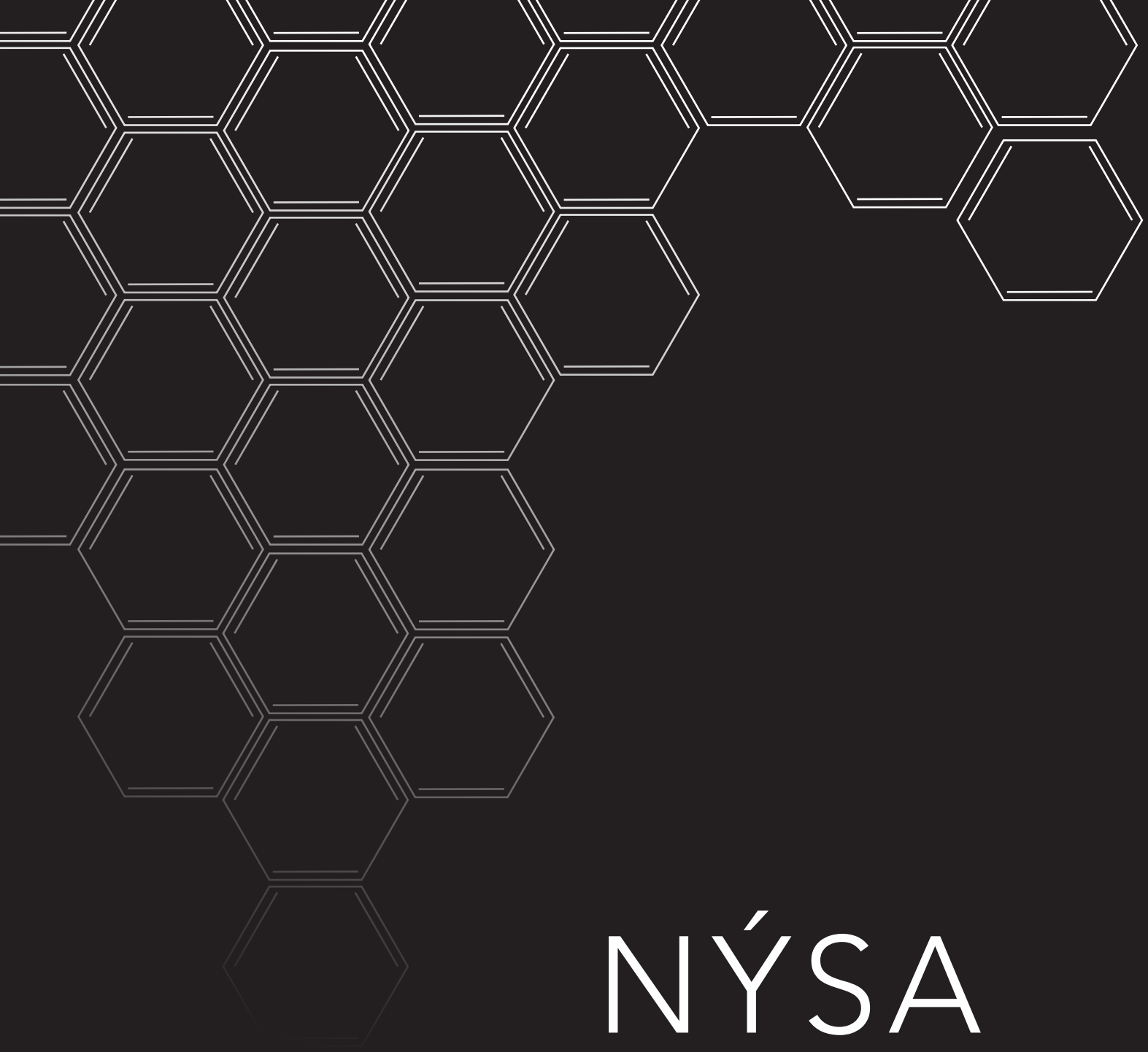

NÝSA

The Northern Kentucky University Journal of Student Research

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Nýsa, The NKU Journal of Student Research

Nýsa publishes research from students at NKU and across the commonwealth. It is published by NKU's Institute for Student Research and Creative Activity. All submissions are peer-reviewed by an NKU faculty member and an NKU student.

About the Title

Names are tricky things. Journals of student research are relatively common, and in looking for a name, it was important to find something evocative of the intellectual effort and exhilaration that accompany any research endeavor. If it could relate to our identiy as The Norse, all the better. "Nýsa" worked perfectly. In the words of David Kime, Adivising Coordinator for NKU's Honors College, who suggested it:

"The Viking raids were only one aspect of Norse society. The Norse were shipbuilders, farmers, philosophers, poets, artists, and merchants. The Norse were explorers who engineered new shipbuilding technology and navigation techniques. They sought new knowledge in the stars and from distant lands and cultures. In Old Norse, "nýsa" is a verb meaning to search or investigate; to peer into the unknown. The idea of "nýsa" applies to today's NKU students as much as it did to the Norse a thousand years ago as they peer into the unknown and produce new and exciting examples of research, scholarship, and creativity."

About the Cover

The cover for this first issue of Nýsa, The NKU Journal of Student Research was designed by **Alison Callahan**. She is a senior at NKU, currently pursuing her undergraduate degree in Visual Communication Design with a minor in Women and Gender Studies. She works on a broad range of design projects, but is particularly interested in publication and editorial design. Asked about the design process, she says: "When Dr. Hare [a chemistry faculty member] reached out to the SOTA community looking for a volunteer to design the Nýsa cover, I was excited for the challenge! Not knowing much about chemistry, I found myself filling my sketchbook; researching different symbols and molecules that could make for interesting pattern elements. I was focused on keeping the design clean, structured, and professional to be representative of the great level of knowledge and research that went into creating this edition. Thanks so much to Nýsa for this opportunity!"

From the Editor

This first of hopefully many volumes of Nýsa would not exist without the dedicated help of my enthusiastic Editorial Board (listed below), the unflagging support of the Institute for Student Research and Creative Activity's director, Shauna Reilly, and Vice Provost for Graduate Education, Research, and Outreach, Samantha Langley. NKU faculty and students gave generously of their time providing peer review, and the articles in this volume are undoubtedly better for their efforts. Finally, this journal wouldn't exist without the efforts of the students and their faculty mentors who are constantly asking good questions and using the fruits of their university experiences to answer those questions. I have enjoyed learning about their investigations, and I hope you, as readers, will too.

Patrick M. Hare

Editorial Board

A Legacy of Lead in Lexington, KY: Digging up Dirt on Past Land Use and What it Means for Urban Gardening

Haylee Taylor completed her freshman and sophomore years of college at Northern Kentucky University before transferring to Bluegrass Community and Technical College. Haylee earned both an Associates in Science and in Dental Hygiene at BCTC. During her time at NKU Haylee worked under her mentor, Dr. Kirsten Schwarz, analyzing soil samples for lead content. Haylee is grateful for the experience and knowledge she gained from being involved in research while attending NKU. Haylee is now a licensed Registered Dental Hygienist. She has found her passion educating her patients on the serious health risks associated with periodontal disease.

Nick Wainscott graduated Magna Cum Laude from Northern Kentucky University earning both a Bachelor of Science in Biology and in Environmental Science. He was a Research Assistant at NKU where he analyzed soil samples for lead content. Nick is appreciative of the opportunity to work for Dr. Kirsten Schwarz who served as a mentor during his college years. His professional work experience includes the job titles of Microbiologist and Chemist. Nick is currently a Research and Development Chemist in the pharmaceutical industry working to further the advancement of cancer treatment.

A Legacy of Lead in Lexington, KY: Digging up Dirt on Past Land Use and What it Means for Urban Gardening

Haylee Taylor and Nick Wainscott. Faculty mentor: Kirsten Schwarz
Biological Sciences

Abstract

Converting vacant lots into urban gardens can be an effective way to increase food production and build community relationships, advancing goals of urban environmental sustainability. However, the history of a site, specifically whether it used to contain buildings and other infrastructure, is essential to understanding potential health concerns, as the historic use of lead can leave a toxic legacy on the landscape through the soil. Through a partnership with Seedleaf, a Lexington, KY non-profit, eight properties currently in production, or slated for production, were intensively sampled for soil lead using handheld x-ray fluorescence technology. The rapid sampling time and portable nature of the x-ray fluorescence analyzer allowed for numerous samples to be taken at each property. Soil sampling revealed that seven of the eight sites contained at least one area of the property where soil lead concentrations exceeded 400 ppm, the USEPA reportable limit. The site with no lead readings above 400 ppm did not contain a home in the recent past, suggesting that paint used in housing is an integral source of lead. This study examines how site history, including past residential land use, can influence lead concentration in the soil. Knowing the history of a site can inform safe gardening practices, prevent exposure to soil lead, and advance urban sustainability goals. This study also demonstrates the importance of capturing the inherent spatial heterogeneity in soil lead, highlighting the need for spatially explicit testing to identify lead hotspots.

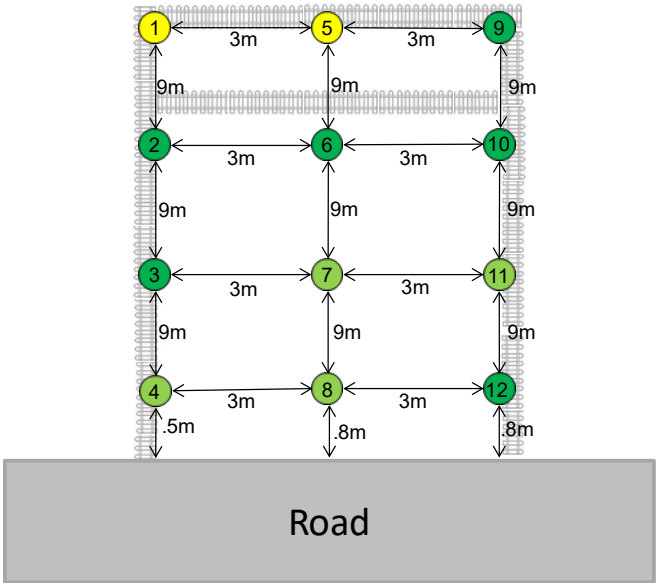
Keywords: lead, environmental science, soil sampling

Introduction

Considerable effort has been made to eliminate the use of lead in consumer products; however, childhood lead poisoning remains a major environmental and public health problem - one which is entirely preventable (Tong, Schirnding, & Prapamontol, 2000). An estimated 4% of children in the United States, and 6% in Kentucky have elevated blood lead levels (CDC, 2016). Exposure to lead can happen through inhalation of lead particles as well as consumption of foods that contain lead (Assi et al, 2016). Lead poisoning can cause serious complications in children such as damage to the brain and nervous system, anemia, hyperactivity, developmental delays, hearing loss, kidney and liver damage, and sometimes even death (Assi et al., 2016). Although lead poisoning is a more serious concern for children, it can affect both children and adults (Koller, et al., 2004). In adults lead poisoning can cause poor muscle coordination, nerve damage, hearing problems, and reproductive issues (Assi et al., 2016).

A lesser known source of lead in the environment is soil (Mielke & Reagan, 1998). Lead-based paint, leaded gasoline, and industry have all contributed to increased lead levels in urban soil (Morrison et al., 2013). Even though regulations were made decades ago to discontinue the use of lead-based paint and leaded gasoline, residue from these lead-based products remains in the soil (Elless, Bray, & Blaycock, 2007). Even a property that appears to be vacant may be influenced by past land use. This can complicate sustainability planning, specifically the conversion of vacant lots to urban gardens. Even though produce grown in contaminated soil can accumulate lead, a greater concern is the direct ingestion of soil (Clark, Hausladen, & Brabander, 2008). A few known drivers of soil lead concentrations exist, including whether there is, or was, a pre-1978 constructed home on the property, if the property is located close to a roadway, or if the site is located close to current or historic industry (Clark et al., 1991; Schwarz et al., 2013). This information can help assess the likelihood that soil contains elevated lead; however, soil testing is the only definitive way to determine soil lead concentrations.

Generally, when soil is tested for lead, a composite sample is collected. Composite samples are a combination of samples mixed together to give one average score for the entire property (Environmental Protection Agency [EPA], 2005). Composite samples are more affordable than collecting and analyzing individual samples; however, there are tradeoffs to this sampling methodology (EPA, 2005). Soil lead can be highly heterogeneous, with concentrations varying over very fine spatial scales (Schwarz et al., 2012). Composite samples can mask the inherent spatial heterogeneity of soil lead by mixing samples with very different soil lead values. Composite samples work well for soil samples that are well mixed. However, if the goal is to evaluate a site for garden suitability or placement, intensive spatially-explicit soil lead testing is a better alternative. Handheld x-ray fluorescence (XRF) spectroscopy is an efficient and accurate method of soil lead testing that provides real-time data on soil lead levels, the location of hotspots, or areas of high soil lead concentrations. The results can then be shared with study participants in



- **5000 or more ppm (Considered Very High by EPA)** Must be treated with a permanent barrier. Unsafe for all types of gardening.
- **2000-4999 ppm (Considered High by EPA)** Treatment is necessary for any recreational use by children or adults and for pet areas. Unsafe for all types of gardening.
- **400-1999 ppm (Considered Moderately High by EPA)** Treatment is recommended for use as a children's play area and for gardening, especially for vegetable gardening.
- **81-399 ppm (Considered Low by EPA)** The California Office of Environmental Health Hazard Assessment recommends exercising caution when encountering bare soil in this range.
- **80 or less ppm (Considered Low by EPA and the State of California)** No treatment is necessary for most uses by children, adults and pets.

Figure 1. A map depicting the testing results from one of the sites in Lexington, KY. Corresponding treatment recommendations - with the exception of the CA guideline - are from the USEPA Lead Safe Yard Project.

the form of spatially-explicit maps, which show where a sample was collected, the corresponding lead value, and whether the lead level is a concern (Figure 1).

With renewed interest in urban gardening as a goal to achieve urban sustainability and as a method for communities to obtain fresh produce, it is important to understand soil lead levels and the possible implications for urban gardening activities.

For this research project we worked with a Lexington based non-profit dedicated to improving access to fresh and local foods in underserved communities. Concerned about potential soil contaminants from past land use, they were interested in having the soil tested at eight vacant lots that had recently been converted, or were in the process of being converted, to urban community gardens. Our research addresses two questions: 1) What is the spatial distribution of soil lead? and, 2) How does the history of a site, specifically a history of built structures influence the soil lead levels on a property? We address these questions in order to understand how to safely convert vacant land to urban community gardens and ultimately advance the goal of urban sustainability.

Methods

Lexington Field Sites

Eight sites were tested for soil lead in the Lexington, KY metropolitan area (Figure 2). Of the eight sites that were tested, six were once occupied by homes. All the properties are now without buildings and are either in the process of becoming an urban garden or have been converted to urban gardens. No harsh chemical pesticides or fertilizers are used at the sites. Food waste from local restaurants is converted to compost and used in the gardens as a natural fertilizer (Warren, 2013). All eight sites are located in underserved communities.

Materials

All sites were tested using handheld XRF analyzers. X-ray fluorescence results from changes that take place within an atom (Oxford Instruments, 2016). For every sample tested with the XRF analyzer, each element within the sample produces its own fluorescent x-ray spectrum. The XRF simultaneously measures each of the characteristic x-rays emitted by each of the elements in the sample. The XRF can then identify a range of elements, including lead, in the sample and the relative concentrations of each element (Oxford Instruments,

Figure 2. A map depicting the study sites. All eight sites are located in Lexington, KY

Figure 3. Testing the soil for lead with the XRF analyzer.

2016).

Sampling took place between June and July of 2014. The soil tests were completed in situ and took one minute each to run. Soil moisture readings were also completed in situ using a Fieldscout TDR 100 soil moisture probe. Soil moisture readings were collected to ensure that field conditions were appropriate for sampling as high soil moisture can alter soil lead readings (Argyraki et al., 1997).

On five of the eight properties the organization had implemented best management practices for potential soil contamination by installing raised bed gardens. Three of the sites did not have any raised bed gardens. For the three properties without raised bed gardens we used the same sampling scheme. On each of these properties we placed one or two 4 x 3 sampling grids depending on the size and shape of the property. This resulted in twelve to twenty-four testing locations per property.

For sites that contained raised bed gardens we altered our sampling scheme (Figure 4). We placed a 4 x 3 sampling grid on the portion of the property without raised bed gardens. We also tested the center of each raised-bed garden. Transects with four points equidistant from one another were tested along the sides of the raised-bed gardens (Figure 5).

Results

Seven of the eight sites tested had at least one lead reading that was higher than the U.S. Environmental Protection Agency reportable limit of 400 ppm (Table 1). All the sites that were previously occupied by homes had at least one soil lead reading higher than 400 ppm. We tested an average of twenty-six locations per site (Table 1). Nine percent of all the samples collected were considered moderately high by the EPA – between 400 and 1999 ppm. At one property 25% of the tests were higher than 400 ppm. At another site 17% of the locations tested had soil Pb levels of 400 ppm or higher. Both locations previously had homes on them. The site with 17% of sampling locations higher than 400 ppm was more recently occupied by a home. Of the remaining properties, two had two soil lead readings higher than 400 ppm, three contained only one soil Pb reading higher than 400 ppm, and one contained no lead readings above 400 ppm.

Sites 4 and 8 had no history of built structures. Of those two, site 8 did not have any soil lead readings in excess of 400 ppm. The other property, currently a park, only had one reading that exceeded 400 ppm. This high lead reading was located adjacent to the road.All of the soil lead measurements taken in raised bed gardens returned readings less than 400 ppm.

Using Google Earth, we compared recent aerial photos of all eight sites to photos dated between 1997 and 2002 in order to determine site history. Through conver-

Figure 4. A sampling site that contained raised bed gardens.

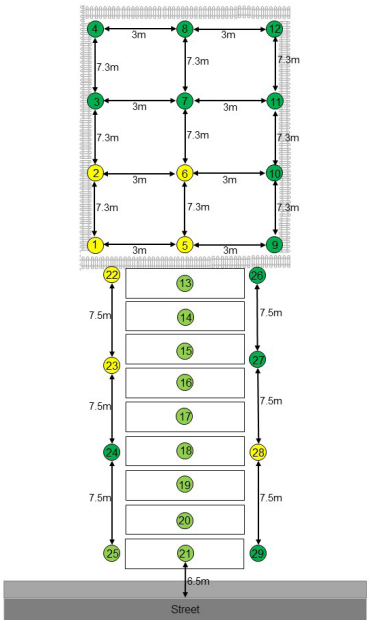


Figure 5. Sampling scheme for a property that contained raised bed gardens. Each circle represents a testing location. Colors correspond to the legend in Figure 1.

Table 1. Soil testing results for all sites.

