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Test Performance And Study Breaks

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TEST PERFORMANCE AND STUDY BREAKS

being

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ABSTRACT

As the culture of American education changes, recess time is declining in favor of instruction time. An important question, however, is whether this shift is truly going to yield the best learning outcomes. The purpose of the present study is to examine the effect of taking a break, both mental and physical, on test performance. Seventy college students were tested on their learning of a list of phobias that they had studied in one of three conditions: no break, mental break, and physical break. It was predicted that participants would perform better on a subsequent memory task when a break was included, and that a break involving physical activity would produce better results than a mental break alone. The results showed that the mental break condition had significantly higher scores than the control group but that the physical break condition scores were not significantly different from the control group scores.

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INTRODUCTION

Recess At Risk

"Elementary school recess has been an American standard for well over 100 years, and by the 1950's, three recesses a day was the norm" (Mulrine, 2000, p. 50). The term recess refers to a break in whatever one is doing, "a period of time away from the task at hand: an interlude, a change of pace" (Jambor, 1994, p. 17). Recess has become a topic of interest as it seems to be a part of the school day that is often being eliminated to find more time for teaching the required basics. The topic is so important that the United Nations Convention on Children's Rights even has a statement about recess. "Recess is the right of every child: Article 31 of the United Nations Convention on Children's Rights states that every child has the right to leisure time. Taking away recess, whether as a disciplinary measure or abolishing it in the name of work, infringes on that right" (Skrupskelis, 2000, p. 124). However, recess may become an idea of the past in the United States. According to a survey taken by the National Association of Elementary School Principals in 1989, 96% of the surveyed school systems had one or two recess periods per day (Pellegrini, 2005, p. 8). Ten years later, another study found that only 70% of the kindergarten classrooms that were sampled had a recess period.

Pressures On The School Day

A Nation At Risk

The outlook and goals of education in the United States have changed greatly over the past fifty to one hundred years. In 1957, in the midst of the Cold War, the Soviet Union launched Sputnik, the first satellite to orbit the Earth. This was considered to be a

possible threat to United States national security. In response to this, the United States passed the National Defense Education Act (NDEA), which authorizes increased funding for scientific research and science education. This was the start of the push towards trying to develop strong science and mathematics academic programs in the United States so there would be highly qualified and trained persons to compete on the international level.

On August 26, 1981, Secretary of Education, T. H. Bell, created the National Commission on Excellence in Education. The goal of the commission was to examine the quality of education in the United States and to make a report to the nation about the findings. In April of 1983, the National Commission on Excellence in Education put out a statement entitled, *A Nation At Risk*. This document started with a very powerful statement that still drives the American education system: "Our Nation is at risk. Our once unchallenged preeminence in commerce, industry, science, and technological innovation is being overtaken by competitors throughout the world. This report is concerned with only one of the many causes and dimensions of the problem, but it is the one that undergirds American prosperity, security, and civility. We report to the American people that while we can take justifiable pride in what our schools and colleges have historically accomplished and contributed to the United States and the well-being of its people, the educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people. What was unimaginable a generation ago has begun to occur--others are matching and surpassing our educational attainments" (United States, 1983, p. 5). This was the beginning of the increase in governmental involvement and reform. Within this

document, there were many recommendations, one of which was, “We recommend that significantly more time be devoted to learning the New Basics. This will require more effective use of the existing school day, a longer school day, or a lengthened school year” (United States, 1983, p. 29).

NCLB – The Push For Standardized Testing

Along the same theme as in 1983, another large and controversial act, the No Child Left Behind (NCLB) Act, was approved by Congress and signed into law by President George W. Bush in 2002. This law, which is the reauthorization of Elementary and Secondary Education Act (ESEA) of 1965, holds schools accountable for student achievement levels and provides penalties for schools that do not make adequate yearly progress toward meeting the goals of NCLB. The penalties are substantial. Districts must meet certain academic benchmarks to continue to receive both state and federal funding. According to the National Center for Educational Statistics, 26 percent of high school seniors had writing levels that were below basic in 2002. Also in 2002, 25 percent of eighth graders had reading levels below basic. In 2000, 34 percent of eighth graders had math levels below basic. Minority students and students who live in lower class areas are most likely to have inadequate reading, writing, and math skills. So the NCLB Act forces schools to be accountable for the quality of education that they provide. Specifically, students must take and pass standardized tests to prove that they have learned the basic English and math skills appropriate for their grade level. Schools that do not show significant improvement according to test score results will be required to provide supplemental services such as tutoring.

More recently, President Barack Obama "presented states with an unprecedented challenge and the opportunity to compete in a 'Race to the Top' designed to spur systemic reform and embrace innovative approaches to teaching and learning in America's schools. Backed by a historic $4.35 billion investment, the reforms contained in the Race to the Top will help prepare America's students to graduate ready for college and career, and enable them to out-compete any worker, anywhere in the world." (White House, 2009, p. 1). Clearly, there has been a continued push from the 1950's towards increased academic rigor in elementary and secondary education in the United States.

A Changing School Culture

The culture of schools has changed greatly in the last decade with the enactment of the NCLB Act of 2001. With this enactment, came increased pressure on school districts to perform well on high stakes reading and math standardized tests in order to continue to receive federal funding. The result of this has been increased instructional time in the school day for basics like reading and math, but also a decrease in recess time and other activities. There is no statement in NCLB that requires schools to cut recess, but that has been a common response. According to McMurrer (2008), "44 percent of school districts in a survey had increased time for English/language arts and math in their elementary schools and decreased time in other subjects since the 2001 enactment of No Child Left Behind, which requires schools to test academic achievement" (p. 2). Academic achievement is the main focus of school districts in the United States right now because so much depends on the outcome of the high stakes achievement tests that are given annually. National and state funding are both based on the results of these tests.

There are school districts within the United States that have opted to eliminate recess all together, to the point that they are building new schools with no playgrounds. Such districts that are eliminating recess are located in Atlanta, New York, Chicago, and New Jersey. The superintendent of Atlanta schools, Benjamin O. Canada, has said, “We are intent on improving academic performance and you don’t do that by having kids hang on the monkey bars” (Johnson, 1998, p. A1). These cities and states believe that increased academic achievement and test scores are worth giving up recess.

Eliminating time for recess is not a panacea, however. The National Center for Education Statistics has a Nations report card that shows increases or decreases in test scores by state and by city. In 2009, the average score of fourth-grade students in Chicago was 202, which was not significantly different from their average score of 201 in 2007, and neither score was significantly different from the national average score of 210 for public school students in large cities.

