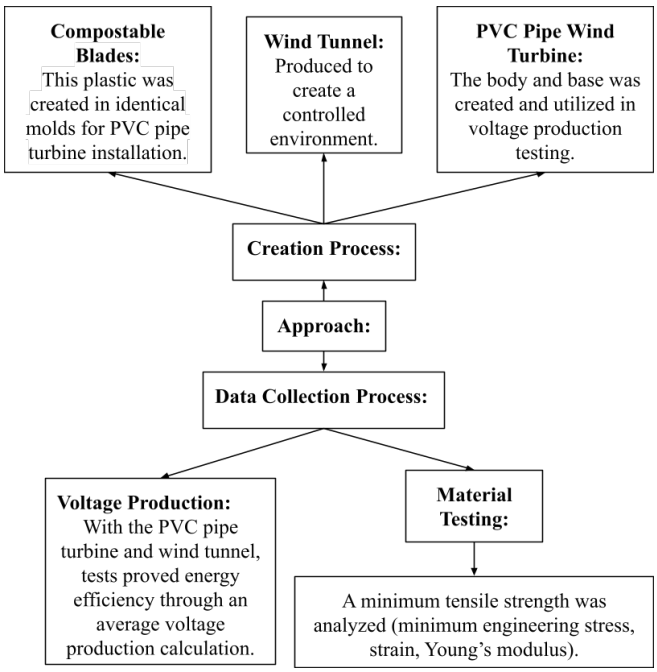
the production of such plastics. In addition, there have been inquiries investigating the efficacy of thermoplastics and recyclable alternatives in the creation of wind turbine blades, however, the use of compostable plastics for this purpose has been overlooked. The following research filled both gaps in the scholarly conversation, while providing a purpose to the otherwise harmful and invasive *Hemigrapsus sanguineus* species, commonly referred to as the Asian Shore Crab.

Methodology

The following methodology consists of a creation process and data collection process with the purpose of answering the question posed: Can *Hemigrapsus sanguineus* and alternate Brachyura (crab) shells be utilized in the creation of structurally sound, energy-efficient, compostable wind turbine blades? The creation process addresses plastic production, wind turbine production, and wind tunnel production. The data collection process includes material testing through two methods (voltage production and material testing). The creation process of this research was designed with the intention of producing compostable wind turbine blades and utensils with which to test these blades. The data collection process of this research endeavor attempted to prove that these blades are structurally sound and energy-efficient. Refer to Figure 1 for a simplified overview of the overall approach (and subcomponents).

Figure 1

Flowchart of Methodology Consisting of Two Parts (Creation and Data Collection Processes)



Note: The products developed in the Creation Process were then utilized in the Voltage Production portion of the Data Collection Process. Additional material testing was also conducted in this portion.

Creation Process

Plastic Production

A metal container was situated over a hot plate (off). In this canister, 1g of powdered crab shells (including the Asian Shore Crab invertebrate), 30 g of 90% deacetylated and powdered chitosan,

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20 ml of glycerin, 150 ml of distilled water, and 20 ml of vinegar were added. All ingredients were mixed prior to the instigation of the hot plate. Mixing continued at a constant, medium-pace as the hot plate was turned on low (around 30 degrees celsius). The solution in the pan was mixed with increasing heat for 30 minutes (final temperature measurement of 60 degrees celsius) until a paste-like substance with low viscosity was formed (30 minutes total on heat). The mixture was then poured into two identical molds (image 2).

Image 2

Solution Poured Into Two Identical Clay Molds Covered in Aluminim Foil

Note: These molds were produced with clay and prepared in a common oven at a temperature of 135°C for 360 minutes. They were then covered in aluminum foil.

The plastic was left to cool at room temperature for 72 hours before removal from molds. It is significant to note that this procedure produced one batch of two identical blades. These steps were then repeated 2 more times to produce 3 total batches of two identical blades each (6 blades total).

It should be noted that chitosan is often a large component of commercially sold compost, and crab shells are often used in homes to produce compost. This method is an alteration of approaches emphasized by Stanford University (Sullivan, n.d.) and Oregon State University (Oregon State University, 2010). The original materials published by these institutions emphasized the use of starch rather than chitin and its chitosan derivative. Starch-based biodegradable plastics are prevalent commercially, however, virgin starch (more common than reclaimed starch) plastics result in greenhouse gas (GHG) emissions during production and cultivation. The compostable plastic produced with chitin at the Georgia Institute of Technology was revolutionary for its use of a superior alternative to starch. This method was created with consideration of all of the above information.

Wind Tunnel Production

Measurements, which were reliant on the diameters of the fan utilized, resulted in a flow straightener of equivalent height and width to the fan and a flow straightener with a length equivalent to about half of the height of the fan. With cardboard tubing, the

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flow straightener was created and attached to the head of the fan (with a commercially sold adhesive). The 1 cm outermost end of the perimeter of the straightener was then connected to the contraction segment composed, also, of cardboard (45-degree angle inward).

This wind tunnel was produced with the purpose of providing a constant, controlled environment during the data collection portion of this research. The materials utilized in the production of this necessary utensil were selected due to their ability to control the path of the air in motion, as well as their availability and accessibility.

PVC Pipe Wind Turbine Production

A T-fitting was placed on the end of a PVC pipe, 24 inches in length. A hole was drilled in the lid of a large plastic container, and the bottom half of the T-fitting was situated in the lid. Next, the nacelle was prepared.

For the nacelle, a three-inch segment and a one-inch segment were sawed off of a second 24 inch PVC pipe. A 90-degree fitting was secured on one end of the three-inch segment, and a coupler was situated on the opposite end. The one-inch segment was fitted into the coupler. The circumference of the motor was covered in duct tape (for secure placement) and placed ½ an inch into the one-inch segment.

The motor wires were eased through the nacelle and PVC body. The nacelle was connected to the body (24-inch) and the ends of the wires were released through the 90-degree angle of the T-Fitting. Using alligator clips, the wires were connected to the multimeter (set at DCV 20). The crimping hub was then attached to the motor and everything was checked for security. The large plastic canister was filled halfway with weights, and the lid of the canister, with PVC pipe wind turbine attached, was secured on top of the canister.

The production of this PVC pipe wind turbine was requisite in order to test the blades for energy efficiency. See images of construction in the Appendix.

Data Collection Process

For voltage production testing, the two identical blades from batch one were attached to the crimping hub. The PVC pipe wind turbine, with blades, was then placed five inches away from the flow contraction segment of the wind tunnel, and the voltage production was observed (on the multimeter, set to DC Volt setting at 20 volts) for 30 seconds per trial (ten trials per batch). These blades were then removed and replaced by the remaining two batches (4 blades), two blades at a time, for the same observational approach.

Additionally, the tensile strength was calculated for one blade from each batch (3 total

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blades were tested). First, the cross-section area for each of the three blades was calculated, and the initial length of each blade was noted. Next, The blades were secured, vertically, against a wooden platform (blades were at rest, Fnet = 0N). The blades were then connected to more than 304.5 kg worth of mass (this value was multiplied by an acceleration of -10m/s/s for an approximate force of weight). To calculate the strength of the material, the engineering stress—load (applied force) divided by the cross-section area—and engineering strain—displacement (appearing minimal) divided by the initial length—were calculated. With these variables, the stress-strain response was analyzed, in addition to a Young's modulus, to determine the strength of the polymer independent of its size. It should be noted that the blades at no point fractured, so a complete stress-strain curve was not constructed for the analysis of blade strength. Rather, these calculations produced a minimum strength calculation.

Results and Analysis

Results

Voltage Production Raw Data

During voltage production testing, six blades in total were analyzed in pairs. Each batch (pair) was tested for voltage production ten times, resulting in 30 datum points. The average voltage production for all three batches was as follows: 0.65 volts, 0.91 volts, 1.20 volts. These values produced a cumulative average of 0.92 volts.

Datum points recorded in Table 2 (may be viewed in the appendix) were analyzed with a one-sample, single-tailed T-test. To conduct this test, the standard deviation, mean, and assumed mean were calculated, as displayed in Table 3 (may be viewed in the appendix). The result obtained was approximately 7.1. Using the value of 29 as the degree of freedom, and analyzing the 99% confidence interval, the null hypothesis (there is no correlation between the material used and the average voltage produced) was rejected.

In addition, alternate central tendency statistics were analyzed as visible in Table 1.

Table 1

Central Tendencies Displayed During Voltage Production

Tendencies	Batch One (volts)	Batch Two (volts)	Batch Three (volts)
Average:	0.65	0.91	1.20
Median:	0.65	0.91	1.20
Mode:	0.62	0.88	1.20

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Note: These central tendencies clarify the extent to which each blade appeared common/similar

These statistical central tendencies, though similar per batch, appeared in variety most likely due to the varying temperatures during the setting of the blades. To avoid variation in future studies, an environment of more constant temperature should be procured. Regardless, the minimal variation of inter-blade central tendencies supports the validity of this portion of the data collection process (the second component of the overall methodology).