Site	1	2	3	4	5	6	7	8
Tests per site	12	33	38	24	29	24	24	20
Tests considered moderately high by the EPA (400 - 1999 ppm)	2	2	4	1	7	1	1	0
Tests considered low by the EPA (81 - 399 ppm)	6	13	22	17	12	13	11	11
Tests considered low by California (<80 ppm)	4	18	12	6	10	10	12	9
Property history	House	House	House	Playground	House	House	House	No House

sations with local community members, we learned that the site with the highest percentage of soil lead readings in excess of 400 ppm previously contained a house that had burned down. Figures 6a, b, and c display what site number five looked like over the past twelve years. In figure 6a, aerial photos from 2002 show that the property still had a home located on it. In figure 6b, aerial photos from 2013 show the condition of the property prior to being converted into an urban garden. Figure 6c displays the results of our lead testing - moderately high soil lead levels correspond to the southern end of the building footprint.

Discussion

It is apparent that past land use influences the current soil lead content. Seventeen of the eighteen sampling locations that had moderately high lead levels were located along historic building footprints. Properties with no evidence of past structures had low lead levels, with only one property demonstrating a single moderately high soil lead reading. The source of lead was not analyzed, as it requires the use of lead isotopes (Filippelliet al. , 2005); however, the location of the reading—adjacent to the road—suggests that leaded gasoline was a possible source of the lead.

On all eight properties the lead content varied at a fine spatial resolution. This is congruent with past research (Schwarz et al., 2012). Elevated soil lead in one area of a property did not necessarily mean that the rest of the yard was also elevated. For example, site number 5 had seven high lead readings and ten low readings. The efficient nature of the XRF allowed us to collect data for multiple locations on each property as opposed to one composite sample. This helped to distinguish areas of high and low lead content in the soil. This spatially explicit data provided a more accurate representation of lead distribution throughout each property thus reducing the risk of gardening in unsafe soil.

The sites that previously had a home were more likely to contain high soil lead readings than those without a home. Site number 8 was one of the two properties tested that was never occupied by a home. This was also the only site that did not have a soil lead reading exceeding 399 ppm, suggesting that lead pollution at the other sites is at least in part derived from the past presence of lead-based paint on the exterior of buildings and structures. Site number 5 was previously a playground and never had a home. On this property, high levels of lead were observed adjacent to a roadway. Because this site had no history of a home and the reading was taken next to the road, the observed lead may be attributed to the past use of leaded gasoline.

The United States Environmental Protection Agency recommends treating soil that is used for children play areas and gardening if lead levels are between 400-1999 ppm (USEPA, 2001). Seven of the eight tested properties had at least one reading that fell within this range. There are gardening practices that can be implemented to help mitigate the health risks associated with gardening in lead contaminated soil. Prior to testing, the non-profit organization had implemented raised bed gardens on five of their properties. Raised bed gardens have been suggested to improve the health of gardens by producing a better soil structure and drainage system (University of Minnesota Horticulture, 2009). Raised bed gardens are considered a best management practice for potential soil lead contamination. The beds have also received compost amendments, which is a recommended practice when gardening in potentially contaminated soil. We expected all of the raised garden beds to have low soil lead values since they contain imported soil, and this was true.

Conclusion

Spatially-explicit testing with handheld XRF technology allowed for accurate and detailed soil lead testing. It also enabled us to share the results of our testing to the community in the form of accessible maps that clearly show the spatial distribution of soil lead. This information can be easily translated into management practices by showing what areas are safest for gardening and

Figure 6. a) Google Earth aerial photo from 2002 showing the property which contained the highest percentage of soil lead readings over 400 ppm. b) Google Earth aerial photo from 2013 depicting the same property after the building has been demolished. c) Soil lead testing results overlaid on the aerial photo. The green diamonds are considered low lead levels by the USEPA and the red diamonds are considered moderately high (400 ppm of lead or higher).

which may require remediation or implementation of best management practices in order to avoid exposure to lead.

In an investigative report by USA Today, hundreds of communities from around the United States located near past industrial sites were tested for soil lead (Young, 2012). The factories used a process called smelting, which released harmful lead particles into the environment. Even though the factories are not in use today, the legacy of the factories remains through the lead levels in the soil. Many families living next to where the factories once stood are unaware of the potential hazards in their yard (Young, 2012). The source of lead in our study is likely different, but the concept that past land use leaves a legacy of lead on the landscape is the same. The original source of lead may no longer be seen; however, the effects can still linger, unseen, in the soil.

A property's history can give clues to possible causes of lead pollution and which areas are expected to contain higher levels of lead in the soil. The presence of a home built before 1978, major road networks, and historical industrial activity can all influence current soil lead concentrations. Knowing the history of a property provides valuable information that can help assess site suitability for urban gardening and aid in the safe placement of gardens.

Our population is growing and becoming more urban, with over 80% of the US population now living in urban areas (The World Bank, 2017). More attention than ever is focused on advancing urban sustainability goals. Urban agriculture can play an important role in achieving these goals by providing access to fresh, healthy, and local food while promoting community cohesiveness. Urban gardening provides greenery and may decrease the heat island effect, reduce storm water runoff, and improve air quality (Howard, 2014). In addition, urban gardening can reduce greenhouse gas emissions associated with industrial food systems by decreasing the need for transportation.

Converting vacant land into urban gardens can be an effective way to increase food production and build community relationships. However, site history needs to be considered in order to avoid soil contaminants associated with past land use. Our study demonstrates that past factors leave a legacy of lead on the landscape. Capturing the inherent spatial heterogeneity in soil lead through spatially explicit testing and knowing the history of a site can support safe gardening practices and prevent exposure to soil lead. In addition, our data support the notion that employing best management practices such as the use of raised bed gardens and soil amendments can potentially mitigate risk from legacy pollution.

Acknowledgement

We would like to thank our community partner, Seedleaf, for access to the study sites.

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Cognitive Performance and Sounds: The Effects of Lyrical Music and Pink Noise on Performance

Marissa Chitwood graduated as a university honors scholar at Northern Kentucky University in May of 2018 where she obtained her Bachelor of Science degree in psychology and a minor in neuroscience. She plans to get a Ph.D. in experimental psychology with a concentration in behavioral neuroscience. Her main research interests include developmental cognitive neuroscience, neural mechanisms of behavior, mental disorders, diagnostic tools and early intervention research.

Cognitive Performance and Sounds: The Effects of Lyrical Music and Pink Noise on Performance

Marissa R. Chitwood. Faculty mentor: Kalif E. Vaughn
Psychological Sciences

Abstract

Given that a large percentage of students listen to music while studying, we investigated whether external noise could impair learning. In the current experiment, participants were tested on their performance in reading comprehension while listening to different types of sound. Undergraduate students (N = 70) were asked to read a passage while listening to either pink noise (equivalent to the spectrum of natural sound), pop music (genre of popular music), or read in silence. After reading an informative passage and completing a brief distractor task, participants completed a final test to assess their performance. Afterwards, participants answered questions on their personal study habits. We hypothesized that listening to pink noise while studying would improve cognitive performance compared to listening to pop music or studying in silence. In addition, we predicted that listening to pop music while studying would impair performance relative to pink noise and studying in silence. Results indicated no difference for the different types of sound on performance, suggesting that studying with sound has a minimal impact on learning.

Keywords: learning, pink noise

Introduction

Some of the most common techniques students use for efficient studying may not be the most advantageous. Techniques often used when studying material include highlighting important text, re-reading text, mental imagery or visualization, and summarizing. Dunlosky, Rawson, Marsh, Nathan, and Willingham (2013) examined ten different study techniques and each were assigned a low, moderate, or high utility rating. The utility rating describes the effectiveness and easiness of each learning technique. Highlighting, re-reading parts of a text, imagery, and summarizing what you have read are four of the ten learning techniques reviewed and each were assigned a low utility rating. Thus, students tend to use ineffective study strategies.

The environment in which a student is studying can affect their cognitive functions and impact their learning of material. Previous studies have indicated that 79% of junior high school students reported they like to listen to music while studying (Anderson and Fuller, 2010) and that 59% of college students chose to listen to music while they completed their homework (Calderwood, Ackerman, and Conklin, 2014). As students frequently listen to background music while studying, it is critical to further explain the relationship between sound and cognitive performance. Although listening to background music while studying is prevalent in students, it does not indicate that sound is beneficial to the learning of the student, nor does it suggest it to be detrimental.

Pink noise is a random noise that is found widely in nature and many physiological processes. It is commonly explained as a relaxing sound, relatable to that of a waterfall. Pink noise is also similar to white noise, which is comparable to the sound produced from a nonexistent radio station or TV channel (often known as static). White noise has a higher and greater structural sound frequency than does pink noise. With a lower frequency, pink noise is equivalent to the spectrum of natural sound and has become of considerable interest to researchers (Papalambros et al., 2017; Sejdić and Lipsitz, 2013; Zhou et al., 2012).

One study of interest examined the effects of ambient noise, pink noise, and a TV sitcom soundtrack on visual attention. Participants were assessed using a continuous performance test (CPT), a computerized attention task that keeps track of participant's reaction times as well as different types of errors they made. It was found that participants in the pink noise group showed higher CPT scores than the ambient noise group, indicating that participants' attention improved while listening to pink noise as compared to the ambient noise (Wasserman and Segool, 2013). If it is true that pink noise leads to better visual attention, then it may be true that listening to pink noise while studying could lead to better learning.

In the current experiment, participants were tested on their reading performance during which they read a passage in silence or read while listening to either pink noise or pop music. We predicted that listening to pink noise will improve cognitive performance compared to listening to pop music or studying in silence. Calderwood et al. (2014) examined the different types of media-multitasking and distractions that students readily choose while they study. Their results showed that students who did not listen to music during the session had fewer distractions compared to students who did listen to music during the study session. Another study found that most students (74.5%) had lower reading comprehension scores while listening to lyrical music in the background compared with students in a quiet environment (Anderson and Fuller, 2010).

From the speculation that listening to lyrical music while completing tasks that require continuous attention will affect the efficiency of learning, we hypothesized that studying with pop music will impair performance relative to pink noise and studying in silence.

Methods

Participants

A total of 123 undergraduate students signed up to participate and begin the study; however, participants were excluded if they did not finish the experiment (n = 52) or if indicated that they had completed the experiment previously (n = 1). Seventy undergraduate students (Female = 43, Male = 25, Not Specified = 2) from Northern Kentucky University completed an online study on SONA, a research management software, for extra credit or credit toward a course requirement. Participants' age range was 18-48, and they described themselves as White, Non-Hispanic (74.3%), African American, Non-Hispanic (10.0%), Asian/Pacific Islander (4.3%), Hispanic/Latino (2.9%), or Other (8.6%). Participation for this study was voluntary and participants could decline continuation at any time during the session.

Each participant was randomized into one of three conditions: pink-noise group (n = 18), pop-music group (n = 24), or silence group (n = 28). Participants were asked during the final questions whether or not they listened to music during the study session. In addition, participants identified the type of sound they listened to or if they completed the study in silence. After correcting for potential errors, participants were assigned according to what sound they recognized listening to while reading the passage, if different from their originally assigned condition. The participant groups based on final questions response—pink-noise group (n = 22), pop-music group (n = 25), and silence group (n = 23) —were analyzed.

Materials

All participants read an approximately 1,000 word informational passage about dolphins. The scholarly information about dolphins was derived from Encyclopedia.com. A labeled bottlenose dolphin body diagram inserted within the passage was found using Google Images. The nine labeled body structures of the dolphin diagram included: beak, melon, blowhole, dorsal fin, back, flukes, eye, flipper, and belly. The informational passage incorporated text and a labeled diagram in order to mimic the layout of an educational textbook to better simulate a study-test scenario.

During the passage, participants in the pop-music group listened to two songs: "Counting Stars" by OneRepublic and "Drops of Jupiter" by Train. The songs are classified into the pop music genre which consists of elements from country, urban, rock and other genres. The songs were selected using the published top 50 "Greatest of All Time Adult Pop Songs" listed in Billboard Magazine, and were chosen from the first ten on the list. Both songs were obtained individually from YouTube as videos and then converted into a combined 8.5 minute MP3 file.

Participants in the pink-noise group listened to 8.5 min of pink noise digitally generated at 24-bit/96 kHz. The pink noise was obtained from YouTube as a video and then converted into an MP3 file. The video selected had the highest amount of views compared to all other pink noise videos on YouTube.

Procedure

All materials and procedures were pre-approved by the Northern Kentucky University IRB. Participants signed up for the study on SONA with an estimated completion time of 30 min. If completed, participants were compensated two credits for participation. Once participants signed up on SONA, they were directed to an external website which displayed the beginning of the experiment. Participants were provided the informed consent form and continued to the next portion of the study if they clicked to agree to participate. Instructions about the nature of the experiment were provided. Participants were asked to wear headphones during the study and to complete the study in a quiet environment. To ensure the functioning of the sound before the passage was presented, participants completed a noise test in which the pink-noise group listened to the first ten seconds of the pink-noise MP3 file, and the pop-music group listened to the first ten seconds of the pop-music MP3 file. Participants in the silence group were not presented a noise test.

During the study phase, all participants were asked to study the passage information which included the dolphin text and diagram for 8.5 min. Pink noise played in the background for the duration of the passage in the pink-noise group, just as pop music played in the background for the duration of the passage in the pop-music group. No sound played during the study phase in the silence group. Participants were asked before and after the passage whether or not they heard the music or pink noise (dependent upon assigned group).

The distractor phase included the game of Tetris as a brief distractor task. Instructions were provided and participants were given two minutes to play. After playing Tetris, instructions for the final test were explained. The final test consisted of nine drop-down questions on the dolphin body diagram and ten multiple-choice questions on the dolphin passage, for a total of nineteen questions. Additionally, survey questions were introduced in which participants reported their personal study habits, music preferences, as well as demographics. Finally, participants were thanked and debriefed about the experiment.

Statistical Analysis

To examine multiple-choice and diagram performance, separate one-way ANOVAs were conducted comparing performance as a function of group (pink-noise, pop-music, or silence) using JASP (Version 0.9) statistical software.. Additionally, a chi-square goodness-of-fit test analyzed participant's responses regarding which noise they thought best for learning (pink noise, pop music, or silence).

Results

The mean percentage of final multiple-choice performance was analyzed as a function of group (pink-noise, pop-music, or silence; see Figure 1). A one-way ANOVA was conducted using JASP (Version 0.9) statistical software. The results conclude no significant difference of sound on multiple-choice performance, $F(2, 67) = 0.082$, $p = 0.921$, $\eta^2 = 0.002$. In other words, listening to external noise while studying had no effect on the performance of final multiple-choice questions.

A one-way ANOVA was conducted to evaluate the mean percentage of final diagram performance analyzed by group (pink-noise, pop-music, or silence; see Figure 1). The results were not significant, $F(2, 67) = 1.198$, $p = 0.308$, $\eta^2 = 0.035$, indicating there is no significant difference of sound on diagram performance. That is, listening to external noise while studying had no effect on the performance of final diagram questions.

Participants were asked which type of noise they thought improved learning the most. The majority (78.6%) of participants believed that silence is best for learning, while some participants thought that pop music (12.9%) or pink noise (8.6%) is best for learning (see Figure 2). A chi-square goodness-of-fit test analyzed the distribution of responses and revealed a significant effect, $\chi^2(2) = 64.66$, $p < 0.001$. Thus, these results provide evidence that sound has no effect on performance, even though students think that silence will improve their learning the most.

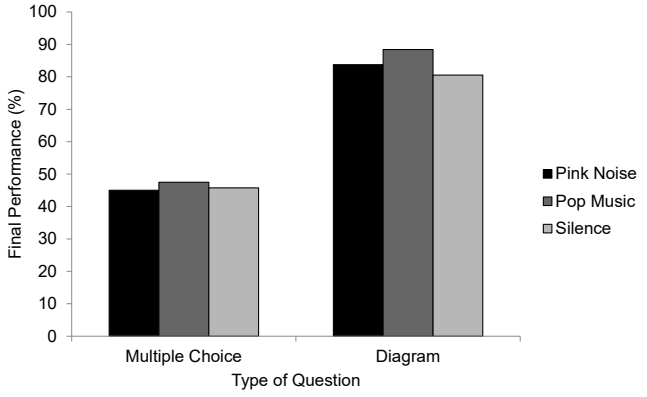

Figure 1. Mean final performance as a function of question type (multiple choice or diagram) and group (pink noise, pop music, or silence).

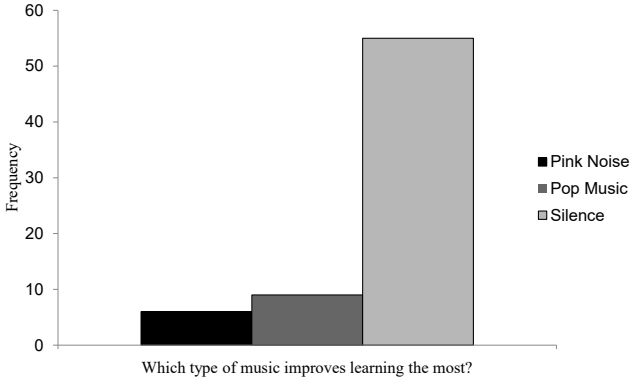

Figure 2. Frequency of responses to specific survey question in comparison between groups (pink noise, pop music, or silence).

Discussion

The present study examined if listening to lyrical music impairs students learning and if pink noise improves students learning. These results show that studying with pink noise, pop music, or studying in silence did not influence performance. However, most students believe silence is best for learning. This is consistent with the findings of a previous study that found participants rated music as more distracting to their performance than silence (Reaves et al., 2016).

The limited capacity model (Broadbent, 1958) explains the negative effects of competitive tasks on concentration. Pool, Koolstra, and Van Der Voort (2003) argue that attempting to accomplish two tasks simultaneously exceeds a person's capacity for attention and will have limitations on successfully achieving one or both tasks. According to the limited capacity model, listening to lyrical music competes with cognitive tasks required to learn, thus limiting the effectiveness of one or the other. In the current study, there was no difference between silence and listening to pink noise or pop music while attempting to learn information, suggesting that music may not interfere with learning. Although this highlights a situation in which there may be competition for attentional resources, the amount of resources required to listen to music may be relatively small and thus not interfere with learning.

Rideout, Foehr, and Roberts (2010) reported the frequency of teenagers multitasking when using specific types of media. The results indicate that teenagers multitask often, particularly while reading (53%), using a computer (66%), watching television (68%) and listening to music (73%). Due to the high prevalence of multitasking, this research adds a greater understanding of

the importance to investigate potential negative effects on cognitive performance.

As this study was administered online, it was vulnerable to numerous external variables. The testing environment of which the participant began the experiment (e.g. participants in the silence group could have been exposed to noise outside of the experiment) could have affected the results. Participants could alter the volume on their own which led to inconsistent volume levels across participants, while some participants could have disregarded the request to have headphones available before beginning the experiment. In addition, the diagram questions were potentially not challenging enough and so could have caused the exhibited ceiling effect between groups. For that reason, administering this study in a lab-based setting would enable more control over external variables and allow for higher internal validity.