On the other hand, there are a few states that have passed a bill that mandates recess. One of these states is Connecticut. In 2004, Connecticut began requiring schools "to include in the regular school day for each student enrolled in grades kindergarten to five . . . a period of physical exercise" (Public Act 04-2004). The state Board of Education recommends up to 150 minutes of physical activity for elementary students each week. According to the Nations report card, in 2009 the Connecticut average score of fourth-grade students was 229, which is significantly higher than the national average score of 210 for public school students in large cities, and significantly higher than the average of cities like Chicago and Atlanta that have eliminated recess.

The Dangers Of Reducing Recess Time

The schools that cut recess time reported reductions from 184 minutes per week pre-NCLB, or 37 minutes per day, to 144 minutes per week in 2007, or 29 minutes per day. (McMurrer, 2008). There has been an obvious decrease in recess time, but along with that, "nearly a third of United States elementary schools do not regularly schedule recess, according to the Alliance for a Healthier Generation" (2005). With NCLB, there has been a strong push on basic academics, but other arguments have been used to justify the abolition of recess. Jambor and Guddemi (1992) and Pellegrini (1995) listed some issues as: school's needing instructional time and not recess time to raise test scores, that recess causes children to become excited and unable to then focus on their academic work, and that recess may allow children to express aggression and antisocial behavior. The idea that more instructional time is needed to raise test scores has much evidence to support it and that seems to be the biggest motivation behind eliminating recess. The idea that recess disrupts the work patterns of children thus causing high levels of excitement and inattentiveness is not as well supported. To the contrary, there is much evidence that supports the idea that "taking a mental break" actually helps a child learn. This is the real issue regarding the importance of recess.

Recess And Attention Span

If schools are moving towards a no recess school day, what effect is that having on learning? Child development researchers cite many benefits of having a recess time during the school day. According to Johnson (1998), researchers such as Pellegrini offer the insight that every study shows that, after recess, children are going to be more

attentive for academic work. Pellegrini adds that not having a recess during the school day is almost inhumane because children are being kept confined in their classrooms for many unnecessary hours each day (Johnson, 1998).

Prolonged periods of confinement in elementary classrooms have been found to lead to increased fidgeting, restlessness, and subsequent inability to concentrate (Pellegrini & Davis, 1993). This idea goes all the way back to a theory, proposed in 1898 by Herbert Spencer, known as the surplus energy theory. This suggests that surplus energy accumulates while one is engaged in sedentary activities and that an opportunity for physical activity is needed to "blow off steam" or use up the surplus energy. This idea seems logical and has much appeal, but the buildup of energy is not supported by physiology.

Another variation of this theory presented by Berlyne (1954), and later by Robertson and Ellis (n.d.), is the novelty arousal theory. This suggests that persons function better when they have a change of pace. When a person is engaged in an activity long enough to become habituated, they become bored and seek novelty. This can be translated into the school setting. If a student sits and does only one task for a long period of time, they eventually become bored and need a change of pace to become reengaged. This would not necessarily refer to a physical break, just a break of some sort or a change in activity.

Merriam Webster defines attention as, "the act or state of applying the mind to something [or] a condition of readiness for such attention involving especially a selective narrowing or focusing of consciousness and receptivity" (Attention, 2011). Attention is

necessary and an important aspect of learning and retaining new material. There is also sustained attention known as vigilance which, "refers to the state in which attention must be maintained over time. Often, this is to be found in some form of a 'watchkeeping' activity when an observer, or listener, must continuously monitor a situation in which significant, but usually infrequent and unpredictable, events may occur" (Vigilance, 2011). There are many careers that require sustained attention or vigilance, and most research has been concentrated in those careers.

Factors That Affect Vigilance in Adults

Air Traffic Controllers

One career that requires a high level of vigilance is that of air traffic controller. Monitoring screens for extended amounts of time, they have to keep a complete focus on the task to ensure plane safety. "The mental effort, required to maintain the highest level of attention and vigilance, as well as to safely and effectively face the task in terms of cognitive and memory load, can vary widely in relation to air traffic density and connected problems, therefore, to guarantee the best level of performance efficiency avoiding excessive mental stress and fatigue, particular attention has to be paid to arranging duty periods" (Costa, 1995, p. 13). Based on the fact that air traffic controllers have to have complete focus and attention, a few guidelines must be followed to insure the safety of all flyers. Using the work of Costa (1995), regulations for breaks during operational duty can be shown, including: no operational duty exceeding two hours without there being a break or breaks of at least 30 minutes. During periods of high traffic density, the possibility of having more frequent short breaks is also an option.

Sufficiently long breaks for meals should be allowed, with nice facilities and hot, quality meals. These breaks are necessary to refocus workers to reduce mistakes on the job.

Cognitive Capacity

Air traffic controllers are required to take a break after two hours on the job, but why? This is due to the fact that during those two hours they are working at full cognitive capacity. The same thing can be seen with students in elementary school. They are learning things for the first time such as reading or math facts. To learn these skills, it takes full cognitive capacity and memory to learn and put this newly learned material into categories to be accessed later. So, if air-traffic controllers need breaks why wouldn't a student in school? If anything, they probably need more frequent breaks, because they are younger and typically have a shorter attention span than adults. But, in general, attention and vigilance increase with shorter durations of work and with multiple and frequent breaks within the task.

College Student Attention Span

The effects of vigilance and attention can be seen in other areas. Some studies have been done with adult learners. According to Johnstone and Percival (1976), adult learners can keep tuned into a lecture for no more than 20 minutes at a time at the beginning of a lecture. This time decreases as the lecture proceeds. They observed students in over 90 lectures with 12 different lecturers. During these observations, they recorded breaks in student attention. It was determined that the first lapse of attention usually occurred between 10 to 18 minutes into the lecture. As the lecture continued, the attention span became shorter and many times fell to only three or four minutes towards

the end of a standard lecture. During a similar study by Burns (1985), students were asked to write summaries of presentations and tallied the bits of information reported by the half-minute segment of the presentation in which they occurred. Results showed that students recalled the most information from the first five minutes of the presentation. Impact declined, but was relatively constant for the next two 5-minute portions and dropped to the lowest level during the 15-20 minute interval. Both of the above studies note the severe lapse of attention at the 15 to 20 minute interval of a lecture. It can be assumed that when a student has lost attention, there is not a large amount of learning occurring. These studies were on adult learners, but it can be safely assumed that children's attention spans are shorter than that of college students.

Is there a reason why students lose their attention after around 20 minutes? There are many different learning theories to support a reason for a break or the inattention of the student. One of which is the "information transfer" model of the traditional lecture. Research, including Middendorf and Kalish (1996), states that the brain does not record information like a videocassette recorder. It handles information by reducing it into meaningful chunks that we call categories. Learning consists of fitting this reduced information into already existing categories or sometimes forming new ones. Categorization determines how a concept is acquired, how it is retrieved from memory, and how it is put to work in abstracting or generating inferences. Basically, this is making and drawing connections between old knowledge and new knowledge. Once that newly acquired concept has been introduced, the student needs an opportunity to practice thinking in terms of that concept. If the student is given a break after the introduction of a

new concept, this lends itself to the mind's natural process of categorization and improves learning of the material.