Material Testing Raw Data

Tensile strength was analyzed through the utilization of mass greater than 304.5 kg and, consequently, a force greater than approximately 3,045 N. Three blades (one from each batch/pair), were analyzed. All three blades withstood this force and displayed minimal elongation (around 0.5 cm). The cross-sectional area measured for all blades was approximately 47.7 cm squared. The initial length for all blades analyzed was, approximately, 10.6 cm. With this information, a minimum engineering stress of 92.6 psi was calculated, in addition to a strain of 0.04, and Young's modulus of 245.4 psi.

Data Analysis

Voltage Production: Objectives and Results

The expected outcome for this portion of the approach was voltage production of approximately 0.4 - 0.8 volts, as this is the average for the majority of PVC pipe wind turbines with similar wind energy. Voltage production on such small-scale objects relies on many factors (pitch, number of blades, blade shape, total drag, and much more), making such endeavors less valid than material testing. The material of the blade is not the only aspect necessary to consider when observing voltage production, displaying a limit of this portion of the methodology. To defend this above-average voltage production, and this portion of the methodology, a T-test was conducted. As stated prior, the null hypothesis was rejected, supporting that, despite the impact of outside variables, the material utilized significantly contributed to the above-average voltage production. To further defend the purpose of the voltage production portion of the data collection process, it should be noted that this segment of the research approach did prove that the plastic described in the method above is able to hold the capacity for sufficient implementation in the wind industry. This method supports the ability of this material to take the shape of a blade mold and hold it well enough for above-average voltage

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production. The T-test value supports that voltage production of this material produces greater voltage to a significant extent in comparison to the average voltage production of similar turbines under comparable conditions (0.4 - 0.8 volts, though the average, 0.6 volts, was used to calculate the T-test value). This approach also indicated the level of simplicity that should be associated with the formation of this substance for the specific purpose of wind turbine blade production.

According to the United States Energy Information Administration, energy efficiency is defined as "using technology that requires less energy to perform the same function," (2020). The above-average voltage production observed by the blades created (0.92 volts) signifies that *Hemigrapsus sanguineus* invertebrates and alternate Brachyura shells can be utilized in the creation of compostable and, presumably, "energy-efficient" wind turbine blades: These blades can be composed and adjusted (was proven in this portion of the data collection process) to meet the requirements of the other aforementioned factors for maximum energy production with minimal-effort/simplicity (less energy required for an above-average result).

Further Analysis of Compostability

The following is an analysis and defense of the materials utilized in the production of this novel plastic (and their contributions towards the compostability of the plastic):

As stated prior, chitin is a polymer found in crab shells (a common component of compost) and chitosan is a soluble, deacetylated derivative. Vinegar is commonly added to compost to prevent weed growth and add necessary nutrients. Powdered crab shells contain both chitin and calcium carbonate. Though crab shells are known to be compostable, the presence of calcium carbonate should be further emphasized, as calcium carbonate raises the pH of soils. As is common knowledge, soils are most efficient when possessing a pH of between 5.5 and 6.5, often making calcium carbonate a necessity in compost. Dihydrogen monoxide is needed for plant development and is a natural compound. This leaves the added 20 ml of glycerin. Glycerin was utilized as a "plasticizer" and, though many may argue glycerin may negatively impact the environment, in such small quantities "glycerin does not affect the quality of the final compound[s] [in composts]," (Fehmberger et al., 2019). Cumulatively, it is evident that the plastic produced is compostable and beneficial to the environment.

Material Testing: Objectives and Results

Material testing proves, definitively, the efficacy of certain materials in their ap-

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plication within the wind industry. The objective of this research was to create compostable—through the use of materials listed prior—energy-efficient—determined by the voltage production portion of this research—and structurally sound—determined through material testing—wind turbine blades. As this plastic was composed in a home environment (due to school and facility closures), quality-impacting flaws were inevitable, though limited with great care in production.

The average tensile yield strength of the recent, and preferred, thermoplastics used in wind turbine blades is approximately 3.2x10^3 psi. The objective of this research was to produce plastic with a tensile strength of at least 640 psi (one-fifth of 3.2x10^3) or 44.8 atmospheres. Though unable to attain access to necessary machinery to calculate the exact tensile strength of this novel plastic, a minimum stress and strain were calculated. These values, with minimal elongation, support that this material would most likely reach, if not surpass, the objective of 640 psi. The Young's modulus of 245.4 psi further validates this claim.

Conclusions and Implications

The hypothesis was determined to be accurate: the *Hemigrapsus sanguineus* (Asian Shore Crab) invertebrate and alternate Brachyura (crab) shells, due to the large presence of chitosan, aided in the production of structurally sound, energy-efficient, compostable wind turbine blades; providing a superior alternative to common, non-recyclable, glass and carbon fiber situated blades, whilst also providing a purpose to the otherwise harmful and invasive Asian Shore Crab species; successfully filling both aforementioned gaps in the scholarly conversation. This research holds implications within the wind industry and material science fields, though potentially limited geographically: where there is not enough land for efficient wind farm instigation (or resources for offshore wind farming), where wind energy is not publicly supported. It should be noted, however, that wind energy is gaining popularity globally, so the impact of this research may prove more widespread as years progress. Also, this research created a path for novel inquiries in this field. Evidently, chitosan-based compostable plastic is a viable alternative to common wind turbine blades, however, this data cannot be applied for all types of compostable plastics. MF-Chitosan plastics should be investigated, due to the superior solubility of MF-Chitosan in comparison to chitosan, in addition to chitosan-paramylon blends. Paramylon is found in the *Euglena gracilis* protists and is known to contribute to the strength of many thermoplastic substances. The inclusion of this polymer would most likely aid in increasing the structural

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integrity of this novel, chitosan-based plastic, without harming the compostable nature of the substance.

In addition, this research provided an additional purpose for human intervention in the lessening of Asian Shore Crab populations (the creation of this polymer) in locations where these organisms are considered a concern, displaying implications in the safeguarding of biodiversity on the eastern coast of the United States of America. This, of course, would impact, in a positive manner, those who live in locations such as Connecticut and Long Island (Dauvin, Rius, Ruellet, 2009). This would especially aid those who make a living off of crustacean sails, such as local eateries and Bait and Tackle stores; there are laws restricting the sale of Asian Shore Crabs in these areas. Asian Shore Crabs lessen the population of crabs these communities may profit from, lessening the strength of the national economy as a whole.

Further research should be conducted to emphasize the validity of these results; further material testing is essential. Recommended testing includes compression testing, oxidative degradation testing, and shear force testing. Though the minimum tensile strength calculated proved that these blades are structurally sound, these additional forms of material testing would further emphasize the extent to which this plastic is structurally viable; which the data presented in this paper cannot do.

In addition, though these blades are energy-efficient (determined by the above-average voltage production, and validated by the T-test), this data cannot confirm the extent to which they are energy-efficient. A more specific analysis into the energy-efficiency of this novel plastic should be instigated.

Again, it should be emphasised that through methods consisting of a creation process and data collection process, this single engineering-situated research inquiry aided in the lessening of consequences associated with two separate complications; these were two gaps in the scholarly conversation. These gaps were filled through the provision of a purpose for human intervention in the increasing invasive crab species populace, and through the creation of a novel wind turbine blade material alternative. Ultimately, a path was paved for research hereafter. A path of future inquiries with which limits will be mitigated and implications escalated. A path which may lead to the preservation of Earth and its many magnificent ecosystems.

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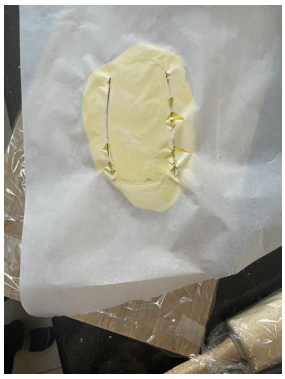
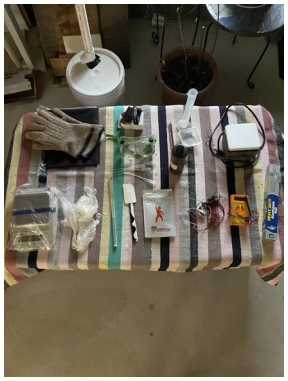
Appendix

Images of Clay Mold Production



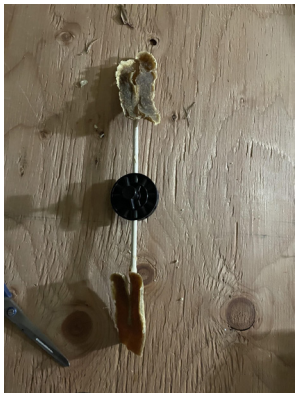
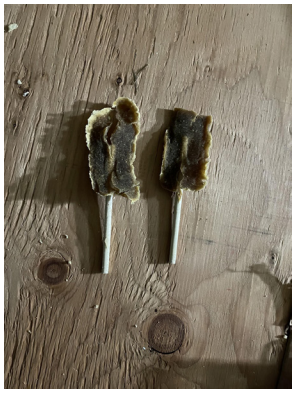