The type of sound that students choose to study with (music, external noise, random noise, etc.) and the manner in which they listen to the sound (volume level, audio source, etc.) could impact their learning. A study found that memorization performance while listening to pink noise at a moderate volume level was better than that under city background noise at a moderate volume level, although performance was not better under loud pink noise (Skarlatos and Georgiou, 2001). If the sound is loud and startling, then sound with more soothing qualities may be a better option for learning. Sound that features a relaxed and consistent melody may be more comforting and not as unexpected.

If a student typically listens to music while studying, this could become a fixed way of learning. If one was never reinforced by music or any noise at all, then they would be expected to complete tasks better in silence because they were never reinforced by a stimulus, other than silence itself. Personal experience could explain why people differ in their judgement of effective study methods. One may think they study more efficiently while listening to music, while someone else may think they study best in silence - and considering their personal experience, both claims may in fact be justified according to this theory.

Individual differences such as personality, motivational interest, and typical study habits should be a focus when investigating cognitive performance. A study found that individual differences such as personality, interest, and motivation were found to have greater influence than test-length for determinants of cognitive ability test performance and reactions (Ackerman and Kanfer, 2009). Additionally, specific factors that may be important to consider would be familiarity of the song, preferred genres of music, lyrical versus non-lyrical music, and other musical characteristics. The differing results between studies could be contingent upon individual differences.

According to the Eysenckian hypothesis, introverts and extroverts differ in their levels of arousal as extroverts have lower levels of excitement and choose environments that provide more stimulation while introverts have a higher level of arousal and do not seek out stimulating environments (Eysenck, 1967). Furnham and Bradley (1997) found that pop music had a detrimental effect on immediate recall and a reading comprehension test for both introverts and extroverts. However, the introverts who performed with music were less able to store the information for later recall than extroverts (Furnham and Bradley, 1997). This indicates that the effects of listening to music while studying may interact with personality traits and could provide an interesting avenue for future research.

Conclusion

The current study aimed to address whether or not pink noise improved learning. Although further investigation is needed to determine the effects of sound on cognitive performance, participants in the current study think studying in silence is best for learning, even though results show that studying with sound has a minimal impact on learning. No harmful or beneficial effects of listening to music while studying were found, nevertheless this is not to imply that music could not ever influence performance. Further research, especially research examining individual differences, is needed to further explore the relationship between listening to music and study performance.

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Electoral System Dysfunction: The Arab Republic of Egypt

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Electoral System Dysfunction: The Arab Republic of Egypt

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Abstract

Elections are the cornerstone of democratic systems, but the form they take and their overall quality varies widely. In this paper, electoral systems and their formulae for deciding a victor are analyzed using the Arab Republic of Egypt as a case study. This manuscript explores how the differences in electoral formulae influence voting behavior and governmental longevity. An analysis is done through a qualitative and quantitative study of Egyptian elections, beginning with Anwar Al-Sadat in 1970 and ending with Abdel Fattah Al-Sisi in 2018. We find that the Egyptian majoritarian system has not provided increased legitimacy, as suggested by the literature for a variety of reasons. This leads to further questions about the electoral formula in Egypt as well as the role of other institutions in the Egyptian political system.

Keywords:MENA, Egypt, elections, electoral systems

Introduction

The Arab Republic of Egypt is the state that now has political hegemony on an area in which human society has grown and prospered for millennia. This country, as with many on the African continent, perennially struggles with autocracy and the short lifespan of government. While many explanations can be made as to why, the one that rises above others is the majoritarian system in which elections are decided. Egypt, throughout this paper, will serve a case study for the theory that an electoral system, more specifically the electoral formula, influences the political character of a country.

Various literature will be aggregated forming the academic basis of this paper. The literature presents three separate electoral systems and their formulae for deciding a victor in elections, whether it be parliamentary or presidential. These include majoritarian, plurality, and proportional, as well as mixed systems. Each of these systems has benefits and detriments influencing the character of a political system.

The contemporary history and geography of Egypt will be briefly reviewed as well. After this review, the literature will serve as a rubric for the analysis of the Arab Republic of Egypt. This analysis will be done through a review of governmental and non-governmental data on registered voters, voter turnout, number of rounds of voting held, years a head of state serves, and number of constitutional revisions.

Other variables examined will be the constitutional basis for these regulations, and how these regulations are circumvented by the executives or military of Egypt. The events that initially led to the rise of authoritarianism in Egypt, and the lasting impacts of the Arab Spring and the Egyptian Revolution will be considered. Measures that could be enacted by the Arab Republic to rectify their electoral system that hinders the designation of a free democracy will also be discussed.

Literature Review: Electoral Systems and Elections

Electoral systems are the processes through which officials are selected by the populace to serve in the government. When a country democratizes, or reconstitutes, the drafters must select a metric to determine how one can be declared the victor when the votes are tallied. Quintal (1970, 752) succinctly states that "An electoral law authoritatively prescribes the manner in which the political preferences of a community are to be expressed and ordered." Each system, with its associated laws, poses challenges that affect the political structure existing within a state.

In 1958, Grumm articulated theories underpinning electoral systems. The main systems that exist are plurality, proportional, and majority. Plurality systems are systems in which the person who receives the most, but not a majority of the vote, is declared the winner. Proportional is the system in which the percentage amount a party wins above a minimum is equivalent to the seats in the legislative body they are awarded. Majority systems require someone to get above fifty percent of the vote to be declared the winner (Grumm, 1958).

Grumm examines proportional representative systems. The traditional thought is that in a proportional representative system, multipartism is the result, and that in a plurality system, with single-member districts, bipartisanism is the result (Grumm, 1958). He finds, based on European case studies, that there is not an empirically valid explanation for the relationship between proportional representative systems and multipartism or between bipartisanism and majority or plurality systems.

Similarly, Blais examines these same systems and divides them into their empirical and normative observations as presented by Grumm. In a plurality system, a state garners its strength and political stability from the possession of a one-party state. With this, the head of government can pass their legislative priorities and

govern effectively. Blais cites data from a 1984 study in which in a sample of 120 countrieswhere 45 select their representatives through a plurality or majority system, the mean minimal majority was only 1.15 parties, compared to the 1.96 mean minimal majority for proportional rule systems (Blais, 1991). This would lead to the conclusion that plurality systems are the most efficient way to form a government, as there are fewer parties involved. Proportional rule makes it difficult to form new governments. In Anglo-American countries (plurality rule) governments are "dismissed" in 39% of elections compared to 23% of elections in (proportional rule) Europe. Blais ultimately concludes that the values of each form of government are similar to the functions of a government (Blais, 1991).

Blais also summarizes the argument for a proportional representative electoral system. He does this by providing a diagram that details how this electoral formula provides a descriptive representation of opinions. This allows for an enhanced state of responsiveness among representatives as well as lending the government legitimacy which maintains order. The last electoral formula he looks at is the majority system. The two arguments for this system are that representatives who are elected have strong support which grants legitimacy and that it weakens extremist parties, leading to political order. Blais notes that the legitimacy of electoral systems is dependent upon voter turnout.

When an electoral system is being selected, it is necessary to know how it will affect the various potential and current political parties. Quintal (1970) formulates a framework to explain the various effects. He examines legislative costs, quantified in terms of votes, for different electoral laws. In parliamentary systems, he finds that a plurality system requires a higher form of payment from smaller parties than from larger parties, while list systems of voting equalize the payments. The higher form of payment that Quintal discusses is literal, in the sense that smaller parties physically must expend more capital to obtain the same amount of power. It is also figurative in the sense that socially they must use more effort than larger parties to achieve electoral goals.

He finds that as the seat to vote ratio increases, the total costs experienced by a party increase overall. He then looks at contingent costs incurred due to political change. There is a high decision-making cost associated with changing electoral law, especially in a coalition of parties over a single party. Extrapolating from this, one can assume that because of the immense social cost required to change electoral law, once it is set it is seldom changed. This makes it important to know why a system was selected in the first place.

Norris (1997) builds on the conclusions generated from Blais's work and starts to analyze the previous question. She describes how framers of constitutions select an electoral system. She maintains the classifications of electoral formulae, majoritarian, semi-proportional, proportional, and mixed systems; she further breaks them down into their component parts then does a global study, sorting countries into the categories she defines. In Norris's 1993 study, 83 out of 150 countries were found to have majoritarian electoral systems, with the remaining using some form of the other three systems (Norris, 1997). She finds there is no "best" electoral system. When a system is chosen, many things are taken into consideration, such as accountability, coalition-building, representation of social groups, casework, single party or coalition government generation, vote proportionality, and the impact it will have on the party system. Each system impacts these metrics in various ways (Norris, 1997).

Interestingly, there seems to be very little difference in voter turnout between majoritarian, mixed/semi-proportional representation, and proportional representation. The country that has the highest voter turnout in the study is Australia, which has mandatory voting enforced by a small fine, which is a byproduct not of its electoral formula but its wider electoral laws. This opens the door to a wider study of how the different requirements to vote affect political systems (Norris, 1997).

As has been stated, in majoritarian systems a candidate must receive over fifty percent of the vote to be declared the victor. This leads to multiple rounds of elections. Blais et al. examine the effect this system has on the voters within a given country. The Downs Model of Voting ($V = pB - C + D$) serves as the basis of this study, with special attention paid to the B and V variables. B is the perceived benefit from candidate and V that candidate's viability. The Downs Model of Voting mathematically models the cost/benefit of an individual going to cast their ballot. (Blais et al., 2011). They find that strategic vote choice does not vary between one-round and two-round voting at statistically significant levels. The external validity of this study, however, is questionable with its small scope and smaller sample size, but its results potentially offer indicators of a tendency in the larger population.

After an electoral system is selected, its effects and benefits must be measured. Teorell and Lindstedt (2010) gauged the best metrics to analyze these various electoral systems. They take models used by past researchers and attempt to replicate the results found within their studies. Data sets from Golder (2005), Persson and Tabellini (2003), The Database of Political Institutions, Johnson and Wallack (2003), are the basis for the analysis.

The first data set provides electoral system data for 867 legislative and 194 presidential elections. The second provides data on rules in use for elections for 85 lower legislative chamber elections from 1960-1998. The third provides data on electoral systems for both lower and upper houses in a global sample of both democratic and non-democratic countries from 1975-2006. The final is

a data set that provides measures for the variables being tested (Teorell and Lindstedt, 2010).

They conclude that there is no empirical benefit for any of the data sources and their scope, finding only a theoretical benefit for them (Teorell and Lindstedt, 2010). This indicates that the macro-data one uses, at least of the ones sampled, does not have a significant impact on the outcome of the study; but that the variable being measured and at what level they are being measured are important to the results of the study. The various data consisted of various quantitative variables surrounding electoral systems, the implication being that there is not an empirical, only a theoretical benefit to these measurements.

The literature presents an image of electoral systems globally. Whether they be proportional, plurality, majority or some mixture thereof, each system offers unique challenges for the state that implemented them. Proportional systems offer descriptive representation but government forming is difficult. Plurality and majority systems have less descriptive representation but forming a government is easier, although the legitimacy of the government is dependent upon voter turnout. The level of difficulty political parties encounter when seeking to gain control of the governing apparatus also varies. These factors, derived from the literature, will be aggregated and used to form the metric with which the Egyptian electoral system will be measured.

Background: The Arab Republic of Egypt

The literature offers a multitude of metrics with which to analyze the Arab Republic of Egypt, its electoral system, and the effect that it has on the political system and culture. Noting that the scope of this paper is contemporary Egypt, before delving into the current electoral system, it is necessary to briefly review Egypt's geography and modern history.

The country is situated in Northeast Africa and is the only country on the continent that is connected to the Middle East (Asia Minor). It has access to both the Mediterranean and Red Seas (BBC News Editors, 2005). The geopolitical significance of this is immense, as it gives them, and whomever their allies happen to be at the time, a path to get to the Atlantic and Indian Oceans. The population of Egypt is, as of 2018, 93.5 million, making it the most populous in the Middle East and North Africa. The major Egyptian cities are concentrated around the Nile River Valley due to the generally arid climate ("The World Factbook 2018").

Egypt was not colonized in the same way as much of the rest of Africa was. It was named a protectorate of Britain in 1914 after being conquered by them in 1882. This lasted until 1922 when Fuad I became the King of Egypt and the country became officially independent, although British influence remained significant. Egypt was still short of full sovereignty. There is little significance to note about the rule of King Fuad I, with one exception: The Muslim Brotherhood was founded in 1928 by Hassan Al-Banna. The Muslim Brotherhood campaigned against western influence in Egypt; this legacy will be one built upon by opposition parties later in Egyptian history. (BBC News Editors, 2018).

Twenty-five years later, a coup d'état occurred, ending the monarchy. The coup leader, Colonel Gamal Abdel Nasser seized power, ruling until his death in 1970. Nasser formed the United Arab Republic which was made up of Egypt and Syria, and was a byproduct of Pan-Arab sentiments. Syria eventually seceded from the union in 1968, however Egypt retained the official name of the Arab Republic of Egypt. Nasser's iron fist rule of Egypt set the stage for the rise of authoritarian regimes such as Anwar Al-Sadat in 1970 and in 1981, Hosni Mubarak.

The Mubarak regime is one most often noted by the international community when referencing Egypt. Mubarak re-declared a state of emergency severely limiting political activity, freedom of expression, and of assembly (Sharp, 2006). Mubarak was not the first, nor was he the last to invoke a state of emergency to limit the freedoms of Egyptians.

President Mubarak and his supporters in the Egyptian military maintained a stranglehold on the country's electoral and political system. That is until 2011, when Egyptians inspired by the popular uprising occurring in the nearby Republic of Tunisia, revolted against their autocratic regime. Mohamed Bouazizi setting himself ablaze, ignited revolution across North Africa and the Middle East. Egypt was one of the sixteen countries who participated in this revolutionary Arab Spring. The longstanding political order in the region, especially in Egypt, was essentially shattered, even among regimes who instituted reforms while avoiding democratization (Rudbeck et al., 2016).

Case Study: The Egyptian Electoral System

Anwar Al-Sadat set the stage for the rise of his successor, Hosni Mubarak, to take the reins of the government of Egypt and establish himself as a lasting autocrat. Article 5 of the 1971 constitution sets up a multiparty system, stipulating the parties are regulated by law and that the Egyptian people have the right to establish political parties under the same regulations. It also stipulates that religious based political parties are prohibited. The prohibition of religious based political parties on one hand ensures that the government is not legislating religious beliefs. On the other hand, this prohibition restricts the freedom of speech and of religion among the Egyptian people (Constitution of the Arab Republic of Egypt, 1971). This is a significant stipulation on both grounds. The constitution then allowed for political parties to be restricted by non-constitutional law.

This constitution set forth a majoritarian system of election. The election of the president is governed by this regulation. The constitution set no term limits which allowed indefinite rule. (Egy Const, art. 77). While this could allow for democratic rule, as it does in many European states, in Egypt it has only empowered dictators. In theory, due to this majoritarian system, a run-off election would be required, however other sectors of the constitution would have prevented a significant challenger to President Al-Sadat. Political parties wishing to field a candidate for election had to be in existence for at least five consecutive years, with 3% of the elected members of both the People's Assembly and the Shura Council, the two chambers of the bicameral parliament of Egypt. Not only this, but many of the extensive freedoms and rights within the constitution were in a perpetual state of suspension. Nasser, albeit under a different constitution, Al-Sadat, and Mubarak all wielded this power as tool to circumvent the constituted electoral system and political freedom of Egypt.

Mubarak, hearing the political warning bells signifying the end of his reign, instituted further restrictions on political parties that threatened his power. Constitutional amendments banning the formation of political parties based on race, religion, or ethnicity were passed by a 76% approval despite low voter turnout. This was the final revision of the 1971 constitution.

In 2005, the last presidential election of the Al-Sadat constitution and government was held. President Hosni Mubarak faced nine challengers from minor political parties. However, before this election, the constitution did not allow the Egyptian people to directly elect their President. An amendment approved by the President was selected by the People's Assembly and approved by a nationwide popular referendum.

Despite the multitude of candidates, the incumbent had no trouble achieving an absolute majority. At that time, Egypt had over almost 32 million registered voters. Of that roughly 32 million people, only a minute number of voters showed up to cast their ballot. Twenty-two percent, or 7.3 million Egyptians went to the polls. Hosni Mubarak of the National Democratic Party achieved an astounding, compared to western elections, 88.57% of the vote (Sharp, 2006).

The Egyptian Parliamentary elections in 2005 occurred in three rounds until an absolute majority was achieved by a party, with 5,414 candidates competing for the 444 out of 454 seats. Under the 1971 constitution, the President Mubarak was granted the ability to appoint 10 members of the parliament. This left only 444 of the seats available for Egyptians to run for. Mubarak's National Democratic Party (NDP) contested all 444 electable seats.

Showing a quirk in the Egyptian electoral system, the NDP successfully fielded only 158 actual party members, an electoral showing of 35%, far below the absolute majority necessary to be declared the winner and parliamentary majority. This was circumvented by the 166 "independent" candidates who successfully gained seats within the People's Assembly. These independent candidates were NDP partisans. They switched their partisan classification awarding the NDP 324 seats, a 72% majority.

The Muslim Brotherhood grew from the anti-western organization founded in 1928 to a significant political organization despite being banned from organizing as a political party. This, of course, was due to the de jure electoral secularism. Their strong showing in the first round of this election (88 seats and a 58% victory percentage) was significantly curtailed by repression and arrests in the next round (Sharp, 2006). While the government could have argued then this was done merely to enforce the secularism of the government, it was a clear attempt by the NDP to maintain their electoral majority.

Six years later, the political unrest of the Arab Spring ignited within the Egyptian people a revolutionary spirit. The Egyptian Revolution triggered from this only lasted two weeks. In less than two weeks, on February 1, 2011 to be specific, Mubarak announced that he would not seek re-election for President. The protests in Tahrir Square in Cairo had to fend off state actors in the form of law enforcement personnel, and of what were most likely government funded mercenaries. The inability for the Mubarak regime to disperse the protesters showed the significant lack of political and social capital he wielded. The popular uprising could withstand him, and it did: Mubarak stepping down on February 11, 2011 (Rudbeck et al., 2016).

The military of Egypt, through the Supreme Council of Armed Forces, was given power, suspending the 1971 constitution. The Tahrir Square protesters remained for months, before the military finally dispersed them in August. They returned in November, and violence began once again, as the military was accused of attempting to retain their control of Egypt. Parliamentary elections were held following the naming of a new unity government led by President Mohamed Hussein Tantawi.