Attention and Learning Principles Applied to Elementary Schools

Children and Adult Memory Spans

A study was done by Flin, Boon, Knox, and Bull (1992) to determine if children forget information faster than adults. They compared six-year olds, nine-year olds and adults on their memory of an incident. The amount of information recalled by all three groups was very similar when tested the next day.

Massed Versus Distributed Practice

Pellegrini and Bjorklund (1996) asserted that school learning would be more effective if children are afforded opportunities to engage in non-focused, nonintellectual activities, such as recess periods occurring throughout the day. Recess would be an example of a change in activity that would allow the child to refocus their attention. The goal of school is to learn and retain materials over time. This means teachers want students to learn something and retain it, not just memorize it and later forget it.

The principle of massed versus distributed practice is that memory recall is improved when a specific duration of learning is spaced out over several sessions rather than massed into a single session. According to Bloom and Shuell (1981), distributed practice is defined as, "interrupting practice or study time with rest intervals of up to 24 hours or longer" (p. 245). An example of this would be when a person may spend only a total of an hour studying some material. This may occur all at one time as massed practice or it may occur as three 20-minute study periods on each of three consecutive

days. Toppino, Kasserman, and Mracek (1991) found that memory is improved in children from preschool to third grade and in college students if the presentation of material is spaced out rather than presented all at once. Furthermore, younger children need a more pronounced change in activity before they are ready to focus on another cognitive task.

Bloom and Shuell (1981) did a study in which they had two groups of students learn vocabulary words. Both groups met on three consecutive days. One group worked on unrelated material the first two days and then were given thirty minutes the third day to study the words. The other group studied the words for ten minutes on each of the three days and worked on unrelated material the other twenty minutes. The students were given a test at the completion of the three days. On the initial test, results were not significantly different between the two groups, but on the retest four days later the group that had distributed practice remembered substantially more words (35% better) than those students who had studied under conditions of massed practice.

What does this mean for students in the classroom? These results imply that students need breaks between learning activities to give them the optimal capability to learn and later recall information. Though students think that cramming the night before a test is all right to do even at the college level, if students are asked to retrieve that same material a week later, they often cannot. Massed practice seems to result in only a very shallow or fragile form of “learning” the material.

Stress

With the implementation of NCLB, there is much high-stakes testing that takes place. Because these tests are used for the basis of district and school funding, teachers emphasize to the students the importance of these tests. This may lead to stressful situations for students. How much stress is too much stress? The relationship between stress and performance can be explained using the "inverted-U" relationship between stress and performance (Martens and Landers, 1970). This means that if there is not much stress or pressure on the person to carry out a task, there is little incentive for the person to focus energy or attention on the task. As stress increases, the person enters an area of best performance. In this part of the U, people are able to focus on the task and perform well. There is just the right amount of pressure on the person to focus their attention, but not so much that it disrupts performance. However, additional stress beyond the optimal range often leads to a disruption of performance.

Attention Deficit Hyperactivity Disorder

There has been a rise in the prevalence of Attention Deficit Hyperactivity Disorder (ADHD) in America in the last few years. In order to receive a diagnosis of ADHD, the person must have either the following A or B set of symptoms (American Psychiatric Association, 2000).

(A) Six or more of the following symptoms of inattention have been present for at least 6 months to a point that is disruptive and inappropriate for developmental level: (1) often does not give close attention to details or makes careless mistakes in schoolwork, work, or other activities. (2) Often has trouble keeping attention on tasks or

play activities. (3) Often does not seem to listen when spoken to directly. (4) Often does not follow instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions). (5) Often has trouble organizing activities. (6) Often avoids, dislikes, or doesn't want to do things that take a lot of mental effort for a long period of time (such as schoolwork or homework). (7) Often loses things needed for tasks and activities (e.g. toys, school assignments, pencils, books, or tools). (8) Is often easily distracted. (9) Is often forgetful in daily activities.

(B) Six or more of the following symptoms of hyperactivity-impulsivity have been present for at least 6 months to an extent that is disruptive and inappropriate for developmental level: (1) often fidgets with hands or feet or squirms in seat. (2) Often gets up from seat when remaining in seat is expected. (3) Often runs about or climbs when and where it is not appropriate (adolescents or adults may feel very restless). (4) Often has trouble playing or enjoying leisure activities quietly. (5) Is often "on the go" or often acts as if "driven by a motor". (6) Often talks excessively. (7) Often blurts out answers before questions have been finished. (8) Often has trouble waiting one's turn. (9) Often interrupts or intrudes on others (e.g., butts into conversations or games).

Through the National Survey of Children's Health (NSCH), it was indicated that the percentage of children aged 4 to 17 years, with a parent-reported ADHD diagnosis, increased from 7.8% to 9.5% during 2003 to 2007 which represents a 21.8% increase in 4 years. The 7.8% represents 4.1 million and the 9.5% represents 5.4 million children.

Social/Emotional Development

Kids that probably need recess the most are the ones that are losing it. Presently, the trend in many school districts in response to the NCLB Act of 2001 is a reduction in physical outlets and unprogrammed free time. This is done through the elimination and reduction of time for recess, creative arts and even physical education in an effort to focus on reading and mathematics which are evaluated through assessments. Children who come from disadvantaged backgrounds were more likely to not receive scheduled recess at school. These children are more likely to be from lower-income families and from black and Hispanic ethnic groups. This is of great concern based on the idea and evidence that many children from disadvantaged backgrounds are not free to roam their neighborhoods or even their own yards unless they are accompanied by adults. For many of these children, time at recess may be the only opportunity for them to practice their social skills with other children. (Barros, Silver & Stein, 2009).

Physical Exercise And Learning

So far all that has been discussed is the possible effect of mental breaks on learning. However, another dimension to this discussion is how breaks with physical activity affects learning. The most basic thing that exercise does for the brain is to increase oxygen flow to the brain. There are many different cognitive benefits of exercise which lead to better learning. van Praag, Kempermann, and Gage (1999) has done work with mice and the effects of exercise on learning. The study consisted of a comparison between mice that ran an average of three miles on a running wheel and sedentary mice. The mice that did aerobic exercise showed dramatic brain growth, mostly in the

hippocampus, which is the brain region associated with learning and memory. The active mice had a hippocampus that was twice as large as that of the sedentary mice. The brain cells in the aerobic mice could also sustain longer bouts of long-term potentiation, the increased efficiency of communication between neurons that occurs after neurons fire.