Images of Plastic Production





Images of Wind Turbine and Wind Tunnel Production


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Image of Voltage Production

Data Tables

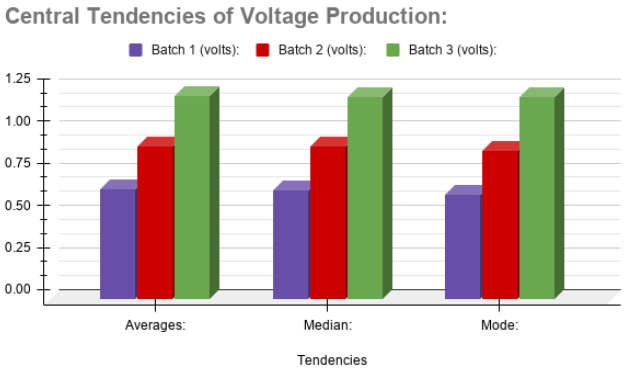
Table 2

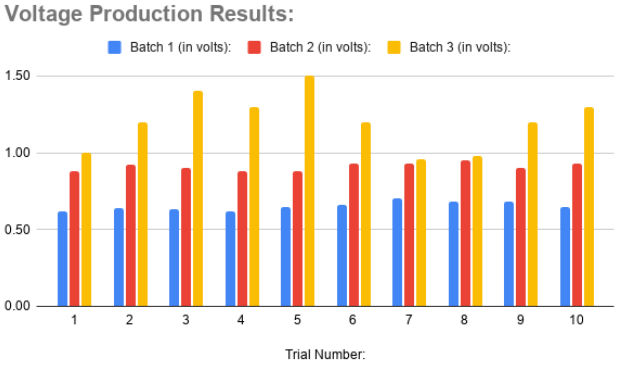
Voltage Production Per Batch (with slight placement adjustments per trial)			
Trial Number:	Batch 1 (in voltz):	Batch 2 (in voltz):	Batch 3 (in voltz):
1	0.62	0.88	1.00
2	0.64	0.92	1.20
3	0.63	0.90	1.40
4	0.62	0.88	1.30
5	0.65	0.88	1.50
6	0.66	0.93	1.20
7	0.70	0.93	0.96
8	0.68	0.95	0.98
9	0.68	0.90	1.20
10	0.65	0.93	1.30

Table 3

Values Obtained for T-Test Calculation	
Average:	0.92
Standard deviation:	0.2468830132
Mu	0.6
Sqet(n)	5.477225575
Denominator of formula	0.04507446514
T-test value	7.09936403

Additional Charts





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American Blacks: The Power of Representation

Cayla Anne-Eloise Midy

Abstract **-** African Americans are often viewed as a monolithic group in the United States because Black people generally have been subjected to the same racism and prejudice throughout American society. While African Americans have had many similar experiences in the United States, their opinions on the current political, social, and economic worldview may differ based on ethnic groups. The author chose to closely examine the extent to which family history and decade of one's arrival (or one's family's arrival) to the United States, and the region from which one (or one's family) originated, might influence the current political, social, and economic worldview of adolescent and adult Americans who self-identify as Black. In order to study the effects of these variables, I administered surveys to 146 African American adults in suburban New York City. The online survey consisted of four parts. These parts included views on economic success, law enforcement, current events, specifically the Black Lives Matter Movement, and Black representation in American society. Ultimately the study found statistically significant differences between region/decade of arrival and societal world views. There were also gender gaps.

Introduction

Although Black Americans, Caribbean Americans and Africans carry similar emotional baggage from years of oppression (Jackson & Cotharn, 2003), Black Americans are more attuned to discrimination than Afro-Caribbeans. Many Caribbean Blacks believe that their ethnic status garners more respect in the United States and that stereotypes directed towards Black Americans do not apply (Head & Thompson, 2017). Additionally, Afro-Caribbeans tend to report higher levels of internalized racism[1](Molina & James, 2016).

A word about the terminology used in this `paper. After conversations with Professor Marsha Gardener, chair of the Black Studies Program at Adelphi University, the

1 Internalization of racial oppression by the racially subordinated

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following definitions will be used throughout this study: Black American is defined as African Americans whose family history dates back to pre-Emancipation, Afro-Caribbean refers to participants who were born or descendants of those born in the Caribbean, then immigrated to the United States, African describes participants who were born or descendants of those born in Africa, then immigrated to the United States and African American describes those from any part of the African Diaspora who immigrated to the United States.

Despite African Americans reporting significantly lower rates of upward mobility and higher rates of downward mobility compared to whites (Chetty *et al*., 2019), differences between Black Americans and Afro-Caribbeans continues in the sense that Afro-Caribbeans are often seen as a model minority. Ifatunji (2016) found that Afro-Caribbeans are 12% more likely to have a job than Black Americans. Additionally, Ifatunji's study mentions that Afro-Caribbeans are less likely to characterize themselves as "lazy" and consider themselves to "work hard" (2016). Not only does subculture play a role in the determination of economic success, but generation and decade of one's arrival contributes as well. Afro-Caribbeans born in the United States enjoy higher earnings and occupational status relative to Afro-Caribbeans who personally immigrated to the United States. According to one study, American born Afro-Caribbeans are able to better assimilate due to the influence of the Caribbean parents transmitting the concept of hard work and achievement by emphasizing the importance of schooling (Kalmijn,1996). In addition to economic success, there appears to be a generational difference among African Americans regarding law enforcement. It was found that immigrant generations rated law enforcement, specifically the police more positively on measures of effectiveness, misconduct and general satisfaction than did native-born Americans. However, they were less likely to contact the police for assistance. "Immigrants were significantly less likely than non-immigrants to believe that the police stopping people without a good reason, police engagement in racial profiling, and verbal or physical abusive by police officers were problems" (David & Hendricks, 2007). A Canadian, study evaluated the extent to which Black youth viewed law enforcement, finding that young Blacks in Ontario believed that the police were necessary to prevent crime and provide protection, but that they saw the police as extremely homogeneous-lacking diversity, with insufficient cultural training, and prone to abuse of power (Syed *et al*., 2018). Moreover, a recent study of cultural and gender biases against women and teachers with non-English speaking backgrounds found that those biases tend to decrease with better representation of both

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women and non-native English speakers (Fan *et al*., 2019). The goal of the present research is to learn about internal variety in a population (*my own population*) too often viewed as monolithic.

Hypotheses

It is hypothesized that:

1. Black Americans will be more socially aware of the racism present in the United States than Afro-Caribbeans and Africans.

2. Immigrants will be naiver than second and third generation African Americans about the prejudices faced by black people.

3. Black Americans will report a more negative view of law enforcement than Afro-Caribbeans.

4. Afro-Caribbeans and Africans will report a higher representation index than Black Americans.

Method

Procedure

After informed consent was obtained from participants, a four-part survey was administered. 146 African American adults participated in the study. The survey was used to determine the participants' views on economic success, law enforcement, current events (specifically the Black Lives Matter Movement) and Black representation in American society. After completion, all surveys were scored and entered into an Excel database. Unpaired t-tests, linear and multiple regressions, and between-group ANOVAs were run on all variables to determine mean differences between African Americans of different ethnicities, and to determine the extent to which a variety of independent variables accounted for the variation in the dependent variables.

Participants

Table 1 Ethnicity Statistics

Ethnicity	Sample %
Black American	33.3%
Afro-Caribbean	55.8%
Africans	11.56%
Others	0.06%

Table 2-Generation

Generation	Sample%
Immigrant	29%
First Generation	35.9%
Second Generation	35.17%

Table 4-Gender Statistics

Gender	Sample%
Male	22.4%
Female	76.9%
Other	0.7%

Instruments

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Title	Author(s)/Date	Sample Questions
Interactions with Law Enforcement Index	Adapted from: Imran Mohamed Syed *et al.* (2018)	This measures African American Views on the police on a 5-point scale 1. To what extent do you agree with the following statement: "American police forces are homogeneous and lack representation from a variety of ethno-racial groups." 2. To what extent do you agree with the following statement: "The police are necessary to maintain order in society, and to prevent crime 3. To what extent do you agree with the following statement: "There are some individual officers that abuse their power towards Black people
Representation Index	Midy (2020)	Determines how represented each ethnicity group was. 1. To what extent do you agree with the following statement: "Growing up, I saw people in positions of power that looked like me (same race)." 2. To what extent do you agree with the following statement: "As a child I played with dolls and toys that looked like me (same race)." 3. To what extent do you agree with the following statement: "I grew up in a country in which almost everyone around me looked like me (same race)."
Success Index	Midy (2020)	Determines how each ethnic group views success in the United States. 1. To what extent do you agree with the following statement: "As a Black person, it is relatively easy to be successful in the United States." 2. To what extent do you agree with the following statement: "As a Black person, I can achieve equal success as my white counterparts." 3. To what extent do you agree with the following statement: "As a Black person I have the same resources to succeed as my white counterparts."

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Black Lives Matter Index	Midy (2020)	Determines how each ethnic group viewed the BLM Movement and current political events in the United States. 1. To what extent do you agree with the following statement: "I hold essentially the same views towards the police as I did 12 months ago. 2. To what extent do you agree with the following statement: "I wholeheartedly agree with, and support the Black Lives Matter Movement. 3. To what extent do you agree with the following statement: "The rioting associated with the Black Lives Matter Movement was wrong.