Alongside the elections was a referendum on a constitutional amendment. It would change Article 77 of the Constitution to implement a two-term limit and four year terms onto the President of Egypt. The term limits were intended to weaken the ability for a President to consolidate power for long periods of time. This, however, was the only safe guard on the ballot. The registered voters at that time totaled 45 million. Turnout was, compared to previous showings, incredible, with 41% of Egyptians turning out to approve the amendment by a 77.3% majority ("Egyptian Election Statistics 2000-2018").

The first and last election to happen under the

post-Egyptian Revolution amended constitution occurred in June of 2012. Mohamed Morsi of the Freedom and Justice Party (sponsored by Muslim Brotherhood) faced Ahmed Shafik, an independent, as well as other minor party candidates. Of the 51 million registered voters, 51.9% voted for President. This is the highest turnout for a Presidential election in Egypt thus far recorded. A second round of voting was necessary as no candidate achieved an absolute majority. Following this, Mohamed Morsi took 51.7% of the vote in this run off beating the Ahmed Shafik. ("Egyptian Election Statistics 2000-2018").

Notably, following the election of Mohamed Morsi, the beginning of a constitutional drafting process, and the extension of freedoms, Freedom House reclassified Egypt as a partly free state (Freedom House, 2013). This is an increase from their 2012 ranking of not free. Independent news media increased but was not free from state sponsored censors. University leaders were no longer appointed by the government. Independent labor unions began to increase. The new constitution was controversial despite political reforms extending freedom in Egypt, because it was perceived to be an Islamist constitution written by an autocrat (Fayed and Saleh, 2012).

Morsi issued emergency laws to keep the judiciary from dissolving the Constituent Assembly or dismissing him as head of state as the constitution was drafted. These emergency orders were put forth due to the Supreme Constitutional Court ruling the statutes under which the parliament had been elected unconstitutional (Masoud, 2014). The lower house of the Egyptian Parliament was tasked with drafting the new constitution, while the upper house was tasked with legislation. The resulting constitution created a House of Representatives and a Consultative Assembly. It maintained the majoritarian system for presidential elections and a four-year term (Egy Cons. Art. 133 and 136, 2012; Masoud, 2014).

The constitution leaves it to the government to statutorily decide the formula for how one is elected to the House of Representatives, but it does set forth a universal secret ballot for both the lower and upper chambers (Egy Cons. 2012). The constitution was approved with a 33% voter turnout from the 51 million voters and 64% voting yes in a two-stage referendum ("Egyptian Election Statistics 2000-2018"). This constitutional approval did not bolster the Morsi presidency.

On July 3, 2013, Morsi was arrested by Egyptian military officers, not for any crime, but for a failure to build consensus within the Arab Republic as well as economic downturns, fuel, and electricity shortages. Morsi was imprisoned. The parliament remained officially dissolved. With no stable governance, the Supreme Council of Armed Forces, which had been weakened under the Morsi presidency, once again had control of Egypt (Kirkpatrick, 2013).

Now yet another constitutional vacuum was present in Egypt. The 2012 constitution was suspended, and a committee to revise the constitution was created. It kept most of the provisions of the constitution, such as an Islamic basis for the state. The Egyptian Parliament was altered once more. The Shura Council was abolished and the House of Representatives was created wielding some legislative power, but not enough to effectively counteract the executive. Other changes were a strengthening of language protecting women, the removal of quotas for peasants and workers, and other minor details. A supermajority of voters approved of the constitution. Thirty-eight percent of the 53 million voters voted on the referendum, with 98% voting yes.

In 2014, Abdel Al-Sisi, an independent, and the military leader who delivered the military ultimatum to Morsi, faced Hamdeen Sabahi of the Egyptian Popular Current Party. Forty-six percent of the overall registered voters participated in this election, electing Al-Sisi President by almost as much of a majority as the constitution had been approved by, with 96.8% of the vote.

Four years later, the third presidential election of the post-Mubarak Egypt has occurred. President Al-Sisi once again stood for election in the Arab Republic. Detractors accused the incumbent of intimidating challengers and selecting his opponent for his weakness. Out of the 60 million registered voters, 41% of voters participated in the election; once again with 97% of the vote Al-Sisi was reelected (McKenzie et al., 2018). Whether the 2014 constitution and President Al-Sisi will have longevity is unclear, with Al-Sisi already contemplating constitutional reforms to allow him to run for a third term.

Discussion and Conclusion

Blais asserts that a majoritarian system causes there to be strong support for whomever is elected. This in turn gives the government legitimacy and maintains order and weakens extremist political parties, and these factors interplay cyclically. This reality is elusive for the Arab Republic of Egypt, even with high voter turnout. Leaders who were elected with a majority or super majority have been frequently deposed, and the constitution their election was based upon dissolved by the military.

It seems clear that the electoral system in Egypt serves as an effective case study for the relationship between electoral system and political character. The majoritarian system leads to aspiring autocrats ensuring that they can get a majority, not through building a broad coalition, but through abusing the state apparatus. Their tactics mar the political culture of Egypt. Political parties that dissent from the party-in-power have often been banned and their leaders subject to imprisonment. Journalists in Egypt have widely been replaced with state sponsored

media that ignores oppression and syndicates the ruling party's line. These civil and political repression tactics appear incidental to the pursuit of an electoral majority

Ultimately, for Egypt to prosper politically, and to attain a political culture conducive to free democracy, its electoral system must be revised. This could be a shift to a plurality system, or Egypt could adopt a parliamentary system, with a weak president, a coalition elected prime minister and proportional representation. A proportional representation system comes with its own challenges, but it would mitigate the ability for an autocrat to rise within Egypt. With these reforms, a free, genuinely democratic Egypt may be seen in this century.

Setting aside the majoritarian electoral formula explanation for the transient nature of Egyptian governments and constitutions, the Egyptian military poses a threat to longevity as well. It functions as an autonomous government in and of itself alongside President Abdel Al-Sisi, with the Supreme Council of Armed Forces being empowered for another four years to appoint a defense minister under the terms of the 2014 constitution. It was the military that controlled the government in 2011 both with and without Mubarak. A military officer replaced Morsi after his arrest. Reining in the military and shifting to a proportional representation system, while herculean tasks, would increase the legitimacy of the Egyptian government.

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Influence of Family Communication on the Mental Health of First-Generation College Students

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Influence of Family Communication on the Mental Health of First-Generation College Students

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Communication

Abstract

Colleges and universities have focused on increasing enrollment numbers and keeping students retained to reach their educational goals. Many institutions have examined ways in which they can increase student retention and identify students' academic concerns early in their educational journey. This analysis will look at first-generation undergraduate students (FGCS) who are believed to be more likely to struggle in college than traditional continuing college students. Our study will define first-generation students as those whose parents have not received a higher education degree but may have attended some classes. Quantitative and qualitative evidence was evaluated during the literature analysis. This exploratory research will attempt to draw conclusions on success factors and impediments for first-generation college students and will look at the social support of those students and whether or not an absence of support correlates with mental health concerns.

Keywords: first-generation college student, family communication, mental health

Introduction

Walking onto a college campus can be an intimidating experience for any freshman, regardless of age, background, or experience. The new sights and sounds of a college campus can throw even a prepared freshman into a tizzy of apprehension and anxiety, but what about those students who are less prepared? We are not talking about notebooks and pencils here, but rather the emotional preparation that comes from knowing what to expect. Most new college students have probably heard countless stories from their family members about their own college experiences that help to give the new college student some idea of what to expect. Perhaps, they have shared tips on how to cope with the stress and adjustment to the new workload.

These kinds of communication can help keep a new college student from feeling overwhelmed or can provide the emotional support needed to make their first semester successful. First-generation college students may not have that same communication support if their parents or other family members never attended college. The purpose of this study is to look at what kinds of family communication help support the mental health of college students and specifically if first-generation college students, whose parents have not received a higher education degree, are missing such supportive communication.

Literature Review

First-generation college students comprise an overwhelming number of first-year college students. Approximately, 33% of all first-year undergraduate college students identify as first in their families to seek a college education (Skomsvold, 2015). Additionally, this large population falls behind their continuing generation peers as it relates to degree persistence and attainment. Data from a 2018 United States Department of Education report analyzing college access, persistence and post bachelor outcomes of first-generation college students supports this claim as it relates to persistence tracking, a measure of student's progress towards a credential. The report showed that only 48 percent of first-generation student remained on the persistence track, compared to 67 percent of continuing generation students (U.S. Department of Education, 2018). While there are many factors that impede the success of these students, this study will exam the following: their status as a first-generation student, the type of communication they receive from their families as it relates to support and how these things impact the student's mental health.

Many first-generation college students express feeling less supported while attending college (Longwell-Grice & Longwell-Grice, 2008). When do these feelings start? Family members can be highly influential when it comes to making decisions in life, especially for those attending college because although people may forget even important messages shared with them throughout their lives, studies show that when people do remember messages, they become "a supportive and socializing force that influences the course of message recipient's lives" (Wang, 2014, p. 270).

First-Generation Status

According to Orbe and Groscurth (2004), first-generation college students have been applying and entering colleges and universities at steady rates since the 1920s and that many first-generation students often choose to even go to college later than non-first-generation college students (NFGCS) or choose a less selective college or university to attend because it's easier to get accepted. Then, once they start in school, they often face more

difficulties adjusting to college which can be "tied to lack of support at home, demanding work schedules, or other non-academic demands" (Orbe & Groscurth, 2004, p. 41-42).

These students are often not only at a disadvantage as it relates to having predecessor knowledge, but they are also statistically often disadvantaged socioeconomically as well. First-generation students often come from "lower socioeconomic status (SES) families or from racial and ethnic minority cultures (primarily Hispanic or African American), and may be subjected to stressors associated with those social positions" (Jenkins, Belanger, Connally, Boals, & Durón, 2013, p. 129). Stressors like living in unsafe neighborhoods, discrimination, and financial barriers, to name a few, are among the reasons why first-generation students have more difficulty adjusting to college life. Many students rely on their families for financial support. This looks differently in each situation, whether it be directly paying for tuition and fees or by allowing a student to not work so they can focus on their studies. Regardless of the structure, family fiscal support is critical to completion. In Johnson et al.'s (2009) study they found that students often bear the full responsibility of paying for school: "Nearly 6 in 10 students in our study who left higher education without graduating say that they had to pay for college costs themselves, rather than being able to count on help from their families. In contrast, more than 6 in 10 of those who completed their degrees say they had help from parents or other relatives to cover the costs of school" (p. 9).

The experience many first-generation students face is something scholars have compared to entering an "alien culture" because of the often peculiar way of seeing, hearing, and doing things in college and that first-generation students must also "negotiate issues of marginality – on both ends - as they work to bridge the worlds of their homes and college life" (Orbe & Groscurth, 2004, p. 42). Next, the importance of social support for first-generation college students will be examined.

Supportive Communication

Literature examined for this project displayed concern about the lack of social support from friends and family for these first-generation students. Feedback from family can be very influential when it comes to a life decision like attending college, especially if a student comes from a lower socioeconomic status household and/or if they are from a racial minority culture.

Then, after first-generation college students have embraced the "role of scholar, critic, or informed citizen," that they learn in college, researchers Orbe and Groscurth (2004) found that some students felt it created "a distance between themselves and others who viewed such 'intellectual activities' as a waste of time" (p. 45). They also found that many Latino and African American participants in their studies reported that "family and friends at home accused them of 'acting white.' While a few students of color challenged that stereotype, most ignored it and/or regarded it as exemplifying a strength associated with being college-educated" (Orbe and Groscurth, 2004, p. 45).

There is already evidence that a positive communicative environment is beneficial to a student's success. Wang (2014) found in his research that "…strong parent-student relationships can help first-generation college students overcome college and post college challenges," (p. 272) through the memorable messages the students remember from their parents. Many of these messages that the college students from his study mentioned made a memorable impact on them included , "Don't forget where you came from," (p. 276) "Whatever life throws at you, your family will always be there," (p. 278) or "You don't have to worry about us. We'll be fine" (p. 279). These kinds of communication messages help to calm the students' fears about life at home so they can focus on school or work. The following section will discuss mental health concerns that some students might face without appropriate social support.

Mental Health

The first-generation college student status and family environment has drawn multiple parallels in communication and education research. Many of the scholarly studies reviewed for this project identified common challenges for first-generation college students. Common obstacles for these students include: low income families, ethnic minorities, different native languages, and older age. This often results in them living off campus, taking fewer classes and working full-time jobs (Peabody, 2013). Further findings from his literature review concluded that students who spend time on campus and get involved with organizations are more likely to expand their social network by connecting with other students. When considering that many first-generation students are from low socioeconomic areas, Jenkins et al. (2013) found that these students reported significantly higher PTSD and depression symptoms compared to their counterparts. This is likely due to the fact that these environments increase the risk factor for exposure to traumatic events (Hatch & Dohrenwend, 2007) and often create covictims (Shakoor & Chalmers, 1991). Results from these studies suggest a higher need for mental health services in educational institutions for stress symptoms and academic related challenges to the psychological well-being of students.

When looking to support everyday supportive interactions within personal relationships, families represent one of the most important sources of informal support (Leach & Braithwaite, 1996). This informal support is critical for multiple reasons. The beginning of the traditional college experience often initiates a shift in the decision making process from parent to student. The re-

sponsibility of attending class, completing assignments, and making healthy relationship choices can be stressful and overwhelming for these young adults and requires a need for constant self-checking. When this process cannot be managed internally, it is common for family members to assist in the process. Families play a significant role in this process, often minimizing the need to involve more formal resources such as counseling, academic advising, and professional mentorship (Maguire, 1991). When the communication between student and parent reaches a point of disruption, this may likely affect the type of social support provided by the parents, whether it is offering advice or showing interest in their children's studies.

When this occurs to first-generation college students, the result has the potential to be dramatically worse. As many of these students are unaware of the formal social support services their campuses offer, including student counseling services, career coaching, course advising, campus involvement, etc., they are left feeling on their own. Left unaddressed, the issues hold the possibility to metastasize into larger problems.

Among several psychosocial variables considered for this study, self-esteem seemed to be the single most important predictor of FGCSs' psychological well-being. We found that higher self-esteem was associated with greater life satisfaction, lower levels of stress, and fewer psychological symptoms. Ethnic minority students tended to feel less satisfied with life, reported lower self-esteem and lower levels of academic self-efficacy, perceived less support from both family and friends, and experienced more stress than did their White counterparts (Wang & Castañeda-Sound, 2008).

Hypothesis

H1: First-generation college students are less likely to receive supportive communication about college or realistic expectations and/or suggestions for how to cope with college.

H2: First-generation college students have a higher rate of mental health issues, such as depression and anxiety, due to the lack of supportive communication.

Methods

Procedures and Participants

Upon obtaining approval from the Northern Kentucky University Institutional Review Board, a convenience sampling technique was used to recruit college students to complete a brief online survey. The authors solicited participants via their own social media networks and email contacts, who then voluntarily passed along the survey to other individuals.

Overall, 105 individuals (19 males, 86 females) agreed to participate in the study. Participants ranged in age from 18 to 39 years (M=22.57, SD=3.59). Participants identified as predominately Caucasian (n=89) and were predominantly of Senior Standing (n=40). After providing demographic information, participants were asked to identify their parent's level of college experience and answer three supportive communication questions. Following these questions, participants measured their mental health based on four dimensions of the CCAPS-34 (Counseling Center Assessment of Psychological Symptoms) scale for depression, general anxiety, social anxiety and academic distress to measure mental health. The reliabilities for each dimension were $\alpha = 0.83$, 0.86, 0.85, and 0.86, respectively.

Instrumentation

The Counseling Center Assessment of Psychological Symptoms (CCAPS) is a 34-item instrument with seven distinct subscales that are related to psychological symptoms and distress in college students, and incorporates the Distress Index. Of the 34 items, only five were selected that consistently appeared in the literature to be assessed in our survey. Responses were elicited on a 5-point Likert scale ranging from Not Like Me At All (1) to Extremely Like Me (5) (Locke, et al., 2012). In order to determine a correlation between the CCAPS items and family supportive communication, the survey began with three questions developed based on a provider-support model (Dennis, Phinney, & Chuateco, 2005).

Results

An independent sample t-test showed that FGCS received a lower level of supportive communication from their family ($M = 4.27$, $SD = 1.05$) compared to NFGCS ($M = 4.78$, $SD = 0.39$). This difference was statistically significant, $t(103) = 3.64$, $p < 0.001$.

This result supports our first hypothesis in that FGCS are less likely to receive supportive communication about college or realistic expectations and/or suggestions for how to cope with college due to a lack of communicative support from their parents. Additional research is needed to determine the causes of this lack of support. The sample t-test also showed that FGCS did not report significantly higher levels of mental health issues compared to NFGCS.

Based on this result, our second hypothesis was not supported by the data in that FGCS do not have a higher rate of mental health issues caused by the lack of communicative support.

Discussion

There are many key implications that are suggested as a result of this research. Colleges and universities must focus on keeping the retention of students by offering wraparound services, in which college personnel pro-

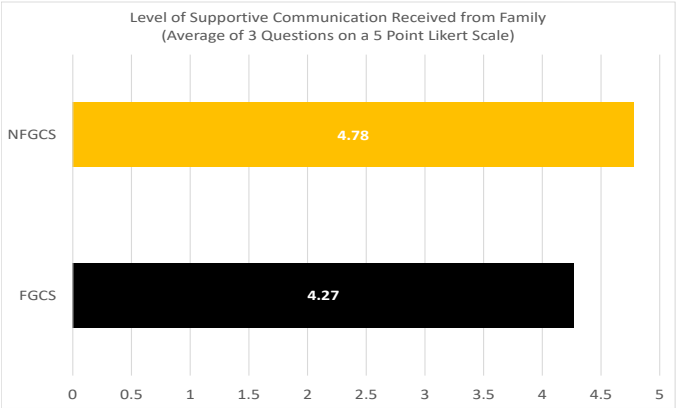

Figure 1. Level of supportive commnication received from family, by type of student.

vide a support system to aid in various areas of students' lives and meet their needs to help them become successful. Examples include informing students of resources and services available to them including counseling and coaching, as well as establishing outreach programs and encouraging the building of mentorships.

As discussed earlier, research shows that FGCS are more likely to be successful if they have support from family, and it should not be assumed that family members are equipped to offer the support that students need. "In order to help these students be successful, institutions, beyond simply providing scholarship, should provide programing and opportunities that help to integrate these students into campus life" (Peabody, 2013, p. 9). Living-learning communities, freshman seminars, student organizations and other targeted initiatives must be integrated into the campus culture to ensure that students are aware of the resources that exist. Further, it is important to consider that first-generation students are less likely to be involved on campus. This stigma must be addressed through the intentional removal of barriers to accessing the resources. Considerations might include online resources such as websites, chat room services, etc.