These differences in brain development can translate into better learning. The mice that did aerobic exercise performed better on a spatial task. As can be seen, the larger hippocampus improves learning and memory, but why? Research has revealed that aerobic exercise boosts levels of brain-derived neurotrophic factor (BDNF) which is a substance essential for the growth of brain cells, stimulates neurogenesis (the birth of new neurons), mobilizes the expression of genes that are believed to enhance brain plasticity and prevent brain tissue loss in older adults (Cotman & Berchtold, 2002).

It is obviously difficult to do these sorts of studies on humans, for ethical considerations if nothing else, but there have been a few studies that show similar results. On the most basic level, there are a few ways in which physical activity affects the brain. According to Trudeau and Shephard (2008), there are cognitive skills and motor skills that appear to develop through a dynamic interaction. The research has shown that physical movement can affect the brain's physiology by increasing cerebral capillary growth, blood flow, oxygenation, production of neurotrophins, growth of nerve cells in the hippocampus (center for learning and memory), neurotransmitter levels, development of nerve connections, density of neural network, brain tissue volume (Trudeau & Shephard, 2008). So what exactly do all those things do for the brain? These physiological changes may be associated with improved attention, improved information

processing, storage, and retrieval, enhanced coping, enhanced positive affect, and reduced sensations of cravings and pain (Trudeau & Shephard, 2008).

Physical Exercise And Human Development

One study on overweight children found that just 40 minutes a day of aerobic exercise improves executive function. Executive function is a part of intelligence that helps people pay attention, plan, and resist distractions, all needed in order for a person to learn. Ratey (2008) believes that there are nine life benefits to be gained from exercise: "it strengthens the cardiovascular system…it regulates fuel…it reduces obesity…it elevates your stress threshold…it lifts your mood…it boosts the immune system…it fortifies your bones…it boosts motivation…it fosters neural plasticity" (p. 233). Based on Ratey's idea, there are three main factors that explain why and how exercise benefits the brain. "First, exercise increases cellular components which support the brain's systems responsible for learning, decision-making and memory among others. Secondly, exercise improves the environment of the brain cells by releasing hormones, neurotransmitters and activates BDNF, which he calls 'Miracle Gro for the brain' that enhance neural pathways for learning, and other growth factors, making it easier for brain cells to adapt or learn new information. Thirdly, exercise, more than any other fact, grows brain cells, called neurogenesis. More brain cells mean more room for learning" (Casarez, 2010, p. 1).

As discussed earlier, with the implementation of NCLB, schools are decreasing physical activity time and increasing academic instruction to increase test scores. So, what would be expected to happen if a study did the exact opposite, cutting back on

academic instruction and increasing physical play? Trudeau and Shepard (2008) found that academic performance increased as time for physical play increased**.** Other research also shows a high correlation between the physical fitness of children and their cognitive performance. One example of this is a study that measured the brain activity of school age children while participating in a stimulus discrimination task. Children who were physically fit displayed faster reaction times and more extensive processing abilities. The higher level of information processing may translate into the ability to learn more easily (Hillman, et.al., 2005).

Hillman also conducted a study to look at how exercise affects cognitive control, the ability to pay attention. The study was done with nine year old participants. They had the participants do a test following a 20 minute rest period on one day, and on another day, do the test following at 20 minute period of walking on a treadmill. They found that "following the acute bout of walking, children performed better on the task. They had higher rates of accuracy, especially when the task was more difficult. Along with the behavioral effect, they also found that there were changes in their event-related brain potentials (ERPs) – in these neuroelectric signals that are a covert measure of attentional resource allocation" (Hillman, 2009, p. 1050).

School districts and principals are under much pressure to perform well on high stakes tests. Based on a meta-analysis done by the United States Department of Health and Human Services (2010) on the relationship between physical activity and academics, "Collectively, the results suggest that physical activity is either positively related to academic performance (50.5% of the associations summarized) or that there is not a

demonstrated relationship between physical activity and academic performance (48% of the associations summarized). In addition, increasing time during the school day for physical activity does not appear to take away from academic performance. This pattern of having positive relationships or no relationships, along with the lack of negative relationships, was consistent throughout the results" (p. 28). Also, according to the United States Department of Health and Human Services (2010) based on this information, "[s]chool boards, school administrators, and principals can feel confident that maintaining or increasing time dedicated for physical activity during the school day will not have a negative impact on academic performance, and it may positively impact students' academic performance" (p. 28).

Hypothesis

The purpose of the present study is to examine the effect of breaks, with mental and physical activity, on learning. It is predicted that participants will perform better on a cognitive task with a break included, and that a break involving physical activity will produce better results than just a mental break. Though the population of primary interest would be elementary or secondary school students, college students will be used as a sample of convenience. It is thought that similar results should occur, though perhaps not as pronounced as that expected for younger children.

METHOD

Participants

Seventy participants, mainly from psychology department classes, were recruited for this study from the on-campus population of a moderately-sized Midwestern university via independent bulletin board sign-up sheet with multiple available timeslots. The students were aged 18-35 (M = 22.99 years old, SD = 3.43) and were comprised of 38 females (M = 22.42 years old, SD =2.65) and 32 males (M = 23.66 years old, SD = 4.12). The participants also indicated their year in school: freshman (n = 6), sophomore (n = 12), junior (n = 8), senior (n = 22), and graduate students (n = 22); their major area of study: College of Arts & Sciences (n = 51), College of Business and Leadership (n = 2), College of Education & Technology (n = 9), and College of Health and Life Sciences (n = 8); and their Grade Point Average (M = 3.24, SD = .45).

Procedure

Participants met in the designated research room in groups of four to six at their pre-selected time. They were given an informed consent release and reminded that they had to be at least 18 years of age to participate in the study and could withdraw their participation at any time. Participants were then given a written description of what they were going to do and time to read it.

Participants then began the study task. There were three conditions to which participants were randomly assigned based upon the time-slot. Condition 1 was given 20 minutes to study and then another 15 minutes to complete the test sheet with no break at all. Condition 2 was given an initial 10 minutes to study, followed by a 10 minute break

period in which they were given puzzles to work on as a group, followed by another 10 minutes to study, and then finally another 15 minutes to complete the test sheet. Condition 3 was the same as condition 2 except that in the 10 minute break, the group played a beanbag toss game. Upon each group's completion, the participants were debriefed and thanked for their participation.

Materials

There were five demographic questions regarding the participant's age, gender, class year, GPA, and major area of study. An instruction sheet described what each participant would be doing in the study based upon which condition they were randomly assigned. The basic task involved a study sheet with a list of 60 phobias and their definitions. Participants were then given a test sheet that included all 60 of the phobias, but only 45 of the definitions to be matched.