Variables

Independent (x)	Dependent (y)
Decade of Arrival	Views on economic, success, the Black Lives Matter Movement and representation
Ethnic Background	
Immigration Generation	

Results

Table 5- Means and Standard Deviations

	Success	Policing	No change	BLM	Rep.
Total Sample	2.14 (1.08)	3.44 (1.17)	3.93 (1.20)	3.92 (1.13)	2.75 (1.05)
Black Americans	2.08[a] (0.83)	3.61[b] (1.15)	4.32[b] (1.15)	4.03[b] (1.08)	2.54[b] (1.04)
Afro-Caribbeans	2.09[a] (1.28)	3.33[a] (1.38)	3.68[a] (1.35)	3.69[a] (1.28)	2.82[a] (0.93)
Africans	2.23[a] (0.81)	3.59[b] (0.88)	4.14[b] (0.97)	4.38[b] (1.01)	1.79[a] (1.13)
male	2.39[a] (1.02)	3.31[a] (1.28)	4.32[a] (0.98)	3.93[a] (1.07)	2.50[a] (1.05)
female	2.07[b] (1.19)	3.48[a] (1.06)	3.81[b] (1.32)	3.92[a] (1.29)	2.64[a] (0.90)
Immigrant	2.29[a] (0.91)	3.21[a] (0.94)	3.61[a] (0.89)	3.67[a] (1.23)	3.15[c] (1.16)
1st Gen	2.04[a] (1.41)	3.52[b] (1.18)	3.90[a] (1.28)	4.13[b] (0.92)	2.18[a] (0.95)
2nd Gen+	2.12[a] (1.47)	3.53[b] (1.36)	4.21[b] (1.31)	3.91[a] (1.16)	2.60[b] (1.00)

*means with different superscripts vary at the 95% confidence level

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Males perceived better economic opportunities in America ($p<.05$) and reported rarely changing their views on policing over the last year, relative to females ($p<.05$). Immigrants express greater overall trust for the police ($p< .05$) *vis-a-vis* other groups and are less likely to have changed their views since last year ($p<.05$). First generation Americans are more likely than immigrants or second/third generation Americans to strongly support BLM (p's >.05). Curiously, immigrants are the group most likely to see themselves represented in American culture ($p<.05$). As predicted, Black identity influences views on policing, BLM & representation. Afro-Caribbean's are least critical of police behavior, but most likely to express evolving attitudes (p's <.05). Africans are the strongest supporters of BLM ($p<.05$), yet also the group least likely to see themselves represented in American culture ($p<.05$). Hypotheses 1 and 2 were neither proved/ nor disproved as there was not enough evidence to support the hypothesis. Hypothesis 3 was supported in that Afro- Caribbeans were least critical of the police compared to Black American. Hypothesis 4 was proved in that Afro-Caribbeans had a mean representation index of 2.82 whereas Black Americans had a representation index of 2.54. Furthermore, the main hypothesis, that African-Americans' cultural background matters in predicting political attitudes and worldview, is supported. However, the picture is nuanced, and further study is warranted.

Discussion

Among 146 African Americans adults, my research unearthed a significant but nuanced relationship between different African American ethnic groups and decade of one's, or one's family's, arrival and their opinions on economics, law enforcement, representation, and current events. This study demonstrates that although African Americans are viewed as monolithic, there are significant ethnic differences between Black Americans, Afro-Caribbeans and Africans. The results of this study demonstrate the different outlooks on racism by each ethnic group. Additionally, it addresses factors that must be changed to provide equal economic opportunity between African Americans and their white counterparts. It demonstrates the attitudes that Blacks have towards the police, especially with the current political and social climate and how the law enforcement must dismantle the racist system it was built on. It was expected that Afro-Caribbeans would have a higher representation index than Black Americans (Table 5) mostly because Afro-Caribbeans and Africans come from a country that is predominantly black compared to native born Black Americans who have lived in predominantly white communities for generations and have been subject to their jurisdiction for years as well. However, it was surprising to see

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that First Generation Americans were more likely than immigrants and second/third generations to support Black Lives Matter because we expected third generation Americans to be more supportive because their family history has suffered generations of the prevalent racism in the United States; this would presumably make them more likely to advocate immediate social change. However, there were some limitations to this experiment. The number of Afro-Caribbeans in the sample doubled the number of Black Americans. Based on the Nassau County Census the participants in this study were not an accurate representation of Black America or Black New York. Moreover, 31% of Nassau County's African Americans hold a bachelor's degree or higher. However, in my sample, 84.5% of the participants had at least a bachelor's degree. This likely resulted from the "snowball sampling" I employed; those who helped distribute my survey had a graduate degree themselves and sent the link to African American friends, relatives, and colleagues. This snowball effect also contributed to the lack of Black Americans because many of my "key informants were of Afro-Caribbean descent themselves. As often happens, female respondents tripled the males in my study. In the future, I plan to increase my number of Black Americans as well as the number of males in my study. I will also seek a more diversely educated sample of African Americans. Further, because my study was entirely quantitative due to the Covid-19 pandemic (i.e., related focus groups were prohibited.) I plan to run a Phase II qualitative study. The consequent mixed-method study will better answer "how" and "why" questions in greater detail.

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Generalized Anxiety Disorder and Sleep Quality during the COVID-19 Outbreak in Adolescents & Parents: A Web-Based Cross-Sectional Survey

Kaylin Spinelli

Abstract **-** The present study found evidence that essential workers and their families are at an increased risk for anxiety, stress and sleep disruption. 120 female adolescents and 55 of their parents completed surveys measuring anxiety and sleep quality during the COVID-19 pandemic. The two samples, although drawn from the same community, were not linked. All adolescents attend an all-girls academy in suburban New York. T-tests and regression analyses suggest that essential workers and their families are at elevated risk for mental illness.

KEY WORDS

- Anxiety
- Mental Health
- COVID-19
- Frontline Workers
- Sleep Quality

INTRODUCTION - Due to the current pandemic, the stress levels of many people throughout the world have grown. Numerous studies show that one's anxiety often becomes heightened during disease outbreaks (Tausczik *et al.* 2012). Every individual copes with stress and anxiety differently, and they are brought on in different people at different times. Some cope with anxiety and stress by sleeping more, while others find it difficult to fall asleep at all during stressful or anxious times. The COVID-19 pandemic has increased anxiety in more people than have most other diseases, in large part because people have been confined to their homes for extended periods of time (Pfefferbaum and North 2020). Teens typically are developmentally prone to high anxiety levels (Henker *et al.* 2002). At their age, it is natural to worry about peer acceptance and academic performance (Henker *et al.* 2002). Gupta *et al.* (2020) found that during the lockdown phase of the pandemic, many individuals began to reduce their hours of nighttime sleep in favor of taking more midday naps. This pattern slowly undermined

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peoples' mental health (Gupta *et al.* 2020).

A study of healthcare workers in Sudan found heightened anxiety during the COVID-19 pandemic (Elamin 2020). This raises the question of, the extent to which the heightened anxiety levels of healthcare workers might affect their families. The present study examines not only the anxiety levels and sleep quality of individuals who self-identify as essential workers but also persons who self-identify as the child of an essential worker. Did these two groups report significantly higher COVID-19 related anxiety or more significantly disrupted sleep?

Our study is a cross-sectional, web-based survey testing generalized anxiety disorder and sleep quality during the COVID-19 pandemic in adolescents and their parents. A similar study of adult workers - frontline and non-frontline - was conducted in China in March 2020 at the height of the pandemic. We intentionally followed similar research protocols to better compare our February 2021 results in New York with the February 2020 data collected by Chinese scholars. Huang & Zhao (2020) found that younger people and essential workers were at highest risk of mental illness due to the COVID-19 outbreak. The present research tests whether the mid-pandemic anxiety levels and sleep quality of essential workers and their children differed from that of their peers using the Generalized Anxiety Disorder Survey (GAD-7) and the Pittsburgh Sleep Quality Index questionnaire (PSQI).

The aim of my study is twofold. It seeks to (1) gain a better understanding of the effects of a global pandemic on adolescents and their parents and, (2) to uncover the impact essential workers have on the anxiety levels and sleep quality of their families during a pandemic.

HYPOTHESES

It is hypothesized that:

1. Essential workers and their family members will be at higher risk for anxiety.
2. Essential workers and adolescent family members will suffer from poorer sleep quality.
3. Adolescents will report greater anxiety levels (higher GAD-7 scores) compared to adults.
4. Adolescents will report poorer sleep quality compared to adults (as per PSQI).