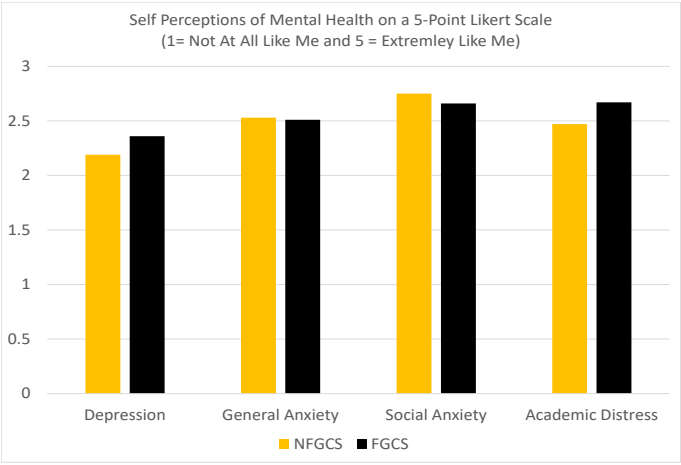

Figure 2. Mental health self perceptions.

Colleges may also explore ways to provide academic credit for student contributions in campus organizations and activities (Wang, 2008). These are additional ways to help students build necessary communication skills while strengthening their networks to increase their level of support in college.

Ramos-Sanchez and Nichols (2007) suggested ways in which college counselors could benefit students by connecting with them early on in their college careers by providing wraparound services and direct outreach. Faculty are also encouraged to partner with counselors on interventions and workshops with the intention of remediating students. Peer mentorships, as well as faculty-student mentorships, are also highly recommended for student success. Many colleges and universities have examined ways in which to increase enrollment numbers and keep students retained by directly targeting first-generation students using intervention methods. It seems there is a high demand for college counselors to identify more efficient ways to screen first-generation students for stress, depression, and life satisfaction.

Limitations

There were a few limitations that would need to be addressed if this study was to be duplicated. The first limitation is the small number of participants. Due to the strict time schedule for this research project, the survey was available online for a week which limited how many participants were able to be reached and who were able to participate in the survey. We would expect that a larger sample size, as well as a more diverse population, could yield alternative results that may show a significance in the mental health of FGCS. Furthermore, many participants are Caucasian, so it is important to capture data from minority groups as it may yield different results. In relation to college standing, a majority of respondents are seniors and had time to adjust to the college culture, so it may be ideal to limit the study to incoming freshman.

The other limitation is the stigma of mental health and how some participants may not have been honest when it came to self-disclosing experiences with mental health. While it may be too difficult to alter a stigma, there are things that can be changed about how the participants answered our questions. Due to the nature of the survey where participants are self-reporting, it is reasonable that some participants would not have felt comfortable admitting to having feelings of inadequacies or even have recognized that feelings of sadness or stress could be symptoms of mental illness. Finding other ways for participants to answer questions in a way that is not confrontational would be important in order to get honest answers. One suggestion would be to have personal interviews or focus groups with participants which may overcome the issues with a self-reporting survey. A benefit to having a focus group where other

people can share their personal experiences may be that participants may feel more comfortable sharing experiences if they see that others have had similar experiences. Also, hearing other participants' experiences may help those who do not recognize their own symptoms or who feel ashamed. Addressing these issues could yield alternative results that may show a significance in the mental health of FGCS.

Conclusion

First-generation undergraduate students face greater challenges than do undergraduate students from college-educated families (Martinez, Sher, Krull, & Wood, 2009; Pascarella, Pierson, Wolniak, & Terenzini, 2004). This study investigated the extent to which supportive communication impacts first-generation college students' experiences with mental health disruptions. It found that while first-generation college students do receive less supportive communication from their families about their collegiate experiences, that deficiency does not impact their experiences with mental health disruptions. The findings from this study do however provide support for the necessity to continue targeted programming towards first-generation college students and encourage college administrators and personnel to look towards the family relationship as an avenue of support for this at-risk population. Colleges should strongly consider enhancing their outreach programs to not only aid students in their successes but also to better equip families with the tools they need to be supportive of their college bound children.

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Appendix I: Survey Questionnaire

Demographic Questions

1. What is your sex? Male/Female
2. What is your age?
3. Did you attend college?
4. What is your class standing? Freshmen / Sophomore / Junior / Senior / Graduate Student

Questions Identify First Generation College Student (FGCS) Status.

1. Did your mother attend college? No / Yes, some college / Yes, completed degree
2. Did your father attend college? No / Yes, some college / Yes, completed degree

Questions that Address Supportive Communication

(Likert Scale of Agreement 1= Strongly Disagree, 5= Strongly Agree).

1. My family is supportive of me getting a college degree.
2. My family encourages me to earn a college degree.
3. My family would be willing to assist me with a college-related problem.

Four Dimensions from CCAPS 34 Scale

Assessed on a 5-Point Likert Scale (1= Not Like Me At All and 5=Extremely Like Me)

<u>Depression</u>

1. I don't enjoy being around people as much as I used to
2. I feel isolated and alone
3. I feel worthless
4. I feel helpless
5. I feel sad all the time.
6. I have thoughts of ending my life

<u>General Anxiety</u>

1. My heart races for no reason
2. I have sleep difficulties
3. My thoughts are racing
4. I have spells of terror or panic
5. I feel tense

<u>Academic Distress</u>

1. I feel confident I can succeed academically
2. I am not able to concentrate as well as usual.
3. It's hard to stay motivated for my classes.

Prevalence of Self-Objectification Among Northern Kentucky Students

Nichole Spjut, MSW, earned her undergraduate in psychology and graduated with her Master of Social Work from Northern Kentucky University in May 2018. She is a practicing therapist, supporting local adult populations. Her primary research has focused on self-objectification among both men and women, specifically self-awareness and contributors to the problem.

Prevalence of Self-Objectification Among Northern Kentucky Students

Nichole Spjut. Faculty mentor: Jessica Taylor
Social Work

Abstract

Past research indicates self-objectification – viewing oneself as an object or collection of body parts – can lead to depression, body-shaming, and eating disorders. This study identifies the prevalence of self-objectification among Northern Kentucky University (NKU) students and student awareness of engaging in self-objectifying behaviors. One hundred twenty surveys were administered to NKU students on campus. Students answered questions designed to measure awareness of self-objectification and actual engagement in self-objectifying behaviors. Prevalence of self-objectification among students was found to be high, while awareness was found to be low. Female students had significantly higher rates of self-objectification (96.6%) compared with male students (77.8%). Female students were also more likely to engage in body or body-part comparison (86.2%) compared to male students (59.3%). Understanding the prevalence of self-objectification can offer insight into reasons behind record-high rates of depression among college students and can lead to more effective treatment interventions. Findings can also help to inform future research and policy.

Keywords: self-objectification, mental health, body-image

Introduction

Self-objectification among college students is an important topic to study given that 34.4% of college women rated personal appearance as "traumatic or very difficult to handle" within the last 12 months (National College Health Assessment, 2016). First-year college students' self-ratings of emotional health dropped to record-low levels in 2010 with female students far less likely to report high levels of emotional health than male students (Pryor, 2010). Depression levels are at an all-time high among college students (Novotney, 2014; Young, 2016).

This study explores the prevalence of self-objectification among NKU students. One hundred twenty surveys were administered to NKU students on campus during the spring semester of 2018. The prevalence of self-objectification among students was found to be high (92.4%). Understanding the prevalence of self-objectification can offer insight into reasons behind record-high rates of depression and anxiety among college students and can lead to better treatments. Recommendations based on the findings of this research include making education about self-objectification a standard part of therapy, making changes in public policy to address how media promotes self-objectifying thoughts and behaviors, and further research to understand how self-objectification affects different genders, races, and ages.

Female self-objectification, when "women view themselves through the perspective of an observer and engage in chronic self-surveillance" (Calogero, 2013 p. 312), is a growing concern as women's exposure to sexualized images through media increases. Additionally, women experience objectifying events in daily life – catcalling, comments about their body (both complimentary and derogatory), overt or covert messages that their worth is directly related to their appearance – which all contribute to a tendency to self-objectify or view their body as a collection of body parts (Kroon and Perez, 2012). Self-objectification leads to diminished well-being in relation to self-esteem and life satisfaction (Mercurio and Landry, 2008).

Chronic self-surveillance can lead to psychological consequences and mental health risks including depression, body-shaming, and eating disorders (Fredrickson and Roberts, 1997). Another negative consequence of self-objectification is referred to as "opting out." Calogero, Tantleff-Dunn, and Thompson (2011) found that 67% of women aged 15 to 64 years withdraw from life-engaging and life-sustaining activities because they feel bad about their appearance (McKay, 2013).

Literature Review

Contributing Factors to Self-Objectification

Current research indicates that media plays a large role in self-objectification. Sexually objectifying media in particular can lead to women internalizing beauty ideals. The internalization of these beauty ideals has been shown to have an indirect relationship to self-objectification and body surveillance (Vandenbosch and Eggermont, 2012).

Harper and Tiggeman (2008) found that exposure to media featuring a thin, idealized woman led to greater states of self-objectification, showing that self-objectification can occur even when women are not focused on their own body. Aubrey (2006) found that frequent media exposure (television programs, talk shows, music videos, and advertising) increased the frequency of viewing the body based on appearance rather than ability, and that frequency, rather than length of exposure, was more damaging. Social media, in addition to more

traditional media sources, presents a lens through which to view and understand self-objectification. Fardouly, Vartanian, Diedrichs, and Halliwell (2015) found that while magazines are significantly related to self-objectification, they are not viewed nearly as frequently as Facebook.

Adverse Consequences of Self-Objectification

Through exposure to traditional forms of media–and newer, emerging social media–women are led to self-objectify and compare themselves to idealized forms of beauty. These comparisons and self-objectifying behaviors are associated with negative outcomes and adverse consequences. Disordered eating has a close connection with self-objectification (Muehlenkamp and Saris-Baglama, 2002; Prichard and Tiggemann, 2005; Tiggemann and Kuring, 2004). Anorexia nervosa and bulimia have the highest mortality of any mental illness (Arcelus, Mitchell, Wales, and Nielsen, 2011). This makes disordered eating a particularly devastating consequence of self-objectification. Depression is another consequence of self-objectification and has driven research aimed at understanding why women experience depression rates higher than men (Muehlenkamp and Saris-Baglama, 2002). Several studies have found that self-objectification and depression are positively related (Miner-Rubino, Twenge, an Fredrickson, 2002; Muehlenkamp and Saris-Baglama, 2002; Tiggemann and Williams, 2012).

Further research to understand rates of self-objectification among college students specifically is warranted given the high rates of depression (36.7%), anxiety (58.4%), and eating disorders (2.4% professionally diagnosed and treated) among this population (American College Health Association [ACHA], 2016). Additionally, self-objectification can have negative impacts on mental performance including a decline in cognitive performance (Quinn, Kallen, Twenge, and Fredrickson, 2006) which is particularly relevant to college students.

Methods

Survey development

Survey questions were developed using definitions for self-objectification and identifying self-objectifying behaviors according to the existing literature. The definition for self-objectification (when an individual views themselves as an object or a collection of body parts) used in the survey came from Kroon and Perez (2013). The survey questions specific to engagement in self-objectifying behavior were created using research by Kroon and Perez, Calogero, Tantleff-Dunn, and Thompson (2011), and Harper and Tiggeman (2008).

The survey consisted of 38 quantitative questions and included a range of topics aimed at assessing students' experience of campus climate. Specifically their perception of racial diversity, access to mental health services on campus, and their experience of body image issues. Six of the 38 questions dealt specifically with self-objectification.

Demographic questions in the survey were created based on gaps in existing self-objectification research, specifically gender identity and race. The participants first read an introduction to the topic of self-objectification so they had a working definition when answering survey questions. The survey is included as Appendix A.

Target Population

The participant pool was NKU students. According to NKU's Office of Institutional Research (2016), undergraduate students are 57% female, 43% male, 83% white, 7% black, 3% Hispanic/Latino, and 1% Asian. Approximately 70% of undergraduates are between the ages of 18-24 years old. Graduate students at NKU are 65% female, 35% male, 81% white, 8% black, 3% Hispanic/Latino, and 1% Asian. Approximately 58% of graduate students are between the ages of 22-34 years old, 33% are ages 35-49, and 10% are age 50 or older.

Survey Administration

Surveys were approved by the Institutional Review Board and administered using two different methods. One method involved researchers handing out surveys in the Student Union during lunch hours. The other method involved partnering with NKU faculty and administering the survey at the beginning of class while the faculty member was out of the classroom. Faculty partnering included both graduate and undergraduate classes in psychology and social work. In-person administration of the survey was chosen over email administration to create a better response rate. One hundred twenty surveys were collected. Descriptive, cross-sectional analysis was conducted on survey responses to determine prevalence of self-objectification among respondents.

Results

Of the surveys collected, 119 were valid and utilized for data analysis and interpretation. All participants were NKU students aged 18 and older. The majority of participants (73.0%) identified as female, while 23.5% identified as male, and 3.3% identified as transgender, gender variant/non-conforming, or chose to self-identify otherwise. Approximately 78% of participants identified as white, 20% identified as black, and 5% identified as Asian, Pacific or other islander, or American or Alaskan Native. The majority of the participants were undergraduate students (86%), and the remaining 14% of the participants were graduate students.

The measured variables included student awareness of objectifying themselves and student rates of self-ob-

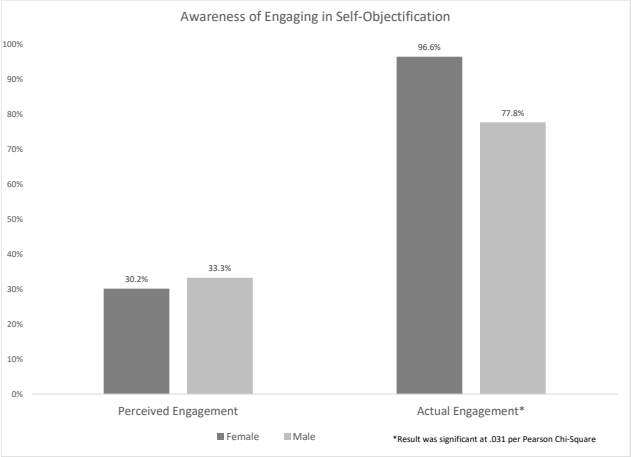

Figure 1. Awareness of engaging in self-objectification.

jectifying behaviors. When provided with a definition of self-objectification, 30.2% of female participants and 33.3% of male participants identified as objectifying themselves. A total of 96.6% of female participants and 77.8% of male participants reported engaging in at least one of five possible self-objectification behaviors being measured. In addition, there was a significant relationship between gender and self-objectification. Being female was correlated with higher rates of self-objectification. This result was significant with a p-value of 0.031 per Pearson's chi-square (Figure 1). Being female was correlated with a higher rate of body- or body-part comparison with a p-value of 0.002, making this statistically significant per Pearson's chi-square (Figure 2).

Discussion

Awareness of engaging in self-objectification was low, with only one-third of students self-identifying as engaging in self-objectifying behaviors. Actual engagement in self-objectifying behavior was quite high, with 92.4% of students reporting engagement in one or more self-objectifying behaviors. Self-objectification rates were higher among females (96.6%) than males (77.8%).

Practice. Implications for social work practice and clinical practitioners include an awareness and understanding of self-objectification and its negative consequences. Educating clients about self-objectification – and helping them identify the degree to which they may be engaging in self-objectification and the negative impacts it may be having in their lives – should be a standard part of all clinical treatment. Because self-objectification appears to be almost universal among female participants, it may be beneficial to explore self-objectification with all female clients presenting with known consequences of self-objectification such as depression, anxiety, and eating disorders. Rates among male participants, though not as high as females, are still an overwhelming majority; thus education among males is also critical. While there are currently no specific recommendations, treat-

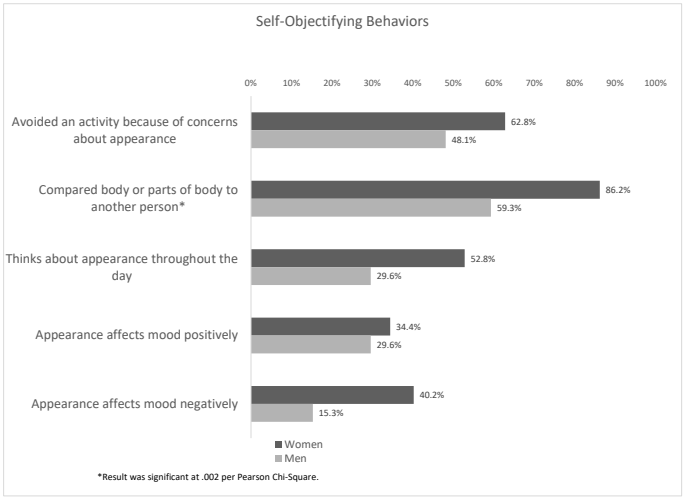

Figure 2. Self-objectifying behaviors.

ments, or education efforts for self-objectification from the National Association of Social Workers, it is aware of and engaged in the treatment of eating disorders and body image issues (NASW, 2001). These current guidelines and educational efforts could be building blocks for development of a specific self-objectification education and treatment initiative.

Policy. Given the negative consequences of self-objectification, efforts should be made at a public policy level to educate, prevent, and mitigate self-objectification. This could include media literacy classes to educate youth about self-objectification and body image – what is real versus what is Photoshopped and how to recognize objectification. This is especially pertinent with the rise of social media as a marketing tool. Recognizing subversive advertisements and objectification disguised as empowerment becomes increasingly challenging with the proliferation of social media influencers. Other policies could include limiting commercials aimed at women's appearance, requiring advertisers to disclose when they have used Photoshop, and setting limits on objectification in the media. Additionally, disallowing advertising of beauty products and weight loss products to anyone under 18 years old, such as in magazines and TV shows specifically targeted to adolescents, should be considered.

England and France both have laws aimed at decreasing the impact media and advertisers have on body image (Navamanikkam, 2017). England has banned misleading advertisements that use digitally altered images to exaggerate the effects of products (BBC News, 2001). France passed a law requiring published images to have a bold printed notice disclosing any digital enhancements (Lubitz, 2016). Israel passed legislation banning underweight models in the fashion and adver-

tising industry, and laws regulating the use of photoshop in media and advertising (Minsberg, 2012). These examples can be useful in guiding efforts to encourage passage of similar laws by the Federal Trade Commission in the United States.

Research. Future research on this topic should include identifying: the age of onset of self-objectifying thoughts and behaviors; when children first start seeing themselves from an outsider's perspective; what the best ways to prevent self-objectification and mitigate its negative consequences Are; how it affects different races and cultures; if the consequences of self-objectification different for males; why the rates of self-objectification are higher for females and what societal factors may be influencing those rates; and how rates of self-objectification change in an individual over time. A study aimed at educating people about self-objectification and teaching skills to help prevent and mitigate negative consequences would be beneficial. Skills would include: media literacy (Hirschman, Impett, and Schooler, 2006), self-compassion, and mindfulness (Cox, Ullrich-French, Cole, and D'Hondt-Taylor, 2016).