For the mental break condition, a 46-piece Mattel my size XL floor puzzle was used first, and if the participants finished that puzzle, a 32-piece Hasbro kid size floor puzzle was used to occupy the 10-minute break period. The physical break condition used a beanbag that was tossed around to occupy the 10-minute break period.

Research Design

This study utilized a between-subjects design. One independent variable, study condition, was manipulated between three levels: control (no break), mental break, and physical break. There was only one dependent variable: score on an Identify-The-Phobia test. Analysis consisted of a One-Way ANOVA plus follow-up *t*-tests.

RESULTS

A one-way ANOVA was conducted on the phobia definition recall test mean scores between the no break condition ($M = 21.63$, $SD = 10.76$), mental break condition ($M = 34.75$, $SD = 7.32$), and the physical break condition ($M = 19.12$, $SD = 12.71$). The test yielded a significant result, $F(2, 67) = 13.25$, $p < .01$. Follow-up t-tests were conducted to assess all three pairwise combinations. The no break, mental break comparison yielded a significant result, $t(42) = -4.63$, $p < .01$; the no break, physical break comparison did not yield a significant result, $t(48) = 0.75$, $p > .05$; and the mental break, physical break comparison yielded a significant result, $t(41.14) = 5.24$, $p < .01$.

An independent-samples t-test was also conducted between male scores ($M = 19.59$, $SD = 12.14$) and female scores ($M = 28.53$, $SD = 11.41$), yielding a significant result, $t(68) = -3.17$, $p < .01$. As is shown in Figure 1, the average test scores for both male and female participants were highest in the puzzle (mental break) condition, Furthermore, *post hoc* analysis of the data yielded significant results when the participants were divided into two new groups: psychology majors ($n = 27$) and non-psychology majors ($n = 43$). Utilizing this variable, a Two-Way ANOVA showed that an interaction existed between the participant's condition and whether or not they were a psychology major, $F(2, 64) = 3.74$, $p < .05$. As shown in Figure 2, psychology majors achieved higher scores on the test in both the puzzle (mental break) and bean bag (physical break) conditions.

Figure 1. Male vs. Female Scores Across Test Conditions.

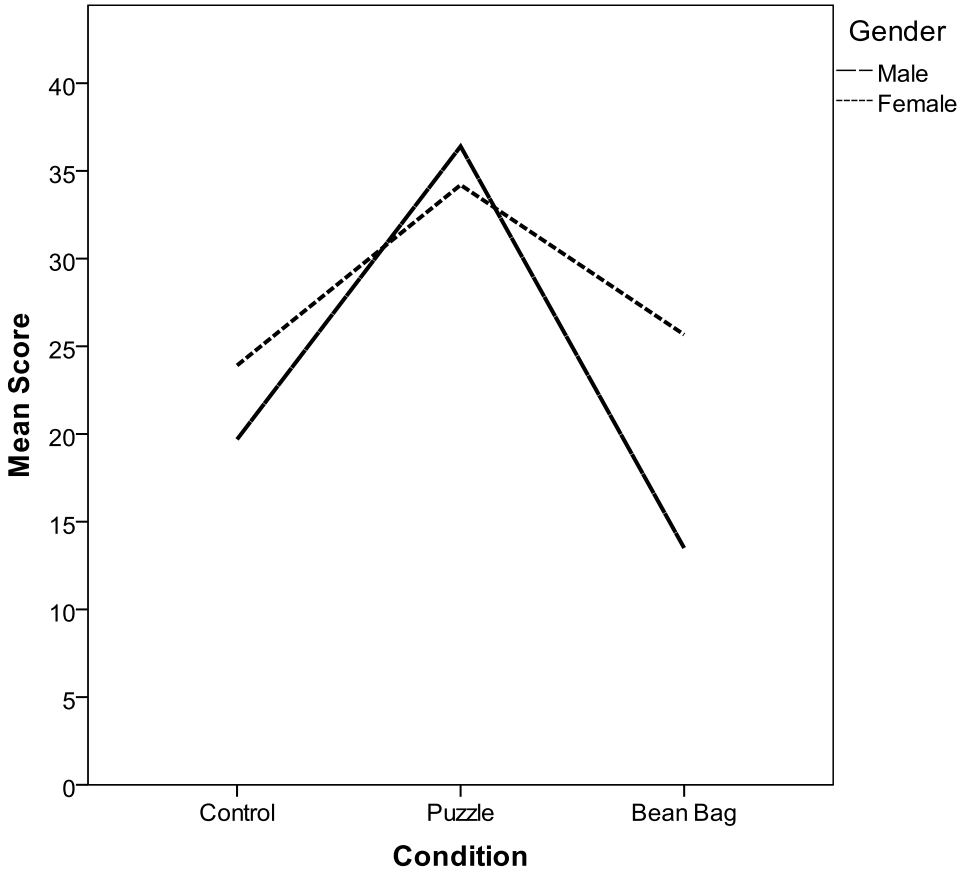
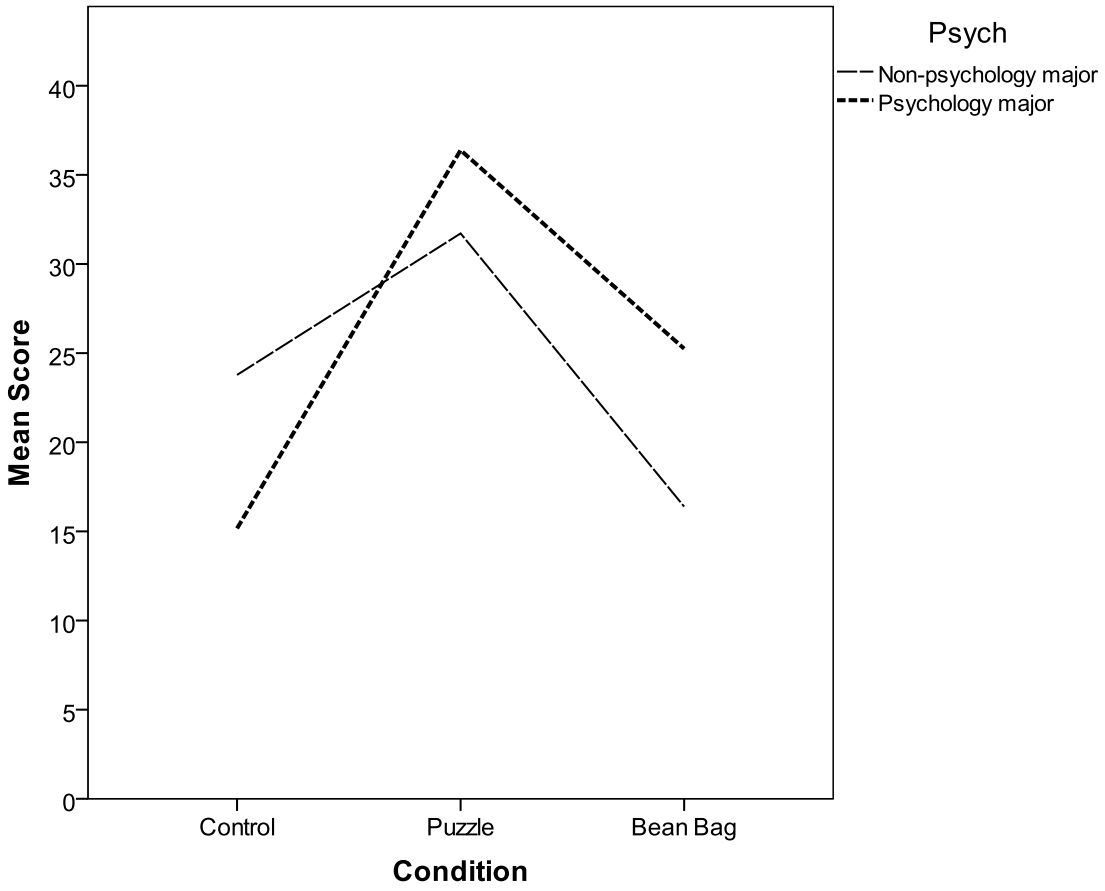