METHOD

Procedure

The sample for this study was not random. We recruited 120 female adolescents from an all-girls Catholic academy

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in a suburb of New York City and 55 of their parents. However, the students and their parents were not linked. We sought to survey adults and teens from the same community, not necessarily test for specific parental influence on individual girls. The participants were told that the project involved sleep quality and anxiety levels during the COVID-19 pandemic. The sample was reasonably representative of the racial/ethnic makeup of the school. The school, although "increasingly diverse," is more Euro-American in makeup than the surrounding county (see Table 1). After informed consent was received from the subjects and one custodial parent/guardian, each subject completed the survey electronically via Google Forms. Students were identified by their school-issued ID numbers, and parents were identified by the last four digits of their phone number and their birth month. Although all responses were kept anonymous, researchers needed a way to identify people in case respondents requested that their information be removed from the study at a later date. Each subject completed demographic information, questions about parents/guardians' schooling and profession or their own schooling and profession if adults were the participant. Then subjects took the Generalized Anxiety Disorder-7 (GAD-7) survey, and the Pittsburgh Sleep Quality Index (PSQ) questionnaire. The GAD-7 is proven to be one of the most effective methods of measuring anxiety (Spitzer *et al.* 2006). Once participants' results were checked for completeness, parents could be classified as essential workers. Thus, two measures of "essential worker" were used - the respondent's and New York States'. From there we were able to test how the jobs of parents might affect the anxiety levels and the sleep quality of their children.

Participants

Table 1- High School Ethnicity Statistics

Ethnicity	High School Population**	Nassau County+	United States+	Sample % for adolescents	Sample % for parents
White	74%	58.5%	60.1%	70.2%	64.3%
Black	10%	13.1%	13.4%	12.9%	14.3%
Asian	11%	10.9%	5.9%	5.6%	3.6%
Hispanic	4%	17.5%	18.5%	11.3%	17.9%
Other	-	2.6%	4.3%	1.6%	0%

** Totals may not equal 100 due to those who reported themselves as multiracial.*

***2018-19 data provided by Sacred Heart Academy Annual 2019 Report to NYSED*

+ 2019 U.S. Census Estimate

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Tables 2-4: High School Sample Gender & Age Statistics

Table 2:

Age categories	Sample % for parents
35 or younger	0%
36-40	7.1%
41-45	12.5%
46-50	33.9%
51-55	35.7%
56-60	10.7%
61 or older	0%

Table 3:

Gender*	Sample % for adolescents	Sample % for parents
Male	0%	38%
Female	100%	62%

** The high school population studied was drawn from an all-girls academy.*

Table 4:

Age	High school population	Sample % for adolescents
13	1.0%	0%
14	25.7%	16.1%
15	22.8%	25.8%
16	31.7%	27.4%
17	13.9%	25.8%
18	4.9%	4.8%

This sample consists of 120 high school students from an increasingly diverse Catholic

all-girls high school and 55 of their parents.

- The adolescents and parents were not linked.
- Details of the sample can be seen in Tables 1 through 4.

Instruments

Title	Author(s) / Date	Purpose / Sample Questions
Generalized Anxiety Disorder 7-Item (GAD-7) Scale	Spitzer, *et al*. (2006)	Over the last 2 weeks, how often have you been bothered by the following problems? (Likert scale of 0 to 3) #1 Feeling nervous, anxious, or on edge. #2 Not being able to stop or control worrying. #3 Worrying too much about different things.
Pittsburgh Sleep Quality Index (PSQI)	Buysse, *et al*. (2010)	#1 During the past month, what time have you usually gone to bed at night? #2 During the past month, how long (in minutes) has it usually taken you to fall asleep each night? #3 During the past month, what time have you usually gotten up in the morning?

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Variables1

Independent (x)	Dependent (y)	Covariates
Essential worker - vs. - Nonessential worker	GAD-7 score	Age, race/ethnicity, SES, previous mental health condition
Child of essential worker - vs. - Child of nonessential worker	PSQI sleep hours subscore	

RESULTS

Teens reported a significantly higher prevalence of anxiety symptoms (GAD-7) than older people. Additionally, adults reported achieving significantly more sleep, measured in hours.

Table 5: T-tests - Means & Standard Deviations

	GAD-7	hrs/sleep
Teens	10.18^{a} (1.35)	6.45^{a} (1.07)
Adults	9.41^{b} (1.23)	6.90^{b} (1.28)

*Means with differing superscripts differ at the 95% confidence level.

Occupationally, workers self-identifying as essential workers and teens who self-identified themselves as the children of essential workers were significantly more likely to report poor sleep quality (all p's < .05), and report higher anxiety levels (p's < .05).

Table 6: T-tests - Means & Standard Deviations

	GAD-7	hrs/sleep
$Teens_{FWparent}$	10.53^{a} (1.22)	6.12^{a} (0.92)
$Teens_{N\text{-}FWparent}$	9.78^{b} (1.36)	6.74^{b} (1.30)
$Adult_{FW}$	9.89^{a} (1.12)	6.70^{a} (1.07)
$Adult_{N\text{-}FW}$	8.91^{b} (1.19)	7.09^{b} (0.89)

*Means with differing superscripts differ at the 95% confidence level.

A series of multiple regressions demonstrated that age group (teen vs. adult) and occupational status were predictive of both generalized anxiety (GAD-7) and poor sleep quality (PSQ); all p's <.05.

Sample Regressions

GAD-7

$r^2_{teen\ x\ adult}$ = .065 | 6.5% of the variance in anxiety could be accounted for by age group alone.

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$r^2_{FW \times N\text{-}FW}$ = .178 | 17.8% of the variance in anxiety could be accounted for by occupational status (essential worker/child of vs. non-essential worker/child of)

Sample Regressions

Hrs/sleep

$r^2_{teen \times adult}$ = .044 | 4.4% of the variance in sleep hours could be accounted for by age group alone.

$r^2_{FW \times N\text{-}FW}$ = .221 | 22.1% of the variance in sleep hours could be accounted for by occupational status (essential worker/child of vs. non-essential worker/child of)

However, age group dropped out of the multiple regression model (both p's>.05); occupational status and the subsequent perceived risk was the only direct predictor of both anxiety and poor sleep (both p's<.05).

As hypothesized, essential workers and their family members were proven to be at higher risk for anxiety, essential workers and their adolescent family members were found to have poorer sleep quality. The adolescents proved to have greater anxiety levels (higher GAD-7 scores) and poorer sleep quality (as per PSQI) compared to adults. These findings can also be found in Tables 5 and 6.

DISCUSSION

Our study identified a significant behavioral health burden on the American public nine months into the COVID-19 outbreak. 1) Younger people and 2) essential workers and their adolescent family members appear to be at elevated risk for mental illness, and may be in need of behavioral intervention. Ongoing surveillance of the psychological consequences of disease outbreaks must become a standard part of preparedness protocols in the United States and worldwide. Our results were in line with those of the study conducted in China back in March of 2020. One of the limitations of this study is that thus far we have only examined self-reported essential workers status. These results were also entirely quantitative in nature. To extend this research, it might be wise to include a qualitative study involving focus groups of a subsample of our survey respondents. Discussion would revolve around the reasons behind their anxiety - specific triggers, prefered coping strategies, etc. This would create a more comprehensive mixed-method study that could answer more questions. Another limitation of this study is the sample size. Our sample of parents remains smaller than that of our adolescent participants. Mid-pandemic, recruiting parents to take even an online survey is difficult because we lack any in-person connections to the parents.

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Standard mother-daughter, father-daughter, and parent-teacher events at school have been cancelled or moved to virtual platforms. In sum, this study has generally supported my hypotheses, but also brings to light new questions worthy of study in further research.

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Identifying Factors Related to Severe Flooding Vulnerability, Preparedness, and Resiliency in Long Island and New York City

Olivia Teng

Abstract **-** Current estimates reveal that approximately 1.2 billion people reside in areas susceptible to flooding. However, due to human-inflicted changes to the environment, it is predicted that within the next 30 years, this number will increase by at least 400 million. Despite the prevailing belief that the effects of flooding are diminutive, catastrophic destruction is possible, especially when victims belong to vulnerable populations. Aside from physical damage, severe flooding often prevents individuals from securing the bare necessities- water, food, shelter, and medical attention- leading to health crises and social segregation. Following Hurricane Sandy, these adverse effects devastated communities on the East Coast, namely those in New York City and Long Island. To mitigate complications during recuperation, researchers proposed updating strategies and policies to take into account factors such as social capital and economic vulnerability. Doing so may ensure that all communities have equal access to ample resources and services, regardless of demographic composition. Therefore, this study investigated the role of community support, as opposed to socioeconomic status, in the vulnerability and resiliency of New York residents to flooding from Hurricane Sandy. Those who are more engaged in politics tend to be more vigilant about the efforts of their local government. If local politicians are unjustly favoring a certain demographic and neglecting the needs of others, people who pay attention to politics are able to identify the problem and understand how it can be rectified. Furthermore, people who pay attention to the workings of their government are more inclined to address social issues. For vulnerable families, this is relevant because an unsupportive, inept government is frequently the root of problems including forced evacuation/homelessness, poverty, inaccessible resources, etc.