In addition, encouraging activities that mitigate self-objectification such as: appreciation of body functionality (Rubin and Steinberg, 2010), athletic and sports participation (Daniels and Leaper 2006), and contextualizing self-objectification (and exposing its ill effects) as the result of a maladaptive society versus a personal inadequacy (Tylka and Augustus-Horvath 2011). Future research should also aim to understand how well these interventions prevent and mitigate the negative consequences of self-objectification. Following participants over time would allow comparing their outcomes to the general population and finding what interventions are most effective, and then focusing efforts on those interventions.

Limitations

Limitations of this study include a small sample size of males (n = 28) compared to females (n = 90), and there were not enough transgender or gender-variant individuals to gather enough data to understand rates of self-objectification among that population. Lack of racial diversity was also a limitation. The participant pool was made up of mostly psychology and social work students and the age range was limited, with most participants being between the ages of 19 and 21. Additionally, data was gathered from psychology and social work classes, so there is a potential lack of diversity in academic background.

Conclusion

Self-objectification is a little-known, yet widely prevalent and harmful pattern of thought. Due to the negative consequences of self-objectification, it is essential to understand its impact and bring awareness to it. Depression, body shame, disordered eating, and declines in cognitive performance are all harmful consequences that can result from self-objectification. As the research in this study has demonstrated, engagement in self-objectification is high while awareness is low. This is alarming because while a majority of NKU students are at risk for, or engaging in, self-objectification, very few of them are aware they are self-objectifying, nor are they aware of its potential negative consequences. Additionally, females are at higher risk than males. Clearly there is a need for education surrounding self-objectification and efforts to control societal influences that may increase self-objectifying thoughts and behaviors.

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Appendix A.

Campus Climate Research Survey

1.) What is your age? _____

2.) What is your current NKU status?
___Undergraduate, full-time
___Undergraduate, part-time
___Graduate, full-time
___Graduate, part-time
___Non-degree seeking student
___ Faculty or staff member

3.) What is your current living situation?
___On campus alone
___On campus with roommates
___Off campus alone
___Off campus with roommates
___Other (please specify) _____

4.) With which gender do you most identify?
___Female
___Male
___Transgender Female
___Transgender Male
___Gender Variant/Non-Conforming
___Not listed _____
___Prefer not to answer

5.) What is your sexual orientation?
___Straight/Heterosexual
___Gay
___Lesbian
___Bisexual
___Prefer to self-describe _____
___Prefer not to answer

6.) How would you describe yourself?
___American Indian or Alaskan Native
___Asian
___Black or African American
___Native Hawaiian or Other Pacific Islander
___White

7.) Check your marital status (select multiple if applicable):
___ Single (never married)
___ Married, or in a domestic partnership
___ Widowed
___ Divorced
___ Separate

8.) Household income (Please check one):
___Less than $25,000
___$25,000 to $34,999
___$35,000 to $49,999
___$50,000 to $74,999
___$75,000 to $99,999
___$100,000 to $149,999
___$150,000 or more
___Prefer not to answer

*For the purpose of the survey, a **crisis** is defined as a moment of extreme emotional pain that gets in the way of living your everyday life (*Crisis Textline, 2016).

9.) Please place an "X" in the appropriate box for each individual question:

	Yes	No
NKU's Health, Counseling, and Student Wellness Center offers a variety of mental health services, including individual and group counseling, psychological testing, crisis intervention, and substance abuse counseling. Prior to this survey, were you aware of the counseling center on NKU's campus?		
If mental health services were available on campus, would you utilize them in a crisis event?		
Traditional counseling hours include Monday through Friday, 8:30am - 4:30pm. Do you feel there is a need for 24 hour mental health resources outside of traditional counseling hours?		

10.) How accessible do you feel NKU student mental health services are to the student population? Please rate between 1-10, with 1 being the least accessible and 10 most accessible.

Least Accessible Accessible Most Accessible

1	2	3	4	5	6	7	8	9	10
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

11.) Please check (1) answer below to express your overall agreeance with the following statement:
NKU's campus offers students adequate resources for mental health and crisis services.
___Strongly Agree
___Agree
___Undecided
___Disagree
___Strongly Disagree

12.) If you chose to seek crisis or counseling services while on NKU's campus, which of the following providers would you prefer? (Please check all that apply.)

___Graduate practicum/intern student
___Licensed professional
___Peer support group

13.) What services you would consider using during a crisis event? (Please check all that apply.)

___Group Therapy
___Individual Counseling
___Crisis Intervention/Hotlines
___Psychological testing
___Substance Abuse testing

14.) Of all the mental health crisis interventions available, which do you feel would be most effective? Please rate on a scale of 1-5, with 1 the least effective and 5 the most effective.

Group Therapy	1	2	3	4	5
Individual Counseling	1	2	3	4	5
Crisis Intervention/Hotline	1	2	3	4	5
Psychological testing	1	2	3	4	5
Substance Abuse testing	1	2	3	4	5

15.) If you were seeking mental health services outside of traditional hours, how would you prefer to receive those services? (Please check all that apply.)

___Text message
___In-person (off campus)
___In-person (on campus)
___Telephone
___Other (specify)_____

16.) What are some of the reasons that students might not seek services on campus? (Please check all that apply.)

___Services not needed
___Cost
___Fear of stigma
___Lack of information
___Concerns of confidentiality
___Other (specify)_____

17.) What would be the most effective way of informing students about the services available to them on campus for mental health? (Please check all that apply.)

___Include information on the NKU website
___Flyers displayed in classrooms and throughout campus.
___Include a presentation during new student orientation.
___Other (please specify)_____

18.) Please place an "X" in the appropriate box for each individual question:

	Yes	No
Self-objectification is defined as when "an individual views themselves as an object or a collection of body parts." (Kroon & Perez, 2013, p. 16). Have you ever viewed yourself as an object or collection of body parts?		
Have you ever avoided an activity (going out with friends, swimming, physical activities, etc.) because you were concerned about your appearance?		
Have you compared your body, or parts of your body, to another person in the last 30 days?		

19.) Please place an "X" in the appropriate box for each individual question:

	Never	Rarely	Sometimes	Often	Always
How often do you think about your appearance throughout the day?					
How often does your appearance affect your mood positively?					
How often does your appearance affect your mood negatively?					
Does media (advertisements, television, social media, celebrities) affect how often you think about body image?					
Do media images cause you to have negative thoughts about your body image?					
How often do you feel images in the media portray realistic body images?					
Do you think that models seen in the media have an "ideal" body?					
Does media affect how you feel about your own body image and self-worth?					

Please mark your answers with an "X":

20.) I would support NKU flying the confederate flag on campus.
___Strongly Disagree
___Disagree
___Neutral
___Agree
___Strongly Agree

21.) How often do you hear inappropriate or offensive comments on campus about race/ethnicity?
___Frequently
___Occasionally
___Rarely
___Never

22.) Thinking about how students of different races interact and treat one another, how would you rate the overall racial climate on NKU's campus?
___Excellent
___Good
___Fair
___Poor

23.) How racially and ethnically diverse do you consider NKU to be?
___Highly Diverse
___Somewhat Diverse
___Not Very Diverse
___Not Diverse At All

24.) Do you think colleges should be able to establish policies that restrict each of the following types of speech or expression on campus? Please place an "X" in the appropriate box for each individual question:

	Yes	No
Expressing political views that are upsetting or offensive to certain groups.		
Using slurs and other language on campus that is intentionally offensive to certain groups.		
Wearing costumes that stereotype certain racial or ethnic groups.		

25.) In response to white supremacist speakers at public universities, I believe it is acceptable to: (Please check all that apply.)
___ Allow the speaker to perform completely undisturbed. They, too, are protected by the first-amendment.
___ Petition the university/student group to cancel the speaker
___ Silent protest (such as holding a poster during the speech)
___ Verbally interrupt the speaker during the event (such as booing or using noisemakers)
___ Blocking the venue entrance
___ Smash windows
___Purposely injure the police
___Purposely injure supporters
___Set small fires
___Other (please specify) _____

Dye Trace Study of Karst Groundwater Flow at Mystery Spring and Wildcat Culvert in Lexington, Fayette County, Kentucky

Daniel P. Martin will graduate in December 2018 with a B.S. in Geology and an Honors minor. In addition to contributing to this article, he has also presented the same research at the Kentucky Academy of Science and conducted other research with several professors in the Geology Department and College of Honors. Daniel currently works as a conservation educator at the Newport Aquarium and hopes to further his education in the field of conservation research and environmental advocacy.

Constance M. Brown is a sophomore geology major at Northern Kentucky University where she is co-president of Kiksuya/First Nations Student Organization, an officer of the Physics & Astronomy Club, and NKU's delegate for the Kentucky Student Environmental Coalition. She has also done undergraduate research with Sarah Johnson, using LiDAR data to identify and map landslides in the Northern Kentucky region. She has presented research at the Kentucky Academy of Science and the Geological Society of America. Constance is currently working on a 'Take Back the Tap' initiative on NKU's campus, as part of her student fellowship with environmental justice non-profit Food & Water Watch, to improve public water infrastructure at her school and end the sale of bottled water.

Ben Currens holds a Bachelor of Science degree from Cornell University in Geological Sciences and Development Sociology. He recently earned a Master of Science degree in Hydrogeology for his thesis modeling stable isotope diffusion in porous media aquifers. Currently a Ph.D. candidate at the University of Kentucky, his research is focused on the use of emerging contaminants as indicators of sanitary sewage contamination in karst aquifers.

Dye Trace Study of Karst Groundwater Flow at Mystery Spring and Wildcat Culvert in Lexington, Fayette County, Kentucky

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Geology
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Abstract

The main purpose of this study was to test connectivity from a sinkhole by William T. Young Library on the University of Kentucky's campus to Mystery Spring (1.5 miles away) near RJ Corman Railroad in Town Branch, and measure groundwater velocity thereto. A secondary aspect of the study was to measure travel time from a storm drain at the bottom of the aforementioned campus sinkhole to "Wildcat Culvert" which discharges into Town Branch (100 meters downstream of Mystery Spring), and to observe if the two were connected.

A map of the groundwater flow patterns in the area was published in 1996 based on mostly unpublished dye trace research. The last known work on Mystery Spring was conducted in 1989 by James Currens at Kentucky Geological Survey. In 1994, the William T. Young Library was built near the subject sinkhole that involved the construction of over 200 concrete and steel pylons, potentially disrupting the previous groundwater flow. In order to determine whether the construction affected karst conduits in the area, we conducted a second dye trace study in July of 2018 recreating, in many ways, the unpublished study from 1989.

90 grams of dye was injected into the two locations noted near the library (the sinkhole and a storm drain at the bottom of the razed sinkhole) and charcoal receptors, as well as an infrared probe, were placed at the predicted outflow points. Probe results at Mystery Spring were inconclusive but dye appeared in the charcoal receptors within 14 hours after injection at concentrations of 2.1 ppb. Eosine dye began appearing in visible quantities within 2 hours of the injection (6:00 p.m. on July 6th) at the outflow, "Wildcat Culvert," which is connected to the storm drain. No connection was observed between the sinkhole and the storm drain.

Keywords: dye trace, karst, groundwater flow dynamics

Introduction

In areas underlain by carbonates, dissolution of carbonate rocks may occur, resulting in groundwater flow dynamics that may be quite different than flow dynamics associated with granular flow. Granular flow patterns are typical of many non-carbonate areas and are characterized by subsurface flow through homogeneous grains and pore spaces, meaning flow spreads through the subsurface at a relatively even rate in all directions (isotropic). In carbonate areas, sinkholes, conduits, sinking streams, and other karst features direct groundwater flow anisotropically, which means the flow pattern is distributed unevenly. This type of flow is largely defined by dissolved void spaces and fractures. According to Kentucky Geological Survey, 38% of Kentucky has karst at or near the surface, including much of the city of Lexington (Geology of Kentucky).

In karst systems, the groundwater flow pattern makes the tracking and cleanup of chemical spills and other pollutants difficult. Dye trace studies, in which a quantity of visually- and chemically-distinct dye is added to a water system and chemical receptors are planted in bodies of water nearby to detect the presence of dye as it moves through the groundwater system, are beneficial in efforts to map the groundwater flow in karst areas.

In 1989, an unpublished study was conducted at a sinkhole (by what would later become the building site of William T. Young Library on the University of Kentucky campus in Lexington, Kentucky) by injecting dye into the sinkhole and placing chemical receptors at nearby bodies of water, establishing a subsurface groundwater flow pattern for the area (Currens et al., 1996). Upon completion of this survey, a karst dye trace map of the region was drafted using the data. The construction of the William T. Young Library in 1994 resulted in over 200 steel and concrete pylons being sunk into the ground to ensure the stability of the library's foundation (Jester et al., 1998). While these pylons were emplaced to prevent damage to the building's foundations from karst features, the construction had the potential to disrupt the previous groundwater flow, potentially rendering invalid the 1989 dye trace study. In theory, groundwater could have been directed to another basin, surface outlet, or a storm drain at the bottom of the razed sinkhole. The purpose of this study was (1) to examine whether the construction of the library had altered the groundwater flow of the region by disturbing the conduits generated by the karst features in the area, (2) test the time of travel of travel between the sinkhole and springs, as well as a sinkhole storm drain and Wildcat Culvert, and (3) test connectivity between the sinkhole and storm drain. In order to study the groundwater flow of the area, a dye trace was performed following parameters similar to those used in the 1989 study. Knowledge of these flow

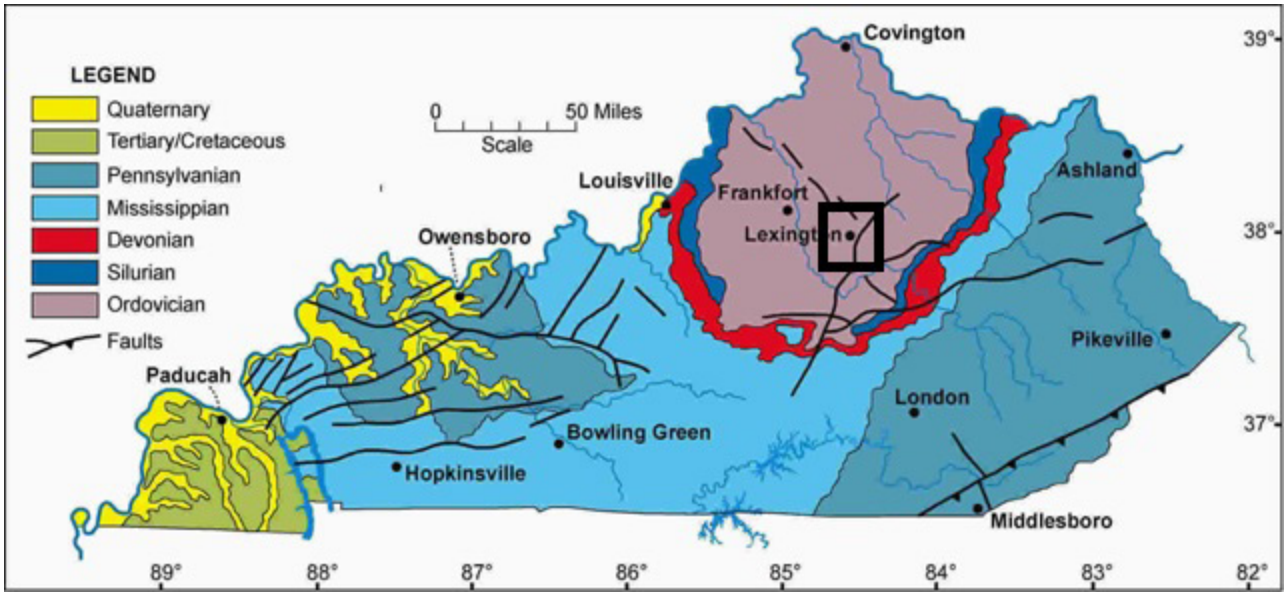

Figure 1. A geologic map of the state of Kentucky (Geology of Kentucky). The study area is outlined in black.

patterns are important for potential remediation in the event of a contamination spill.

Geologic Background

Lexington is located in the central Kentucky region (Figure 1). The location near the William T. Young Library on the University of Kentucky's campus in Lexington, Kentucky is shown in Figure 2. Dye receptors were deployed along Mystery Spring on the west side of Lexington (Figure 3) and a nearby basin, McConnell Spring, to test for interbasin spillover. The primary rock units present in this area of Kentucky are Ordovician in age and are structurally defined on a large scale by the Cincinnati Arch, an anticlinal structure created by the orogeny of the Appalachian Mountains, to the east. The creation of the arch uplifted older Ordovician rock units where they were exposed by erosion (McDowell 2001).

Lexington lies on the axis of the Cincinnati Arch. The rock units in the Lexington area were deposited during the upper part of the Middle Ordovician, the most prominent being the Lexington Limestone. Around 320 feet at its thickest section, the Lexington Limestone is primarily composed of fossiliferous limestone layers high in phosphates, with shale members also present. The formation was deposited in a shallow marine environment. It is divided into 12 distinct members: the Curdsville Limestone, Logana, Grier Limestone, Brannon, Perryville Limestone, Tanglewood Limestone, Millersburg, Greendale Lentil, Stamping Ground, Devils Hollow, and Strodes Creek Members, as seen in Figure 4.

At the dye injection site, the Tanglewood and Brannon Members are the primary surface units. The Tanglewood is a fossiliferous calcarenite that is well sorted and cross bedded with rounded phosphate grains. The Brannon consists of interbedded calcarenite and shale with few fossils and some fragments of chert. In some areas, ball and pillow structures are present on the upper beds of the unit (Cressman 2001). The layer between the Brannon and Tanglewood, the Perryville, is not present at the dye injection site. Along Town Branch at the dye receptor sites, the Brannon and Grier members of the Lexington Limestone are exposed. All of the receptor sites were located on Grier rock units (Kentucky). The Grier member is primarily a fossiliferous calcarenite with evidence of bioturbation and some shale beds (Cressman, 1973). The bedrock in the area dips at a range of 3 degrees to 5 degrees, and local tectonic activity from the nearby Kentucky River and Lexington Fault systems have created further conduits for groundwater flow in the region. Past dye trace studies in the region have determined groundwater flow velocities of 1.2 miles in 6-9 hours from a sinkhole at Campbell

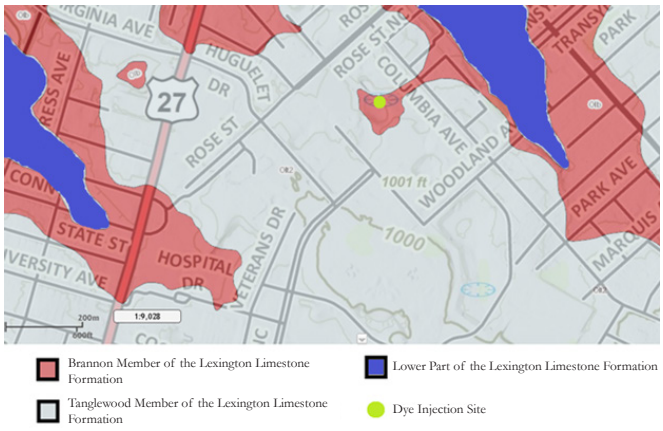

Figure 2. A geologic map of the formations at the dye injection sites near the William T. Young Library on the University of Kentucky campus. The injection side is marked in green. The blue circles on the map denote sinkholes (Kentucky Geologic Map Information Service).