Figure 2. Psychology Major vs. Non-Psychology Major Scores Across Test Conditions.



DISCUSSION

The hypothesis that study breaks enhance learning was only half supported. Participants in the mental break condition had significantly higher scores on the phobia definition test than did the control group. However, the results for those in the physical break condition were about the same as the control group. This leads to a lot of questions. In trying to understand these results, post hoc tests were run. Two two-way interactions were discovered, study condition with sex and study condition with major (psychology versus non-psychology).

For some reason, women generally did better on the phobia test than men. As it turned out, there was an uneven sampling between the three conditions in regards to sex. More women were randomly assigned to the puzzle condition, which also had the highest test scores. This makes it difficult to know what was the causal factor affecting test score, sex or study condition.

A partial explanation for this may come from an observation made by the experimenter that the men seemed to be much more competitive in the distraction task than the women, especially in the bean bag hot potato game. Perhaps men got so much more into the distraction task that it interfered with learning. One very competitive male participant observed during the hot potato game stated that when he sat back down to study for the second 10 minute interval that he did not want to study anymore because he could not concentrate after playing the game. In the future, it may be a good idea either to make the physical break task less competitive or to include different distraction tasks as a separate factor (competitive and non-competitive) to eliminate this confound.

A second possible confounding factor was that psychology majors performed better on the phobia test on the average than non-psychology majors. This may be related to the idea of expert versus novice. Larkin et al. (1980) has stated that, "experts solve complex problems considerably faster and more accurately than novices do" (p. 1335). Psychology majors could be seen as relative experts in this study because they have been exposed to the concept of phobias in the past. This type of material could be easier for the psychology majors to learn and they may be able to learn it in a shorter amount of time.

To eliminate these problems in the future, both of these factors would have to be better balanced across the test conditions. That is, there would have to be exactly the same number of males and females and psychology and non-psychology majors in each condition. An alternate approach might be to have a study task that was equally new for everyone and distraction tasks that were equally distracting for everyone.

With hindsight, other problems became evident with the distraction tasks. The control condition was quiet and the participants worked independently on the task and test. By observation, it was seen that participants in the puzzle condition did not communicate with each other. The room was silent for the most part except for the occasional question related to the puzzle. However, in the hot potato distraction condition, participants listened to music as part of the game, music with lyrics. Therefore, not only was this particular physical break condition louder than the other two conditions but the noise involved words. Participants in this condition also were observed to be more talkative with each other, with the conversation usually about music, movies, and

celebrities. None of the conversations were related to the phobias. Any verbal interference and related thinking was far more likely to interfere with a verbal learning task than a silent visual task such as placing pieces in a puzzle. In a future study, it would be appropriate to play the same music during all three of the conditions to eliminate that as a possible problem. Participants could also be asked to not talk at all during the study to eliminate that as a possible source of distraction. It also might be a good idea to include several different types of distraction task in either break condition.

Another way to gain better control in any follow-up study would be to do a within-participant design in which each participant does all three conditions. Counterbalancing the order in which conditions were experienced would have to be used to eliminate practice and fatigue effects. Different study task would also have to be used for the three different conditions, and would also have to be counterbalanced between participants. This study in the future would benefit from having more participants in each group to see a bigger effect of each condition across all three.

Study Limitations

There are a number of limitations within this study that need to be acknowledged. Adult college students were used as participants. Some studies have shown that adults and children do learn in a similar manner and have similar cognitive capacity for learning. It is, however, unknown if college students are truly comparable to elementary school children in this way. As adults have longer attention spans than children, the

positive effect that was found within this study with adults would likely be the same effect that would be found in a population of children.

Another limitation is the actual task used in the study. The short-term learning of phobias does not represent the more realistic long-term learning of material that is lasting over time. It may simply be memorization. Also, the learning task may be too simplistic for a population of college students. There was also a limitation of knowing how much of a break is needed after what duration of studying. The task that was used was kept short and may not have pushed the participants to their cognitive capacity.

Also, the break activities themselves may be too simplistic to produce a positive difference between the mental and physical break tasks. It may be that only long-term physical activity can show the brain-changing effects of physical exercise. Perhaps running on a treadmill for 10 minutes or until reaching a certain heart rate level would be more appropriate. On the other hand, participants almost turned into children while playing the hot potato bean bag game. Fun and novelty may have to be considered as factors as well as just degree of physical activity.

As can be seen with this study, the possible positive effects of physical exercise were not seen and the effects were even negative for many individuals. In this study the participants were asked to participate in the hot potato game and then immediately stop and go back to work studying. This was a fast transition from an exercise break back to studying. In many classroom settings there is a longer transitional cool down period. Students after recess usually line up and then walk in and get a drink then go into the

classroom and sit down and get ready to work again. There is usually around a 5 minute transition time to get the student reengaged and get their mindset from the playground to the classroom.

This leads into where to go next with a follow up study. The next study would ideally occur in the school system with school-aged children as participants and age appropriate learning and break activities. For example, for an early elementary school-age child, coloring would be an appropriate mental break and playing tag an appropriate physical task. This would eliminate the uncertainty of focus and attentional differences between adults and children. Also, it would be a good idea to implement a cool down period between the physical activity and going back to studying because that represents the real classroom environment.