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If political attentiveness could be quantified, policymakers and community organizations would be able to ascertain which populations are less educated about flooding preparation/reconstruction and which populations can assist the former

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Leveraging Social Media to Maximize Hotel Marketing Effectiveness

Keonha Bae

Abstract - Through platforms such as Instagram, TikTok, and YouTube, hotels are appealing to diverse audiences, leveraging influencer and celebrity voices that resonate with specific demographics. Combining social media, influencer partnerships, celebrity endorsements, and user-generated content provides a strategic edge for hotels, enabling brands to build authentic connections, foster engagement, and instill loyalty that traditional advertising alone often struggles to achieve. With these concerns, this paper investigates how these digital tools allow hotels to showcase genuine guest experiences and create a sense of community, allowing potential guests to see real-time interactions that reflect the brand's values. User-generated content, like guest photos and testimonials, further strengthens credibility by presenting authentic moments that potential guests can relate to.

When used thoughtfully, these digital strategies help hotels gain trust, increasing short-term bookings and fostering long-term loyalty. This paper describes how the hotel industry maintains a balanced and data-driven approach to influencer marketing, social media engagement, and user-generated content. This positions hotels to adapt content quickly, reach new markets, and build lasting relationships with their audience. This paper also states various strategies that allow hotels to stand out and build a brand image that resonates well beyond traditional advertising boundaries.

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The Legacy Effects of a Defoliating Spring Frost Event on Species-Specific Leaf Level Photosynthesis

Prableen Kaur

Abstract - Extreme weather events are becoming more prevalent with increasing global temperatures. In the Northeastern U.S., spring frost events are destroying forest ecosystems by defoliating newly budded trees. In order to grasp a better understanding of community dynamics and carbon fluxes, it is imperative to understand more about species-specific phenological and physiological responses to these events. This study aimed to investigate the legacy effects of a spring frost event in Black Rock Forest on the specific photosynthetic and intrinsic water use efficiency responses within unaffected red maples and sugar maples alongside defoliated red oaks. A LI-6800 machine conducted gas exchange measurements in the north, south, valley, and headquarter sites for each species. The new flush of red oak leaves portrayed the greatest amount of photosynthetic productivity and efficiency while red maples and sugar maples retained their original characteristics with increased sensitivities. Hence, the defoliated tree species had a competitive advantage with shifted phenological patterns. Future research can be conducted several growing seasons after the frost event to determine the extent to which these events impact species dynamics, including DBH tree growth. New predicative carbon models can also be formed to create new management for tree implantation's that maximize sequestration rates.

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Strategies to Narrow Economic Inequality in the U. S. During the COVID-19 Pandemic

Yiyang Stephen Chen

Abstract: The U.S. has historically relied on a robust labor force that was willing to work for arguably meager wages. Unfortunately, the wages, which have not been satisfactorily adjusted with the increase in cost of living and inflation, have led to economic disparity and a wealth gap disproportionately affecting workers by race and gender, thereby perpetuating a cycle of poverty for those at the lowest levels on the socioeconomic ladder.

The vulnerability of those in such a financially unstable system became only too apparent during the shutdown of businesses across the country in hopes of halting the spread of the COVID-19 in the early months of 2020. For those most affected by the sudden pandemic, especially those in a lower socio-economic income level, minorities and women have been shown to be most vulnerable to financial losses, job termination, and disposable equity. Undereducated workers, limited skills, low wages, and a lack of opportunity have led many to suffer during the pandemic because employment options are limited. Historically, Blacks and Women have been paid on average just a mere percentage of what White men make in income. This equals out to trillions of dollars in losses. During the pandemic, many of these people suffered because their jobs, like in the retail or service industry, were restricted due to mandatory distancing. Being unskilled, they suffered great losses because new opportunities were not presented. There is a growing need to solve the problem of inequality so that millions do not suffer trauma due to loss.

Keywords: Economic inequality, COVID-19, wealth gap, race and gender, socioeconomic ladder

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The Effects of High-Deductible Insurance on Human Well-Being and Health

Hrishi Joshi

Abstract: Effective health insurance policies are of the utmost importance as they shape the lives of and provide safety to billions of people worldwide. Under the broader umbrella of general health insurance, the high-deductible health plan (HDHP) is a relatively recent idea. The HDHP essentially consists of a high deductible combined with a lower premium. This study strives to find the impact of the HDHP on overall human well-being and health while assessing its effects and identifying potential benefits and drawbacks.

The potential benefits of this plan were doubted at first; however, studies have revealed that its popularity has skyrocketed in comparison to its predecessors. HDHP users may experience a series of behavioral consequences of varying effects due to the human psyche. Grouping findings from a personal survey with historical data from other sources, analysis across various demographics demonstrate that HDHP users lead better lives. The representations in the report, implemented with the TI-SmartView TI-84 Plus emulator, illustrate that high-deductible health plans correlate with a generally positive impact on its users.

The survey, which considered wording and response biases, confirms that the above trends are valid irrespective of nominal categorical variables such as gender, ethnicity, and age. This study attests to the fact that the HDHP, when adopted with the understanding of the behavioral aspect, can help to improve the health of society as a whole. Finally, it also suggests techniques to make sure that those who select this plan follow certain behaviors that drive positive outcomes.

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Keywords: Health insurance, Human well-being, High-deductible health plan (HDHP)

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South Korea's Birth Rate Decline: Impacts on Workforce, Welfare, and Economic Stability

Junewon Suh

Abstract: South Korea has faced a steep fall in birth rates over the past few decades. Total fertility, defined as the average number of children a woman is expected to give birth to during her lifetime, stands among the lowest rates in the world. And it is far below the replacement rate level of 2.1 needed to maintain a stable population. This is alarming, particularly in the context of a nation that, during the mid-20th century, saw very rapid population growth coinciding with equally rapid economic growth. It is a state of affairs that poses a significant threat to South Korea's development, stability, and living standards if left unchecked. The demographic effects could represent significant challenges for South Korea's economy by impacting the supply of laborers across many industries, social welfare regarding support systems, and possible economic contraction or tepid growth. This paper studies South Korea's birth rate trends and analyzes their effects on the country's economy. This paper explores South Korea's birth rate trends and their economic implications, focusing on: (1) Historical patterns and fluctuations in birth rates, (2) Factors driving the decline in birth rates, (3) Economic impacts, especially on the workforce, pensions, and social support systems, (4) Public policy responses and potential legislative solutions to mitigate the issues arising from low birth rates. As South Korea confronts a shrinking and aging population, this study emphasizes the importance of understanding the economic effects of a fertility rate below replacement level. It identifies actionable strategies to address this demographic challenge.

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Depolarizing Polarity: Data Mining Shared Likes on Twitter to Uncover Political Gateway Groups

Jonathan A. Bar-On

Abstract: This project applies a new theory in the field of intergroup conflict known as "Gateway group theory," which posits that to decrease conflict between two groups, a third group with specific characteristics that appeal to both sides needs to be identified, enabling them to act as a medium. This group is known as a "Gateway group." With the background of the bitter digital divide and echo chambers plaguing the United States' current political discourse, this paper sought to find the Gateway group between polar Democrats and Republicans on Twitter.

This project data mined and examined the shared "likes" of these two populations using originally developed code and definitional parameters. Then, the study analyzed the profiles of the authors of these liked Tweets to compile an aggregated Gateway group profile that can be used to find Gateway group individuals on Twitter who have the ability to decrease conflict between Democrats and Republicans. The study found that Gateway group members exist. They are a group of Moderate Democrats. Every post that was liked by both a Democrat and Republican was also tagged and analyzed for similarities in content. It was found that 55% of all posts referenced "Trump" and 92% of those votes had a negative sentiment. Additional similarities in content were found, for example a keen interest in elections and certain Democratic candidates. This project develops an effective methodology that can be applied to any conflict on Twitter to find the Gateway group for that conflict to decrease polarity between polar groups.

Keywords: Gateway group theory, Dem-

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ocrat and Republican, political discourse, Twitter

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Exceptional and Gifted Children: Performance and Tower Test

Nastaran Abedi

Abstract: Gifted children are people who are capable of high performance in cognitive, educational, scientific, creative and artistic fields compared to their peers. But there are also gifted children who have problems with cognitive, educational, social, emotional and behavioral development. They are called twice-exceptional children. Regarding these children, who have high talents and abilities while at the same time having disabilities, is an important issue for education professionals. The present study mainly aims to compare the executive functions profile of twice exceptional children with gifted ones.To this end, 30 twice-exceptional gifted children and 30 gifted children were selected from among elementary school students in district 3 of Isfahan, Iran. Then, the two groups administered The Wechsler Intelligence Scale for Children, Fourth Edition (WISC®-IV) for assessment of the Tower Test (NEPSY) to evaluate executive functions. The research results showed that the profile and average executive function of the twice-exceptional children were lower than those of gifted children in the Tower test (NEPSY). Therefore, it is suggested to consider executive functions (planning, organization, time management, problem solving, etc.) in identifying and educating these children.

Keywords: Gifted children, twice-exceptional children, executive function

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Impact of Mask Policies on Social and Psychological Consequences During the Covid-19 Pandemic

Vincent Chen

Abstract: COVID-19 has proven detrimental to the economy and changed the nature of social interactions. Governments at every level have increasingly required the use of face masks in public spaces. Evidence has shown that mandatory mask-wearing policies can effectively control the outbreak of the virus, protecting susceptible populations (i.e., individuals with preexisting conditions, individuals 65 and older). Many communities encourage mask-wearing to reduce the chance of viral transmission. While mandatory mask policies appear to effectively reduce transmission of the virus, their long-term psychological effects are not yet known. In this study, we examine the association between the implementation of face mask mandates and detrimental psychological and social consequences as well as other relevant aspects. Also, this study tries to figure out if the mandatory mask policies are advisable, and if so, how it benefits the public.