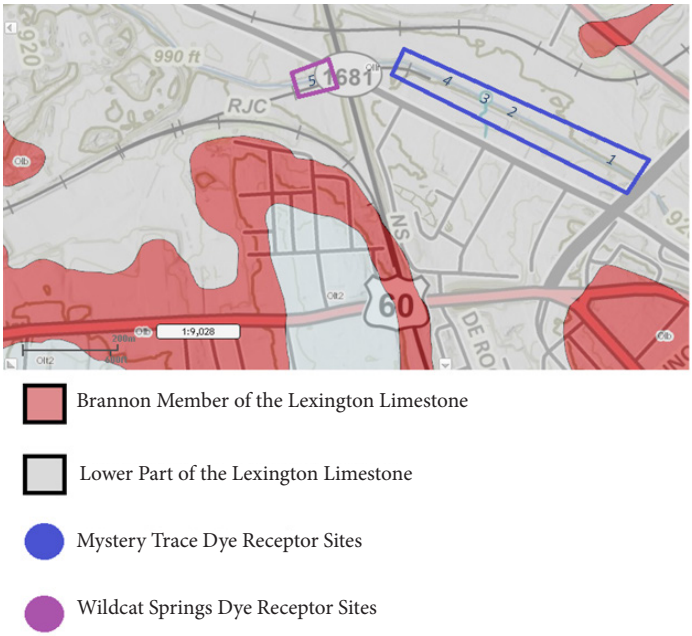

Figure 3. A geologic map of the dye receptor sites along Town Branch, where Mystery Spring and Wildcate Culvert are located. The monitoring locations along the stream are outlined in blue, going from #1 on the right to #5 on the left. Mystery Spring is indicated by the blue line and circle at monitoring point #3, and Wildcat Culvert is #5.

House and McConnell Springs or around 0.16 miles per hour, and 2 miles in 9-11 hours from Campbell House sinkhole to Preston's Cave Spring or around 0.2 miles per hour. The conduit between McConnell Springs and the Campbell House sinkhole exhibited a dye travel time of approximately 0.133 mph (Norris et al., 2016), much faster than the flow rate of non-karst aquifers in Eastern Kentucky which range from 10 feet per day to 0.0001 feet per day (Garrison, 2015).

Methods

Background data were collected from May 24th, 2018 through July 7th, 2018 at Mystery Spring, McConnell Springs, and Town Branch to ensure there was no contamination present in the water system. A dye trace notification was submitted to the State of Kentucky on the 29th of May, 2018.

Charcoal dye receptors and a Cyclops 7 infrared probe were installed in Town Branch. The receptors were installed as a backup to confirm whether dye had passed through the system, and the probe was to quantify dye passing through the system at 1-minute intervals. After this, dye injection into the sinkhole on the west side of William T. Young Library at the University of Kentucky occurred (Friday, July 6th, 2018). On the day of injection, flash rainfall occurred from 3:40pm to 4:00pm temporarily raising flow conditions from near base level to over 200 cubic feet per second (Figure 5). 90 grams of fluorescein dye was injected at 4:17pm into sinkhole (Figure 6). Injection was aided by 125 gallons of water from a water truck hose provided by Facility Services at the University of Kentucky. Water flow began 4:15pm and ended at 4:27pm, with injection occurring at 4:17pm. Fluorescein dye was used because preliminary testing of the predicted outflow location showed negligible levels of background fluorescein contamination. Preexisting fluorescein in the water system would affect the ability to accurately measure the rate of flow and confirm the predicted connection.

Dye was also deployed into a storm drain on the west side of the William T. Young Library at the University of Kentucky on Friday, July 6th, 2018 (see small circle

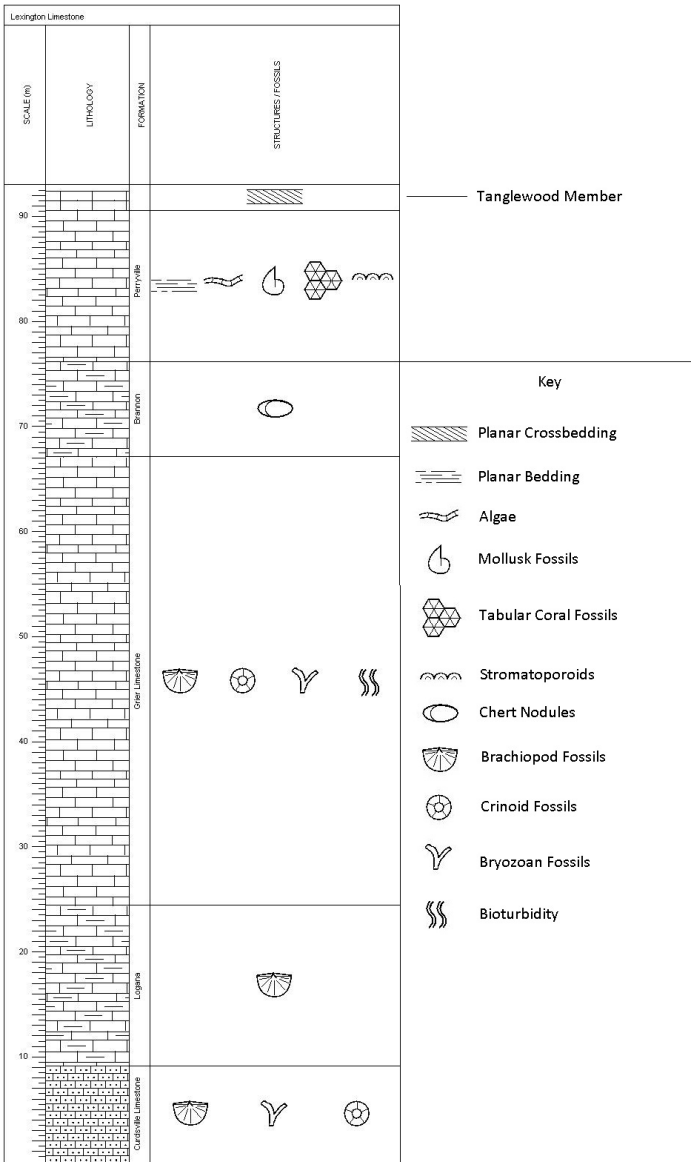

Figure 4. A stratigraphic column of the rock units and formations beneath Lexington, Kentucky (Cressman, 1973).

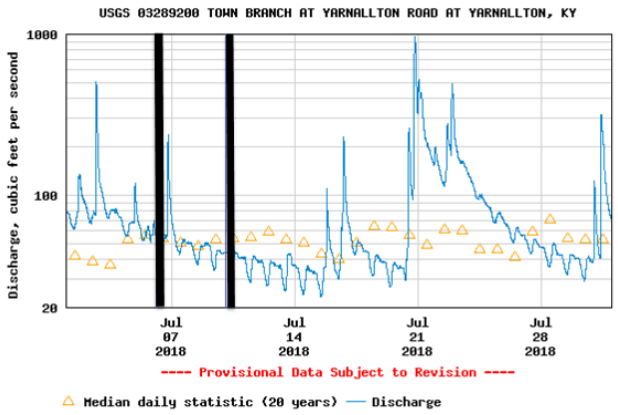

Figure 5. Precipitation measurements from July 2018. The start and end dates for the survey are denoted by black bars.

Figure 6. Fluorescein dye injection on the west side of William T. Young Library at the University of Kentucky on July 6, 2018, performed by a summer research student intern. The black circle in the background marks the location of the storm drain at the bottom of the sinkhole. The foreground ellipse denotes the sinkhole.

in Figure 6), without the aid of the water hose because sufficient water flow was observed in storm drain. 90 grams of eosine dye were poured into the drain grate at 4:30pm. Eosine dye was used in this instance because one of the purposes of this study was to test whether or not the storm drain to Wildcat culvert spilled over into the Mystery Spring.

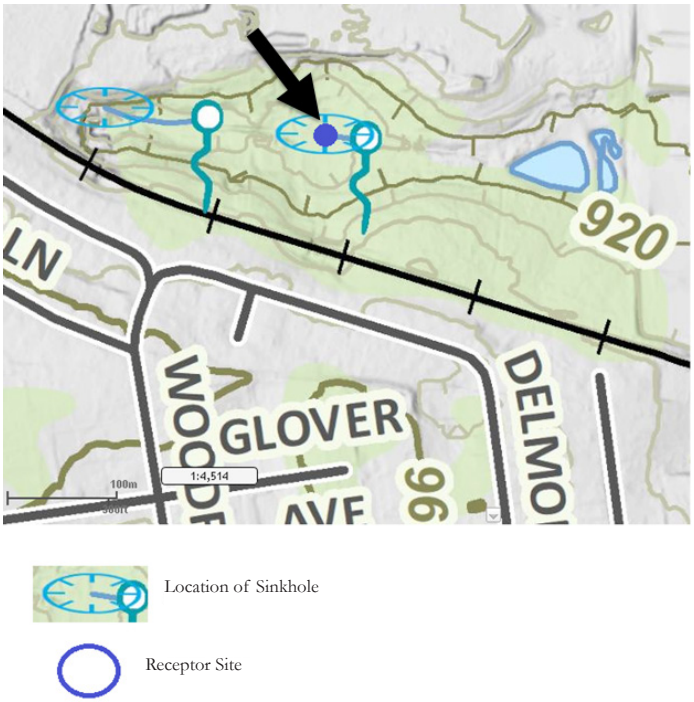

Figure 7. A map of McConnell Springs. Receptors were placed at this site (black arrow) to ensure no inter-basin spillover from Mystery Spring.

To collect dye travel time data from the sinkhole to Mystery Spring, a Cyclops 7 infrared probe was installed at Mystery Spring on Friday, July 7th, 2018. Data were also collected using activated charcoal dye receptors at designated points #1, #2, #3, and #4 at Mystery Spring, point #5 at Town Branch, and point #1 at McConnell Springs (Figures 3 and 7). Samples were collected from McConnell Springs to ensure no interbasin spillover between Mystery and McConnell Springs (Figure 8). A grab water sample was collected from sample point #5, Wildcat Culvert in Town Branch, at 6pm on July 6th, 2018, after dye was visually observed exiting Wildcat Culvert.

Cyclops readings were collected in one-minute intervals until July 8th, with the first reading measured at 11:40am on July 7th, 2018. Charcoal dye receptors at sample points #1 and #3 were collected from July 7th, 2018 through August 16th, 2018. Dye receptors were exchanged daily for three days, then sampling interval reduced to once weekly. Receptors at point #2, #4, and #5 were collected from July 7th, 2018 to July 10th, 2018. The receptor at sample point #1 in McConnell Springs was exchanged on July 7th, 2018. All collected samples were analyzed in the hydrology lab at the Kentucky Geological Survey located on the campus of the University of Kentucky using a Varian Cary Eclipse Fluorescence Spectrophotometer.

Care was taken to ensure a lack of contamination of the charcoal dye receptor packets. Surgical gloves were utilized during collection and installation of the packets and discarded after each packet was installed, and after

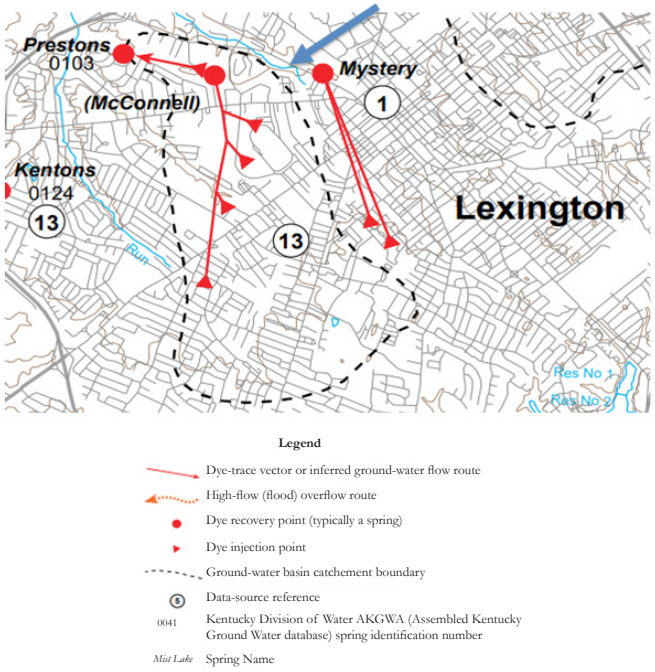

Figure 8. A section of mapped karst groundwater basins in Lexington, Kentucky, emphasizing Mystery and McConnell Springs (Currens and Ray, 1996). The blue arrow denotes Town Branch.

each packet was collected. The individuals responsible for collecting the dye receptor packets were not involved in the testing of the packets for the presence of dye.

The parameters used in this study were similar to those used in the 1989 study. This was done in order to investigate the effect of the construction of the William T. Young Library on the groundwater flow in the area. A lack of dye in the known outflow of the sinkhole would indicate a change in the groundwater flow potentially caused by the construction of the library.

Results

Prior to the study, charcoal dye receptors were deployed for two weeks in Town Branch to test for background dye in the system. No appreciable background dye was detected. After the injection in the campus sinkhole, fluorescein dye appeared within 14 hours at Mystery Spring. Though probe data were monitored following the injection, no obvious spike in the visible spectrum, as would be produced by the presence of fluorescein dye, was detected (Figure 9). See Figure 10 for a chart outlining dye intensity over time at Mystery Spring using charcoal dye receptor data.

Eosine dye injected into the campus storm drainage visibly appeared at the dye receptor sites in Wildcat Culvert at 6pm on Friday, July 7th, 2018, which was less than two hours after injection (Figure 3).

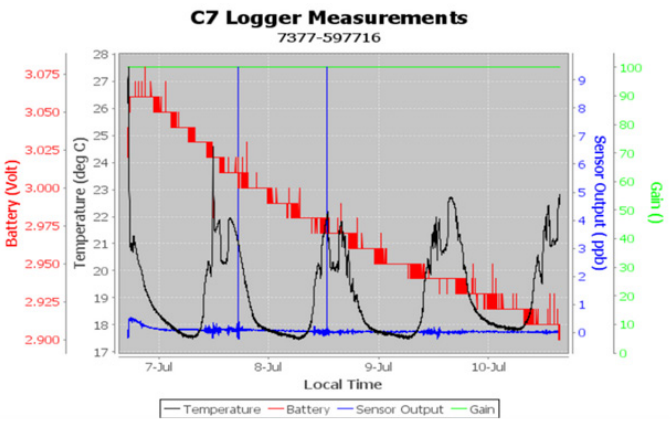

Figure 9. Probe data collected at Mystery Spring from July 7 - 10. The blue spikes are either errors or artifacts from probe removal for readings.

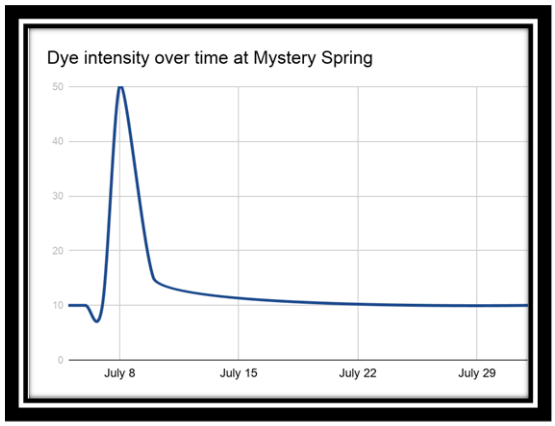

Figure 10. Dye intensity over time at Mystery Spring as measured by charcoal dye receptors and a fluorimeter at the hydrogeology laboratory at the Kentucky Geological Survey. Dye injection occurred on July 6, 2018.

Discussion

The study was successful in determining a connection between the campus sinkhole and Mystery Spring through charcoal dye receptors. However, lack of probe data means dye travel time information was not accurately determined from this study, though when charcoal dye receptors were exchanged on day two at 14 hours, dye had appeared. This suggests a travel time from the campus sinkhole to Mystery Spring (1.5 miles away) of approximately 9-14 hours.

As to why measurable amounts of dye were not observed by the probe, it is possible that the construction of the William T. Young Library on the University of Kentucky campus affected the flow of groundwater in the karst conduits connecting the two sites, but it is

more probable that the amounts of fluorescein dye and water used at injection were not in high enough concentrations to be detected in water. Dye passed through the conduit system, but further study will be needed for accurate time of travel data. For a future study, we suggest tripling the amount of dye injected (270 grams).

Prior to the dye trace, it was communicated by Facility Services at the University of Kentucky that a connection exists between the storm drainage injection site and Wildcat Culvert, but travel time in these flow conditions had not been tested. Our results indicate that a spill on campus that travels to the storm drain could travel to Town Branch in less than two hours.

Conclusion

Karst dye trace studies are important because they provide connectivity and time of travel information that could be helpful in the event of a contaminant spill. If contaminants were to appear in Mystery Spring, without a confirmation of the origin of the springs feeding the body of water, it would be difficult to locate, contain, and purify the source of the contaminant. Therefore, due to incomplete data on travel times, and, to some degree conduit connectivity in the area, it would be beneficial to conduct further research into the groundwater flow patterns and travel times of conduits in the Lexington region.

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Mnemonics, Testing, and Creativity: Creative Thinking and Effectiveness of Learning Method

Sarah Krull graduated in May 2017 from Northern Kentucky University after earning a Bachelor of Science in Psychology with minors in English and Honors. She currently hopes to begin a PhD in Psychology in the fall of 2019. Her main research interests include morality, psychology of religion, and psychology and media.

Mnemonics, Testing, and Creativity: Creative Thinking and Effectiveness of Learning Method

Sarah R. A. Krull. Faculty mentor: Kalif E. Vaughn
Psychological Sciences

Abstract

Much research has been done on various techniques for increasing learning, and both testing and mnemonics such as the keyword method have been proven effective. We addressed whether people high and low in creativity benefit more or less from test practice as compared to a mnemonic strategy. We had participants study twenty Lithuanian-English word pairs. Then participants either restudied the words, received test practice by being given the cue and attempting to recall the target, generated a mnemonic linking the cue to the target, or received no extra practice with the words. After a final test over all twenty words, participants completed Remote Association Triad (RAT) problems (Bowden and Jung-Beeman, 2003) which required participants to find the relationship between three words (e.g., "Cold" is related to "Sore, Shoulder, Sweat"), and yields an index of creativity. Our hypothesis that the effectiveness of different study methods would differ across groups failed to achieve significance, and, surprisingly, so did the expected testing effect. One interesting finding did emerge: higher creativity, as measured by RAT performance, benefited participants regardless of the method employed in studying.