Study Implications

All breaks do not seem to be created equally. Based on this study, a simple changing of mental task seems to be enough of a break to produce cognitive benefits. In the educational system, this would mean that students should be given short mental breaks during cognitively demanding tasks. Results are more problematic for breaks involving physical activity. The results found here imply that breaks that are too absorbing or that perhaps involve distractions related to the school material to be learned can be detrimental to the learner.

These findings have implications for the current and future education system. If the education system continues to move in the same direction as it has since the

implementation of NCLB, there could soon be no breaks in the school day to maximize time in the classroom to meet state and federal standards. Schools have made a paradigm change in which the only thing they are concerned with is time on task and have not considered the benefits of other school activities and the importance of breaks. This lack of break time and more time spent sitting in the classroom may actually hinder children and hold them back from reaching the goals of NCLB. Though counterintuitive, more time spent in the classroom may actually result in lower test scores.

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APPENDIX A

INFORMED CONSENT

CONSENT TO PARTICIPATE IN RESEARCH

Department of Psychology Fort Hays State University

Study title: **Test Performance and Study Breaks**

Name of Researcher: Lori McGinley

Contact Information: 785-493-2979, lemcginley@scatcat.fhsu.edu

Name of Faculty Supervisor & Contact Information, if student research: Dr. Stephen Kitzis

You are being asked to participate in a research study. It is your choice whether or not to participate.

Your decision whether or not to participate will have no effect on benefits or services the quality of your care, academic standing, job status, etc. to which you are otherwise entitled. Please ask questions if there is anything you do not understand.

What is the purpose of this study ?

As the culture of American education changes, recess time is declining in favor of instruction time. An important question, however, is whether this shift is truly going to yield the best learning outcomes? The purpose of this study is to examine the effect of taking a break, both mental and physical, on test performance. One hundred college students will be tested on their learning of a list of phobias that they had studied in one of three conditions: no break, mental break, and physical break. It is predicted that participants will perform better on a test of memory when a break is included, and that a break involving physical activity will produce better results than a mental break alone. College students will be used as a sample of convenience instead of elementary school children. Other research has shown that the memory and attention span is relatively constant after age 5, so an appropriately engaging cognitive task with college students will be analogous to the kinds of attention and memory loads that elementary school children encounter on a day-to-day basis in school.

What does this study involve ?

In this study you will be asked to read and sign the informed consent, complete a short demographic data form, and then read a short description of what will occur during the study. After this introduction, you will begin the study period. You will be provided with a study sheet that has a list of 60 phobias and their definitions. You can be assigned to either:

(a) the no break condition, where you will study the phobia definitions for 20 minutes followed by a 15 minute time period to complete a phobia definition matching test; or

(b) the mental break condition, where you will study for 10 minutes, followed by a 10 minute break in which the entire group will work on a 46 piece floor puzzle, followed by another 10 minute study period of the same phobia definitions and then a fifteen minute time period to complete the matching test; or

(c) the physical break condition, where you will study for 10 minutes, followed by a 10 minute break in which the entire group will play a hot potato bean bag toss game (bean bag will be tossed from person to person in a circle for thirty seconds until the person holding the bag is out, continued until only one person is left), followed by another 10 minute study period of the same phobia definitions and then a 15 minute time period to complete the matching test.

During the break time, please do not speak to the other participants about the phobias, just enjoy the break. The study then will close with a debriefing period in which a debriefing statement will be given to you and any remaining questions you might have will be answered. After completion of the study, a certificate will be given to you to show completion of participation in the research project.

If you decide to participate in this research study, you will be asked to sign this consent form after you have had all your questions answered and understand what will happen to you. The length of time of your participation in this study will be up to 45 minutes. Approximately 100 participants will be in this study.

Are there any benefits from participating in this study ?

There will be no benefits to you should you decide to participate in this study other than the receipt of class research credit or extra credit at the discretion of your instructor. You will receive a certificate at the completion of the study to prove that you completed the research. The benefit to the discipline could be a small addition to the field of education in terms of helping to shape educational practices.

Will you be paid or receive anything to participate in this study ?

No. However, you will receive research credit or extra credit if your class instructor allows it. You will not receive any compensation if the results of this research are used towards the development of a commercially available product.

What are the risks involved with being enrolled in this study ?

It is unlikely that participation in this project will result in harm to participants. Sometimes talking about these subjects (phobias) may cause people to be upset. You do not have to talk about any subjects you do not want to talk about, and you may stop participating at any time. If you feel distressed or become upset by participating, please contact the *Kelly Center, 785-628-4401.*

How will your privacy be protected?

Efforts will be made to protect the identities of the participants and the confidentiality of the research data used in this study. There will be no place for names on the study sheet or test. No responses can ever be traced back to any individual participant. The test results will be kept separate from the signed informed consent forms. Information will be erased after the study has been concluded and the completed tests will be destroyed. Access to all data will be limited to the researcher and faculty advisor. Numeric coding of research data will be used on the electronic files of test results so test scores can not be traced back to the participant.

The information collected for this study will be used only for the purposes of conducting this study. What we find from this study may be presented at meetings or published in papers but your name will not ever be used in these presentations or papers.

Other important items you should know:

• **Withdrawal from the study:** You may choose to stop your participation in this study at any time. Your decision to stop your participation will have no effect on your receiving class credit.

• **Funding:** There is no outside funding for this research project.

Whom should you call with questions about this study ?

If you have questions, concerns, or suggestions about human research at FHSU or specific questions about this particular study, you may call the Office of Scholarship and Sponsored Projects at FHSU (785) 628-4349 during normal business hours. You may also contact Dr. Janett Naylor, Chair of the Psychology Department Ethics Committee, 785-628-5857, jmnaylor@fhsu.edu.

CONSENT

I have read the above information about *Test Performance and Study Breaks* and have been given an opportunity to ask questions. By signing this I agree to participate in this study and I have been given a copy of this signed consent document for my own records. I understand that I can change my mind and withdraw my consent at any time. By signing this consent form I understand that I am not giving up any legal rights. I am 18 years or older.

_____

Participant's Signature and Date

APPENDIX B

DEBRIEFING STATEMENT

DEBRIEFING STATEMENT

The purpose of this research is to examine the possible relationship between taking breaks during studying and learning material, and whether taking a physical break is more effective then taking a mental break.

In this study there were three different conditions:
(a) the no break (control) condition in which participants studied for 20 minutes followed by a 15 minute time period to complete a matching test.

(b) the mental break condition, in which participants studied for 10 minutes, followed by a 10 minute break in which the group worked on a 46 piece floor puzzle, followed by another 10 minutes of study and a 15 minute time period to complete a matching test.

(c) the physical break condition, in which participants studied for 10 minutes, followed by a 10 minute break in which the group played a hot potato bean bag toss game, followed by another 10 minutes of study and a 15 minute time period to complete a matching test.