Overall, this paper tried to suggest that short-term and institutional responses can coexist as a response to the issue. In addition, the quarantine policy examined in this paper showed a partial response. It is clear that there is no one policy that can comprehensively respond to the global and social problems brought about by the COVID-19 pandemic. Perhaps the government's policy cannot and does not need to fully respond to all the ills that our society faces. The government may be able to alleviate the problem by only partially responding to the public concerns and leaving the rest to the officials and citizens. In addition, the central government can overcome

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the issue by withholding judgment and by expressing an active choice by local governments and the media. By reviewing the quarantine policy for the COVID-19 crisis, it will be possible to discuss how a partial response to a policy problem can be improved.

Keywords: COVID-19, Mask Policies, Social Consequence, Anxiety and Stress, Psychological Effects

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Impacts of Labor Force Segments and Various Indices on Economic Growth in the USA

Davin Lee

Abstract: Understanding the complex correlations between labor force dynamics and economic trends requires a multifaceted approach, including data-driven policy measures considering demographic shifts and economic disparities. Analyzing various labor force segments, such as age, gender, skill level, and industry, enables targeted interventions to address specific challenges and maximize the strengths of each group. Promoting economic security and social equity can help reduce disparities and strengthen workforce resilience. This paper explores the intersections of aging populations, race, and gender inequality, particularly in the workplace, to highlight pressing challenges. This paper conducted Exploratory Data Analysis (EDA) to assess the relevance and effectiveness of economic measures for extracting actionable insights. The study, through collecting contemporary data and analyzing the labor market, would enable policymakers to adjust strategies proactively. This comprehensive study on the interplay between labor force dynamics, demographic shifts, and economic policies enables policymakers to examine how these factors intersect with aging populations and racial and gender inequality in the workplace. The findings from this research could play a crucial role in shaping reforms that foster a more inclusive, resilient, and equitable workforce. By addressing these correlations proactively, the study supports a sustainable economic environment where social equity and economic security adapt to meet the changing needs of the labor force.

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Convolutional Neural Network Mediated Detection of Pneumonia

Rohan Ghotra

Abstract: Pneumonia, a fatal lung disease, is caused by infection of Streptococcus pneumoniae; it is detected by chest x-rays that reveal inflammation of the alveoli. However, the efficiency by which it is diagnosed can be improved through the use of artificial intelligence. Convolutional neural networks (CNNs), a form of artificial intelligence, have recently demonstrated enhanced accuracy when classifying images. This study used CNNs to analyze chest x-rays and predict the probability the patient has pneumonia. Furthermore, a comprehensive investigation was conducted, examining the function of various components of the CNN, in the context of pneumonia x-rays. This study was able to achieve significantly high performance, making it viable for clinical implementation. Furthermore, the architecture of the proposed model is applicable to various other diseases, and can thus be used to optimize the disease diagnosis industry.

Keywords: artificial intelligence, disease diagnosis, pneumonia, convolutional neural networks, machine learning

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Seeing Through the Scan: The Impact of fMRI Evidence on Juror Satisfaction and Verdicts

Isabella Souza

Abstract: The areas of the brain that become active when formulating a lie, or â€œdeceit patterns, are denoted on fMRI scans, yielding results that are more accurate than the polygraph. Using publicly available court records and fMRI results obtained from previous literature, the extent to which fMRI scan evidence influences juror confidence, perceived strength of argument, and verdict counts between participants serving as mock jurors in a mock trial exposed to fMRI scan evidence and those not exposed to it were compared. Analysis of these metrics revealed that a mock jurorâ€™s exposure to fMRI evidence increases their perceived strength of the argument for the side consistent with their verdict and drastically changes the distribution of guilty versus not guilty verdicts. The difference in confidence levels between mock jurors in the control and experimental groups was not found to be statistically significant, however future research using a larger sample size may verify the current trend that viewing fMRI evidence increases juror confidence in their verdict. Although fMRI evidence possesses the potential to revolutionize the way juries lend weight to pieces of evidence, because it was found to cause such significant shifts in juror decision making, court judges should caution its admission into evidence or further scrutinize its credibility during evidentiary suppression hearings until it is deemed generally acceptable by the scientific community.

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Sharp-Wave Ripples in Mammalian Behaviors

Keneil H. Soni

Abstract: Though sharp-wave ripples have been recorded in the EEG data of the hippocampus of mammals for years, it remains unclear how ripples can contribute to memory for different behaviors.. Sharp wave ripples are one of the most synchronous patterns in the mammalian brain. These waves are most common during non-REM sleep, although they can also be associated with consummatory behaviors. In EEG recordings, these occurrences can be seen as large amplitude negative polarity deflections (40–100 ms) in CA1 stratum radiatum that are associated with a short-lived fast oscillatory pattern of the LFP in the CA1 pyramidal layer, known as “ripples.” The purpose of this study was to investigate the distinction between sleep and awake ripples along with the connection between sharp-wave ripples and specific mammalian behaviors during memory tasks. The hypothesis tested was that SPW-Rs occur when the animal has an experience that will help guide subsequent successful task completion that results in obtaining a desired reward. To conduct the experiment electrophysiological signals were collected from a rat’s hippocampus during various tasks. The data were then analyzed using Neuroscope and compared to a visual recording of the rat’s actions. The data suggest that sharp wave ripples are more likely to occur close to a reward, most often before the reward, and do not have a higher tendency to occur early or late in learning. Future research can further clarify these results and investigate the process by which these ripples occur.

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Evaluation of Brain Structure and Function in Currently Depressed Adults with a History of Early Life Stress

Joshua Jones

Abstract: Even though Major Depressive Disorder (MDD) is the leading cause of disability worldwide impacting over 300 million individuals, early detection and intervention is hindered by the limited knowledge of its underlying mechanisms. One association found to be significant within MDD is the presence of early life stress (ELS), such as sexual abuse, emotional abuse and family conflict. However, the biological mechanism linking ELS and MDD are unknown.

To properly assess the function consequences of ELS within MDD and address these open questions, we propose an analysis of the metabolism of AMY, ACC, HIP, and DLPFC through FDG PET in addition to a structural MRI in MDD patients with and without ELS. We hypothesize that in MDD patients with prior history of ELS, compared to those without ELS, will have a smaller volume/cortical thickness as measured by MRI and decreased metabolism as measured by PET scans in the bilateral DLPFC, ACC, HIP, and AMY. This study would for the first time, assess both structure and function of critical regions of the HPA axis in MDD, while accounting for the common confounder of ELS.

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Study on Nanoparticles for Water Purification: Stereo-chemical and Thermo-dynamical Properties of the Organic Compounds

Claire Ryu

Abstract: Nanoparticles (NPs) have shown promising capabilities for water treatment through various mechanisms, including the generation and modulation of Reactive Oxygen Species (ROS), as well as utilizing photosensitization and photocatalysis. Photosensitization can enhance the efficiency of ROS generation and pollutant degradation in water. When irradiated with light of an appropriate wavelength, the nanoparticles absorb photons and transfer their energy to nearby oxygen molecules, generating ROS. The ROS produced during photocatalysis can also degrade organic pollutants, break down microbial pathogens, and remove heavy metals from water. The advantages of using nanoparticles for water treatment include their high surface area-to-volume ratio, tunable properties, and ability to target specific contaminants. This research studied the more prevalent use of organic nanoparticles for water purification. This study focused especially on the use of porphyrins and phthalocyanines, as their surface modifications for the adsorption behavior are easier and applicable in a wide range of applications. Various analogs of porphyrins and phthalocyanines were modeled and assessed for their three properties, such as Enthalpy(kJ/mol), Dipole Moment(DM, Debye), and Electrostatic potential maps(EPMs), which show their activities of stability of the molecules.

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Information Communication Practices & Efficacy Regarding Agriculture in Suffolk County, NY

Kevin Tritschler

Abstract: Integrated Pest Management (IPM) systems have been proposed as a method to mitigate excessive pesticide misusage. While prior research has extensively confirmed the efficacy of individual IPM-related solutions, three major issues have prevented sustainable policies from being adopted: a lack of field studies, policy development, and agricultural communication with the public. This study investigates the latter issue, concerning Suffolk County, NY, which was chosen due to its agricultural economy. Data was collected using a survey-based needs assessment distributed across Suffolk County, asking participants about their current agricultural perceptions, stance on different news mediums, and awareness of IPMs. The results show that 35 of the 48 respondents reported no prior awareness of what IPM systems were, indicating ineffective communication on the topic. These findings indicate a need for improvements to the agricultural news efforts in Suffolk County, although similar research across other locations is insufficient for further generalization of this research.