Keywords: retrieval practice, mnemonics, creativity

Introduction

For years, psychologists have conducted extensive research on learning, and with the study of learning comes the study of techniques to facilitate it. Over time, two techniques have emerged as particularly powerful—retrieval practice and the keyword method. Roediger and Karpicke (2006) note that scientists once considered testing simply a tool for assessment of knowledge; however, Tulving (1967) provided some initial evidence that test trials enhance learning. Tulving (1967) had participants study common nouns (study phases were denoted by "S") and freely recall them (recall phases were denoted by "R"). After the initial study phase ("S"), participants either received two additional study phases, followed by a free recall test (SSSR), two free recall tests alternated with two study phases (SRSR), or three free recall tests (SRRR). When Tulving compared final recall performance across groups, he found that recall was approximately the same across groups. The implication that testing could be used to improve, not simply to demonstrate, knowledge opened up a whole new field of research.

Research since Tulving (1967) suggests that testing enhances learning across a variety of situations. For instance, Pierce and Hawthorne (2016) asked college students to memorize a list of words, administered either by audio or visual means. Some of these participants were also required to take a free recall test shortly after completing each list. The researchers found that although modality impacted overall performance in cases where the items were non-categorizable, testing benefited recall for both groups. Furthermore, testing appears useful in situations that hamper study. Mulligan and Picklesimer (2016) first presented participants with a list of 60 unrelated word pairings to study. Then some of the participants reviewed a list of 20 word pairs. During this period, some were challenged to recall the second word (testing period) and some simply saw both words again (restudy). Additionally, the researchers required some participants to perform two tasks simultaneously (representing a divided attention task). In the divided attention condition, participants who restudied the words performed worse than those who attempted to remember them, suggesting that test practice may benefit learning even when attentional resources are scarce.

Research has also found evidence that the testing effect translates from the laboratory into scholastic life. Batsell, Perry, Hanley, and Hotstetter (2016) conducted a quasi-experiment, using two classes, both of which were assigned daily readings from sections of a textbook that were not covered in class. In the testing class, the teacher administered a brief quiz at the start of each class period. In the control class, the teacher simply encouraged the students to read the assigned material. Throughout the semester, both classes were tested on the material during scheduled exams. The test group outperformed their counterparts in the control group, even on questions that had been answered in the material but had not appeared on the daily quizzes. Clearly, testing benefits the process of learning.

However, interestingly, the testing effect appears to have a very significant weakness. Peterson and Mulligan (2013) suggested that under certain circumstances, testing may negatively impact recall by focusing attention on aspects of the memory items that will help cued recall, but not free recall. The researchers asked participants to study a set of 36 rhyming words (e.g., cork/fork) taken from six different categories (e.g., kitchen utensils). Afterwards, they either restudied the word pairs or tried to recall the second word when presented with the first

word. When the researchers asked the participants to recall as many words as they could, the restudy group emerged with better recall than the testing group. Apparently, the emphasis on cued recall prevented the test group from noticing the categories, which might have helped on the free recall test.

Fortunately, learners need not depend solely on testing to improve their knowledge. Another powerful technique, the keyword method, has also proved effective. The keyword method requires the learner to connect two often dissimilar words with a mental picture linked phonologically to the word to be learned (for instance, using the word "wing" to remember the Swahili-English word pair "wingu-cloud"). For instance, Atkinson (1975) assigned participants to learn a set of 120 Russian words. Participants listened to the Russian words through headphones while viewing the English equivalent on a CRT device. For participants in the keyword condition, a keyword (displayed in brackets) accompanied the English word. After each study period, participants took a test in which they listened to the Russian word and then had to type the English version. Participants also took a test over all 120 words after the three study/test trials and another comprehensive test six weeks later. Atkinson discovered that the keyword group recalled far more words than their counterparts in the control group (72% to 46% recall performance on the first comprehensive test and 43% to 28% recall performance on the second test occurring after six weeks for the keyword versus control group, respectively).

Piribabadi and Rahmany (2014) found that the benefit the keyword method produces in language learning translates to learning technical jargon. The researchers randomly selected 120 university students from two engineering classes. Using the Oxford placement test to assess the students' English vocabulary, the researchers sorted the sixty students taken from each class into upper-intermediate (30 highest scores) and lower-intermediate groups (remaining scores). Then one of the classes learned engineering terms using the word-list method and the other learned engineering terms using the keyword method for four weeks. Following this training both classes took a multiple-choice vocabulary test to ascertain learning. In both the upper- and lower-intermediate groups, students trained in the keyword method achieved mean scores higher than their counterparts trained in the word-list method.

Jenpatturakul (2012) found some interesting results particularly relevant to the current study. The researcher selected 40 Bangkok university students enrolled in an English course. During the first week, students learned new words in English. In the second week, they took the first of two vocabulary tests. The teacher introduced the students to the keyword method during the third week and had them practice the technique using new words. At the end of the class, the students took a test over some of the vocabulary learned using the keyword method. Interestingly, not only did the students perform better on the second test, but also 97.5% of them self-reported that the keyword method improved their imagination.

In planning this study, we became interested in the effect of creativity and verbal aptitude on both test practice and mnemonic techniques as study strategies. Testing requires little creative effort; learners are given a cue and attempt to recall the corresponding target. Indeed, Peterson and Mulligan's (2013) results could be interpreted as saying that testing sometimes prevents a person from coming up with a new, better way to solve a problem (that is, being creative). It may therefore prove more effective for learners who lack creativity in certain situations. The keyword method, by contrast, requires the learner to connect two often dissimilar words with a mental picture linked phonologically to the word to be learned. (For example, a learner using the keyword method for the Lithuanian word suo [dog] might create the image of a sumo-wrestler dog to remember the definition.) Thus, the keyword method may be more suited to individuals higher in creativity and verbal aptitude. Therefore, we hypothesized that individuals higher in verbal aptitude and creativity would learn better using the keyword method and individuals lower in creativity would benefit more from test practice. To assess creativity and verbal aptitude, we had participants solve Remote-Associate Triad problems that required them to think of one word related to three other words (e.g., "Cold" is related to "Sore, Shoulder, Sweat"; see Bowden and Jung-Beeman, 2003).

Methods

Participants

361 participants from Northern Kentucky University started the online experiment; however, participants were excluded if they did not finish (n = 61), indicated that they had completed the experiment previously (n = 16), or wished to be excluded (n = 18). After excluding these participants, the remaining sample size was 266 participants (182 females, 62 males, 1 transgendered male, 1 non-binary assigned male at birth, and 1 genderfluid; median age = 19.8 years, age range: 17-43 years). 61 participants did not enter their age or entered a nonsensical value (e.g., 0), and 19 participants did not indicate their gender or entered a nonsensical value (e.g., "vhvhj"). Regarding race, participants indicated whether they were "African-American, Non-Hispanic" (n = 14), "American Indian/Native Alaskan" (n = 1), "Asian/Pacific Islander" (n = 3), "Other" (n = 6), "White, Non-Hispanic" (n = 220), or did not indicate their race or had unusable data for this question (n = 14). Regarding classification, participants indicated that they were Freshman (n = 154), Sophomore (n = 48), Junior (n = 23), Senior (n = 16), Post-baccalaureate (n = 3), Non-degree seeking (n = 1), or did not answer or provided unusable data (n = 21).

Materials

Participants studied 20 Lithuanian-English word pairs (e.g., namas-house) during the experiment (see Appendix A for a complete list of these words). Additionally, participants attempted to solve 10 Remote-Associate Triad problems (reported in Appendix B; see Bowden and Jung-Beeman, 2003) to assess their creativity.

Procedure

On NKU's Sona psychology experiment systems page, participants viewed the study name and a brief abstract. We provided a link to the actual experiment, which was hosted on another website. Once participants clicked the link, they saw a consent form, which briefly described the study and informed them that participation was voluntary and that their data would be anonymous. Once the participant gave consent, they were directed to the experiment and randomly assigned to groups.

During the first phase of the experiment, participants studied the Lithuanian-English word pairs one at a time. On each trial, a Lithuanian-English word pair appeared. Below the Lithuanian-English word pair, the Lithuanian word was repeated with a textbox next to it for the participant to copy in the corresponding English word. After all 20 word pairs had been presented during the copy trials, the second phase of the experiment began.

During the second phase of the experiment, participants completed different tasks depending upon group assignment. In the retrieval group, the participants were presented with the Lithuanian word and asked to recall the corresponding English word. In the keyword group, the participants were instructed to generate a mnemonic for each of the word pairs, which we instructed them to type into a textbox on the screen. In the restudy group, they restudied the word pairs in the same way as during the first phase. The control group did not receive additional exposure to the word pairs and were instead directed immediately to the distractor task (see below).

After the second phase, all four groups played Tetris for two minutes as a distractor task. After the distractor task was finished, the third phase of the experiment began.

During the third phase of the experiment, all of the groups took a final test over the word pairs. During each final test trial, we presented one Lithuanian word at a time and instructed participants to recall the English translation. Each final test trial was self-paced. After the final test, the fourth phase of the experiment began.

During the fourth phase of the experiment, participants completed 10 Remote-Associate Triad problems (see Bowden and Jung-Beeman, 2003). During each RAT problem, we presented three words to the participant (e.g., "Sore, Shoulder, Sweat") and asked them to generate the related fourth word (e.g., "Cold").

Statistical Analysis

To evaluate whether the learning strategy influenced final test performance, an ANOVA was conducted comparing group (keyword, retrieval, restudy, or control) and final test performance.

To determine whether creativity influenced final test performance, participants were first divided into "high" or "low" creativity based upon their RAT performance. Then, an ANOVA was conducted comparing group (keyword, retrieval, restudy, or control), final test performance and RAT performance (high versus low).

Results

Copy Performance (Phase 1)

All participants were given an initial study phase to the word pairs, during which they were instructed to copy the target word (the English word) into a textbox next to the Lithuanian word. The proportion of items that were copied correctly during the study phase was high ($M = 0.96$, $SD = 0.17$), suggesting that participants successfully encoded most of the items. Importantly, out of the 266 participants remaining in the study, there were some participants who failed to copy any items correctly ($n = 4$) or copied 25% or less of the words correctly ($n = 5$). To prevent possible skewing of the results, these nine participants with poor or zero copy performance were excluded from subsequent analyses. Thus, the remaining analyses only included participants with high copy performance (greater than or equal to 75%; $n = 257$). The 257 participants were distributed relatively evenly across the keyword group ($n = 61$), restudy group ($n = 68$), test group ($n = 64$), and control group ($n = 64$). For these 257 participants, the proportion of words copied correctly during the study phase increased ($M = 0.99$, $SD = 0.04$). Importantly, any items which were not correctly copied during the study phase ($68/5140 = 1.32\%$) were excluded from subsequent analyses.

Recopy and Test Performance (Phase 2)

Participants in phase 2 either did nothing (control group), recopied the word pairs (restudy group), attempted to recall the English word when presented with the Lithuanian word (e.g., "namas - ???"; retrieval group), or generated a keyword mnemonic to associate the Lithuanian word with the English word (e.g., one participant wrote "mama's house" to remember namas - house; keyword group).

Participants in the restudy group copied items at a high rate during the restudy phase ($M = 0.97$, $SD = 0.13$). Participants in the retrieval group occasionally recalled the corresponding English word when presented with the Lithuanian cue ($M = 0.30$, $SD = 0.30$). Given that participants in the control group received no further exposure to the material before the final test, and

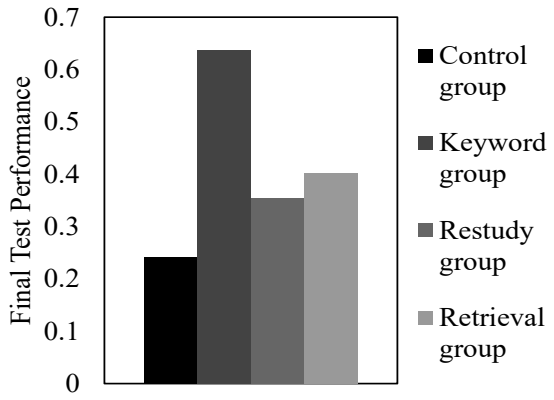

Figure 1. Final test performance (reported as a proportion correct) as a function of group (control, keyword, restudy, and retrieval).

participants in the keyword group generated their own mnemonics that cannot be assessed for accuracy, no statistics are reported for the control or mnemonic group in Phase 2.

Final Test Performance

Final test performance as a function of group is reported depicted in Figure 1. A one-way univariate ANOVA indicated a significant difference in final test performance as a function of group, $F(3, 253) = 21.03$, $MSE = 0.08$, $p < 0.001$, $\eta^2 = 0.20$. Post-hoc Tukey t-tests indicated that participants in the keyword group recalled significantly more word pairs on the final test compared to participants in the retrieval, restudy, or control group (all p-values < 0.001). Additionally, participants in the retrieval group recalled significantly more words than participants in the control group ($p = 0.009$). The control group and the restudy group did not significantly differ in terms of final recall performance ($p = 0.111$). Finally, the retrieval group did not significantly differ from the restudy group ($p = 0.761$).

RAT Performance

RAT performance indicated that participants could solve approximately one-quarter of the problems correctly ($M = 0.27$, $SD = 0.20$). A one-way univariate ANOVA found no significant difference in RAT performance as a function of group, $F(3, 253) = 0.83$, $MSE = 0.04$, $p = 0.479$, $\eta^2 = 0.01$. Given that participants were randomly assigned to groups and that this is a proxy for creativity (which should be evenly distributed amongst our groups), this is unsurprising.

We treated participants who were above the average RAT performance score as "high creativity" individuals ($n = 118$) and individuals who were below the average RAT performance score as "low creativity" ($n = 139$). We then analyzed final test performance as a function of RAT performance (high versus low) and group (control, retrieval practice, restudy, or keyword) (see Figure 2). There was a significant main effect of RAT performance on final test performance, suggesting that individuals who scored higher on the RAT creativity task tended to score higher on the final test, $F(1, 249) = 8.00$, $MSE = 0.08$, $p = 0.005$, $\eta^2 = 0.03$. There was also a main effect of group on final test performance, $F(3, 249) = 21.80$, $MSE = 0.08$, $p < 0.001$, $\eta^2 = 0.21$. Most importantly, there was not a significant interaction between RAT performance and group on final test performance, $F(3, 249) = 0.18$, $MSE = 0.08$, $p = 0.909$, $\eta^2 = 0.00$.

These analyses highlight several key findings. First, higher RAT performance is associated with better final test performance. Second, final test performance changed as a function of what participants did during practice, with the keyword group performing the best overall. Third, the lack of a significant interaction between RAT performance and group on final test performance suggests that the learning strategy used does not necessarily depend upon the creativity of the individual. Rather, more creative individuals tend to perform better on the final test regardless of which learning strategy they use during practice. Additionally, the keyword strategy appears to be effective regardless of RAT performance.

Discussion

Given the finding that no significant interaction existed between group and RAT performance on the final test, our hypothesis that people with different levels of creativity would benefit more from different methods appears incorrect. Instead, creativity, measured by an ability to see a connection between disparate things, acts as a major factor no matter what method of study the person uses. However, a future study might explore the same question using an alternate measure of creativity. This study used the Remote Associations Triad test to

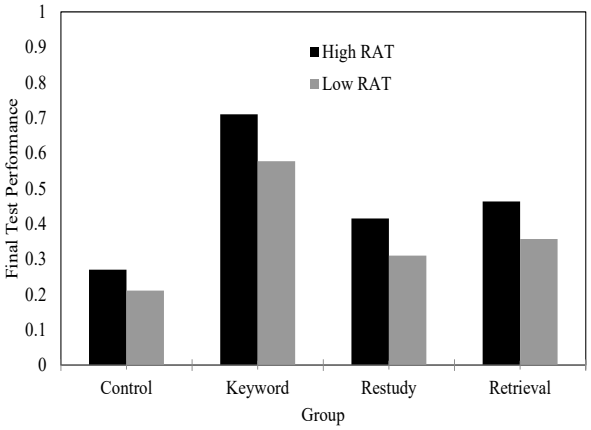

Figure 2. Final test performance (reported as a proportion correct) as a function of RAT performance (High versus Low) and group (control, keyword, restudy, and retrieval).

ascertain the creativity of participants. Perhaps this does not provide the best measure of creativity, and, if the study were attempted with a better measure, we would receive a better idea of our hypothesis' accuracy.

The importance of creativity, regardless of method, may help explain Jenpatturakul's (2012) findings. The participants claimed the keyword method (as opposed to the list method) enhanced their creativity. It is possible the participants were correct, or perhaps, rather than enhancing creativity, it only stimulated the creativity already present. Nonetheless, with creativity serving an important role in test performance, it would still be worthwhile to know if certain methods stimulate it. Perhaps a future study could explore whether the keyword method indeed enhances or activates creativity.

The lack of significant difference between the recall and restudy groups is unexpected. The general body of research states that retrieval practice is superior to restudying in promoting performance. Roediger and Karpicke (2006) conducted a literature review and found that retrieval practice has proven effective many different times and in many different scenarios. Yet our study failed to replicate this expected "testing effect." It seems unlikely that the blame rests on our study's sample size. Even after excluding participants who had already taken part in the study, had not finished, or had requested exclusion, the number left, divided among the experimental groups, resulted in approximately 66 participants per group. It is uncertain why the study came up with this surprising finding.

On an unrelated note, the participants' mnemonic methods in the keyword condition did not strictly match the traditional keyword method. The participants more commonly used phrases than single words to assist their memory; we also cannot be certain if the participants used imagery to link the words, which is considered (according to at least some researchers) to be part of the keyword method. A future study could attempt to implement something closer to the classic definition of the keyword method or simply change the focus of the study from the keyword method to mnemonics in general.

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Appendix A

Lithuanian-English word pairs	
smuikas	violin
bugnas	drum
kunigas	priest
plaukas	hair
kambarys	room
arbata	tea
mygtukas	button
ugnis	fire
pyragas	cake
durys	door
stogas	roof
pastatas	building
vejas	wind
medis	tree
tinklas	net
batas	shoe
daina	song
sesuo	sister
namas	house
upe	river

Appendix B

Remote Association Triad (RAT) problems	
Stick Light Birthday	Candle
Note Dive Chair	High
Rock Times Steel	Hard
Barrel Root Belly	Beer
Notch Flight Spin	Top
Salt Deep Foam	Sea
Playing Credit Report	Card
Broken Clear Eye	Glass
Gold Stool Tender	Bar
Falling Actor Dust	Star

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