The idea behind this thesis was that participants taking a break during studying would perform better on the test than those that did not have a study break, and that the participants taking a physical break and playing hot potato would perform the best. Though this study was done with college students, the main purpose was to demonstrate the usefulness of recess and other break times for learning in primary and secondary education.

This study was dealing with phobia definitions and the learning of new material. If you are feeling personal discomfort, please contact a professional at the Kelly Center on campus (phone number 1-785-628-4401). If you have any questions about your rights as a research participant, please contact Dr. Janett Naylor (jmnaylor@fhsu.edu), Chair of the Psychology Department Ethics Committee, or Leslie Paige (lpaige@fhsu.edu), Chair of the University Institutional Review Board

If you would like a summary of results emailed to you once the study is complete, please enter your email address below:

_____

Thank you very much for your participation in this study.

APPENDIX C

STUDY MATERIALS

Phobia Name	Phobia Definition
Acerophobia	Fear of Sourness
Agrizoophobia	Fear of Wild Animals
Alektorophobia	Fear of Chickens
Alliumphobia	Fear of Garlic
Amathophobia	Fear of Dust
Anablephobia	Fear of Looking Up
Anemophobia	Fear of Wind
Anthophobia	Fear of Flowers
Antlophobia	Fear of Floods
Apeirophobiea	Fear of Infinity
Aulophobia	Fear of Flutes
Barophobia	Fear of Gravity
Batonophobia	Fear of Plants
Bromidrophobiea	Fear of Body Smells
Catoptrophobia	Fear of Mirrors
Chremetophobia	Fear of Money
Clinophobia	Fear of Going to Bed
Deipnophobia	Fear of Dining/Dinner Conversations
Dikephobia	Fear of Justice
Domatophobia	Fear of Houses/Being in Homes
Eleutherophobia	Fear of Freedom
Epistemphobia	Fear of Knowledge
Geliophobia	Fear of Laughter
Genuphobia	Fear of Knees
Geumophobia	Fear of Taste
Hippophobia	Fear of Horses
Homichlophobia	Fear of Fog
Hygrophobia	Fear of Liquids/Moisture
Hypegiaphobia	Fear of Responsibility
Kainolophobia	Fear of Novelty
Kathisophobia	Fear of Sitting Down
Lachanophobia	Fear of Vegetables
Leukophobia	Fear of the Color White
Lutraphobia	Fear of Otters
Macrophobia	Fear of Long Waits

Mageirocophobia	Fear of Cooking
Myxophobia	Fear of Slime
Nelophobia	Fear of Glass
Nephophobia	Fear of Clouds
Nostophobia	Fear of Returning Home
Ochophobia	Fear of Vehicles
Oenophobia	Fear of Wines
Orthophobia	Fear of Property
Pagophobia	Fear of Ice/Frost
Pentheraphobia	Fear of Mother-In-Law
Phronemophobia	Fear of Thinking
Plutophobia	Fear of Wealth
Pohphyrophobia	Fear of the Color Purple
Pteronophobia	Fear of Being Tickled by Feathers
Ranidaphobia	Fear of Frogs
Rhytiphobia	Fear of Getting Wrinkles
Sciaphobia	Fear of Shadows
Scoleciphobia	Fear of Worms
Sinistrophobia	Fear of Things to the Left
Teutophobia	Fear of Germans/German Things
Trichophobia	Fear of Hair
Vestiphobia	Fear of Clothing
Vitricophobia	Fear of Step-Father
Xanthophobia	Fear of the Color Yellow
Xylophobia	Fear of Wooden Objects

APPENDIX D

TEST

PLEASE MATCH THE PHOBIAS TO THEIR CORRESPONDING DEFINITIONS.
PUT THE PHOBIA NUMBER ON THE LINE NEXT TO IT'S DEFINITION.

A. Fear of Wealth _____
B. Fear of Sourness _____
C. Fear of Knees _____
D. Fear of Worms _____
E. Fear of Cooking _____
F. Fear of Garlic _____
G. Fear of Wines _____
H. Fear of Mirrors _____
I. Fear of Novelty _____
J. Fear of Step-Father _____
K. Fear of Slime _____
L. Fear of Floods _____
M. Fear of Knowledge _____
N. Fear of Dust _____
O. Fear of Clouds _____
P. Fear of Responsibility _____
Q. Fear of Body Smells _____
R. Fear of Sitting Down _____
S. Fear of Long Waits _____
T. Fear of Otters _____
U. Fear of Flowers _____
V. Fear of Chickens _____
W. Fear of Shadows _____
X. Fear of Glass _____
Y. Fear of Thinking _____
Z. Fear of Taste _____
AA. Fear of Flutes _____
BB. Fear of Plants _____
CC. Fear of Wind _____
DD. Fear of Vehicles _____
EE. Fear of Frogs _____
FF. Fear of Clothing _____
GG. Fear of Property _____
HH. Fear of Infinity _____
II. Fear of Freedom _____
JJ. Fear of Horses _____
KK. Fear of Gravity _____
LL. Fear of Laughter _____
MM. Fear of Vegetables _____
NN. Fear of Money _____
OO. Fear of Looking Up _____
PP. Fear of Hair _____
QQ. Fear of Justice _____
RR. Fear of Fog _____
SS. Fear of Ice/Frost _____

1. Acerophobia
2. Agrizoophobia
3. Alektorophobia
4. Alliumphobia
5. Amathophobia
6. Anablephobia
7. Anemophobia
8. Anthophobia
9. Antlophobia
10. Apeirophobiea
11. Aulophobia
12. Barophobia
13. Batonophobia
14. Bromidrophobiea
15. Catoptrophobia
16. Chremetophobia
17. Clinophobia
18. Deipnophobia
19. Dikephobia
20. Domatophobia
21. Eleutherophobia
22. Epistemphobia
23. Geliophobia
24. Genuphobia
25. Geumophobia
26. Hippophobia
27. Homichlophobia
28. Hygrophobia
29. Hypegiaphobia
30. Kainolophobia
31. Kathisophobia
32. Lachanophobia
33. Leukophobia
34. Lutraphobia
35. Macrophobia
36. Mageirocophobia
37. Myxophobia
38. Nelophobia
39. Nephophobia
40. Nostophobia
41. Ochophobia
42. Oenophobia
43. Orthrphobia
44. Pagophobia
45. Pentheraphobia
46. Phronemophobia
47. Plutophobia
48. Pohphyrophobia
49. Pteronophobia
50. Ranidaphobia
51. Rhytiphobia
52. Sciaphobia
53. Scoleciphobia
54. Sinistrophobia
55. Teutophobia
56. Trichophobia
57. Vestiphobia
58. Vitricophobia
59. Xanthophobia
60. Xylophobia