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A Configurable Compiled Language With Integrated Transpilation

Milan Lustig

Abstract: Language workbenches and product lines allow users to customize programming languages by providing a framework for the creation of Domain Specific Languages (DSLs). They allow for quicker language development, but still require some programming. The customization offered by workbenches and product lines is focused towards adapting to new domains. The purpose of this research is to introduce a new approach to language customization. This research proposes a language designed to be easily customized and configured for new users, rather than new domains, while still offering language extension. Users can simply select options to configure the syntax and semantics of their personal preferences. This offers a more approachable take to language customization than most language workbenches, especially for inexperienced developers. Developers may also be able to more smoothly adapt to new languages if user-oriented customization is applied similarly to gradual learning. User-oriented customization is also accompanied by an inter-configuration transpiler and standardized language form, ensuring that code written in custom configurations is still readable by all users. User-oriented customization was implemented in a general purpose compiled C-based language in which users are able to configure the syntax and semantics by editing a Tom's Obvious Minimal Language (TOML) configuration file. From the creation of this language, it can be concluded that user-oriented customization can reasonably be implemented into large modern general-purpose compiled languages and, when accompanied by one-to-one syntax translation between

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forms, can be used by many people with many configurations with no added friction.

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The Effect of Colored Light on the Perception of Red, Yellow, and Blue Pigmented Blocks

Armaan Vaswani

Abstract: Colored light may affect an individualâ€™s ability to perceive color correctly, especially in low light environments. Previous studies suggest that colored light affects reaction time and awareness of a human within a vehicle. Additionally, color perception is likely associated with gender. However, more studies are needed regarding the correlation between light hue on the ability to perceive color correctly. This study investigated the difficulty to perceive block color under varying colored lights. The study consisted of 8 different participants, ages 9 to 44: 7 male and 1 female. The environment consisted of LED strips surrounding a black surface where blocks were placed. The perceived block color (red, blue, or yellow) under varying colored lights (red, blue, yellow, and green) was given a value of 1 if perception correctly matched the block color. A value of 0 was recorded if perception and actual block color were incongruent. Green lighting had an average of 0.25, the lowest of all light colorations. Additionally, the yellow block had an average of 0.125, the lowest among the different block pigments. These findings suggest that yellow block color perception was easily influenced by the environment. Additionally, red light can more easily affect the environment, influencing color perception. Future studies may investigate color perception in association with other light and object characteristics.

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The Role of Sports Marketing Managers to Enhance Revenue Generation: Strategic Approaches and Industry Evolution

Sean Kwon

Abstract: The role of sports marketing managers is crucial in the modern sports industry. Orchestrating comprehensive strategies to amplify fan engagement, secure lucrative sponsorships, and drive organizational revenue. This paper presents a multidimensional examination of contemporary sports marketing management, analyzing both traditional methodologies and innovative digital approaches that are reshaping the field. The study establishes three primary research objectives: (1) to identify and evaluate the core competencies required for effective sports marketing management in today's dynamic environment; (2) to examine successful case studies of integrated marketing campaigns that simultaneously target fan bases and corporate sponsors; and (3) to assess the transformative impact of digital technologies and data analytics on sports marketing practices. Presented research explores critical aspects of sports marketing management through several lenses. First, it will analyze the strategic development of marketing campaigns that balance fan engagement with sponsor visibility. Second, it will investigate the financial dimensions of sports marketing, including budget allocation, ROI measurement, and sponsorship valuation. Third, the paper will address the growing importance of digital platforms, focusing on social media strategies, influencer collaborations, and emerging technologies like augmented reality in fan experiences. Special attention will be given to the evolving nature of sponsor relationships in the era of digital transformation and how data-driven insights are reshaping partnership strategies. The conclusion will synthesize key findings, em-

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phasizing the need for sports marketing managers to develop hybrid skill sets that combine traditional marketing acumen with digital fluency. This paper discusses the industry's shift toward more personalized, data-informed marketing approaches while maintaining the emotional connections that define sports fandom.

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Alleviating the Energy Crisis: A Novel Multi-Task Machine Learning Algorithm for Designing Efficient Nanocatalysts to Reduce Industrial

Sophie D'Halleweyn

Abstract: In this project, I delineate a method for solving the scarcity of energy and cutting-edge microchip production supplies which were cut off from the US. Experts have been indicating peak oil has passed, and several recent global crises, including the war in Ukraine and the Covid-19 pandemic, have exacerbated an era of energy poverty. The White House has demonstrated commitment to bringing novel nanotechnology, specifically for the semiconductor chips, which are ingrained in the automotive, aerospace, and technology industries, where state-of-the-art production only exists overseas. I demonstrate a novel methodology in nanocatalyst and nanotechnology real-time characterization using a novel mathematical framework for machine learning algorithms. Previous research in machine learning applications to materials science did not have adapt-on-the-fly models to exploit the hidden patterns of the particular material dataset to meet adaptability requirements becoming increasingly critical as flexible manufacturing smart technology moves to the nanoscale. My multi-task algorithm for variational auto-encoding (MAVEN) creates a disentangled, interpretable latent space through my novel mathematical framework through novel loss functions and evaluation metrics. I demonstrate the power of this method through studying palladium nanoparticles, which are potent catalysts in industrial catalysis, batteries, and fuel cells. Results demonstrate algorithmic independence and real-time structural analysis, essential for efficient production. Furthermore, MAVEN's interpretable capabilities create insight into the nature of fine structure relationships in catalysts on

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a nanometer scale. MAVEN demonstrates efficacy in promoting a greener energy model which will bring advanced scientific and computational production back to the US.

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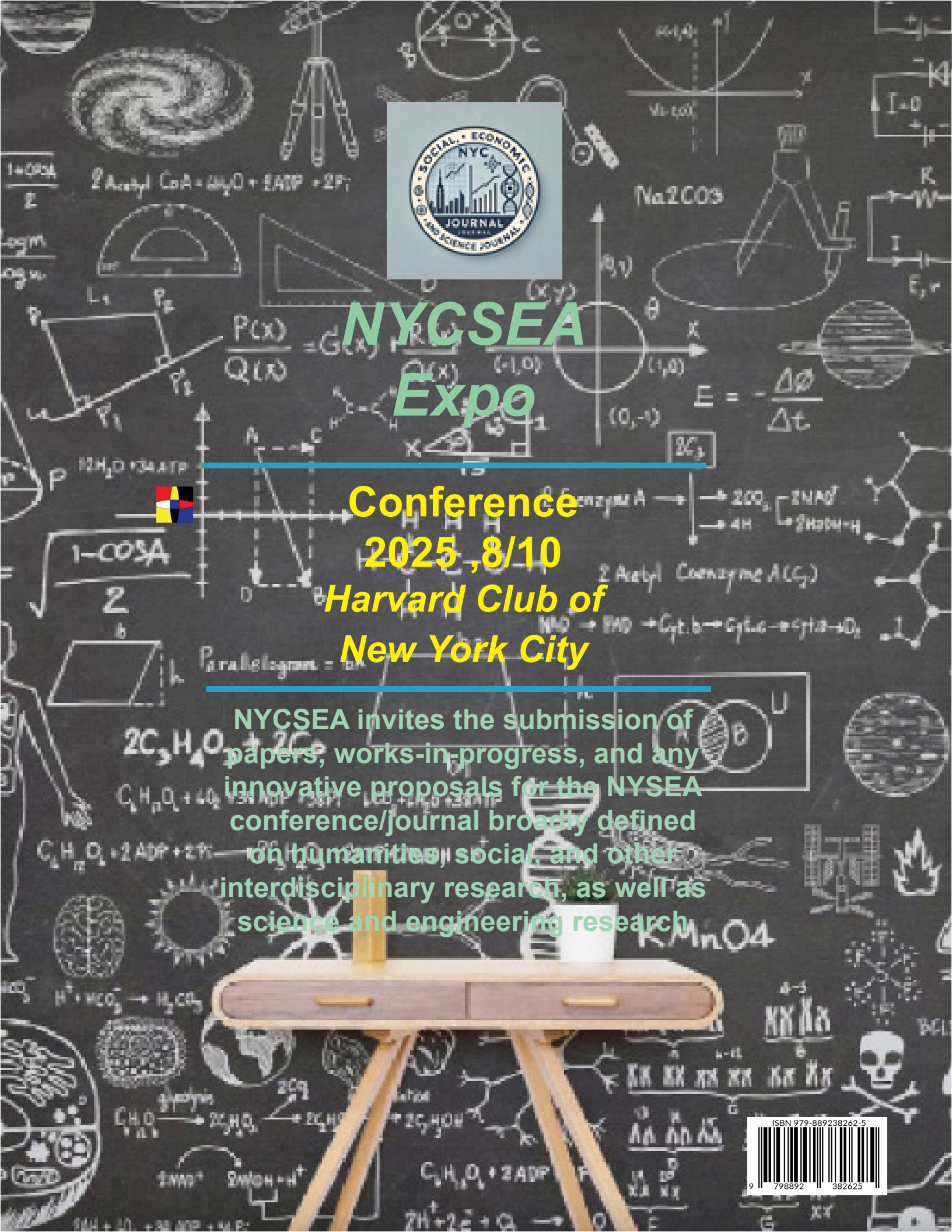

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