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We suggest that the overall text be referenced in this fashion:


Individual chapters may be referenced in this fashion:

Promoting Psychological Science
A Compendium of Laboratory Exercises
For Teachers of High School Psychology

Edited by: Richard L. Miller

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Promoting Psychological Science
A Compendium of Laboratory Exercises for Teachers of High School Psychology

Introduction

Background & Purpose

While psychology appeared occasionally as part of the high school curriculum as early as the late 1800s, and more frequently since the 1920s, the original focus was on the study of the mind and mental hygiene. Since then there has been an increasing emphasis on the scientific underpinnings of the field with a growing number of students, approximately a million a year, graduating each year after having taken a high school course in psychology.

In the summer of 2017, in recognition of the increase in the number of high school psychology courses and students, the American Psychological Association convened a summit on high school psychology education. The purpose of the summit was to explore ways to:

1. Strengthen the value of psychological science through the teaching of high school psychology,
2. Strengthen the delivery and assessment of psychological science through the teaching of high school psychology, and
3. Strengthen the reach of psychological science through the teaching of high school psychology.

The need to address these goals was driven in part by the perception that psychology’s status as a science is often questioned by the public. Its findings are sometimes viewed with skepticism because of a failure to understand that psychological research shares defining scientific characteristics with other sciences. This misunderstanding compromises the acceptance of psychological science as a source of solutions to personal, interpersonal, and societal issues that arise from problematic thought and behavior and as a source of fundamental knowledge about thought and behavior.

It is important that our students understand that whether a discipline is or is not a science is determined by its method of investigation, not what it studies. All sciences use the empirical method, which emphasizes objective and precise measurement. With this criterion in mind, it is clear that psychology is a science and the purpose of the e-book is to provide teachers with the tools to engage their students in empirical investigations.

The recommendations coming from the Summit include the following:

- High school psychology standards should parallel high school standards for other science courses, including, for example, development of critical thinking skills, knowledge of the strengths and weaknesses of various research methods, awareness of how psychological concepts can be applied to behavior.
- High school psychology courses should teach scientific methods and science-based content whether they are housed in the Science Department or the Social Studies/Science Department.
High school psychology qualifies as a STEM discipline as determined by both the National Science Foundation and U.S. Customs Immigration and Enforcement (and others) and should be recognized as such.

High school psychology teachers deserve adequate pre-teaching and professional development opportunities to allow them to teach a science-based course that reflects contemporary perspectives and topics in the discipline.

To address some of the recommendations to strengthen high school psychology curriculums, an American Psychological Association (APA) Summit on High School Psychology Education was held in July 2017 at Weber State University in Ogden, Utah. The Summit’s Working Group or Strand 1 (Psychology as Science) was charged with creating a template that would provide high school teachers of psychology with lab exemplars. The rationale for this is that other science classes taught in high schools generally include lab instruction and this often forms the public’s basis for considering what is and what is not a science. To facilitate this goal, the Society for the Teaching of Psychology has assembled this e-book that provides lab exercises for most of the topics taught in a high school psychology course. The exercises were created by a dedicated group of high school and college teachers. Each of the exercises provides students with the opportunity to plan and carry out investigations utilizing laboratory procedures just as would occur in biology, chemistry, and physics courses, including suggestions for data analysis and the preparation of lab reports.

To facilitate this goal, the Society for the Teaching of Psychology has assembled this e-book that provides lab exercises for most of the topics taught in a high school psychology course. The exercises were created by a dedicated group of high school and college teachers. Each of the exercises provides students with the opportunity to plan and carry out investigations utilizing laboratory procedures just as would occur in biology, chemistry, and physics courses, including suggestions for data analysis and the preparation of lab reports.

**Organization of the Book**

**Chapter 1: Critical Thinking**

*Randi Shedlosky-Shoemaker* and *Ron Shapiro* have created four lab exercises to examine critical thinking. The first is on Conjunction Fallacy, which allows all students to experience a demonstration of the conjunction fallacy and discuss more broadly how contextual information can influence decision-making. The second lab is on Language Bias, which allows students to practice identifying errors in news stories related to psychological phenomena by employing critical thinking. The third lab is entitled “Fake News in the World of Psychology.” This lab allows students to practice identifying errors in news stories related to psychological phenomena by employing critical thinking. The final lab is called “Find the Present,” which illustrates the importance of selecting an optimal strategy in solving problems. Additionally, it provides students an opportunity to develop instructional materials designed to help people solve problems and will provide experience testing the materials.

**Chapter 2: Biological Bases**

*Suzanne Sollars* has contributed two labs that explore the biological bases of behavior. The first lab is on Structure/Function Relationships within Sensory Systems. In this lab, students examine the way in which individual differences in anatomical structures can influence how the system functions. In this lab, students will
test taste intensity of salt and sugar solutions, quantify fungiform papillae (an indirect measure of the number of taste buds), and determine the correlation between the number of fungiform papillae and taste intensity ratings. Dr. Sollars second lab is on the Modification of Sensory Receptor Structure and Function, which provides students with an understanding of how modification in cellular function may lead to changes in sensory perception.

Chapter 3: Consciousness

Joe Swope and John Mohl created three labs that explore human consciousness. The first is on Task Switching, which allows students to explore their own experiences as they work through task-switching exercises and non-task-switching exercises. This lab will also allow students to observe others and record data regarding other’s performance on such tasks. Their second lab is on Hypnotic Suggestibility, during which students explore personal suggestibility experiences while recording observable suggestibility indicators. The final lab on Consciousness examines Sleep. The concept behind this lab is twofold. The first is to investigate aspects of sleep that might relate to the feeling of being rested upon waking. The second is to investigate the concepts related to gathering and analyzing data. Because this lab asks students to collect quite a bit of data, there is ample room for discussion of how this lab’s research design might be changed.

Chapter 4: Developmental Psychology

Krisztina Jakobsen and Tina Athanasopoulos created six lab exercises that explore human development. The first is on Cognitive Development, which requires students to collect and present data on Jean Piaget’s Cognitive Developmental Stages. The second lab explores Language Development and requires students to collect and present data on the language development of children and to interpret the data using both the operant learning (Skinner) and nativist perspectives (Chomsky). The third lab is on moral development. In this lab students discuss moral decisions with their peers and apply Lawrence Kohlberg’s Moral Development Theory. The lab on Parenting Styles requires students to collect data on parenting styles, to characterize them as authoritarian, authoritative, or permissive and to reflect on why a someone might parent a specific way. The lab on Product Evaluation requires students to evaluate the BabyPlus product and develop a method to evaluate its effectiveness. Finally, the lab entitled “Understanding the Complexities of Development” provides students with the opportunity to demonstrate understanding of the ways in which physical, cognitive, and social aspects of development interact.

Chapter 5: Sensation & Perception

Steven Turner and Ron Shapiro have created two labs to explore sensation and perception. The first lab is on the Location of Cones and Rods that assists students with understanding the relationship between environmental stimuli and experienced perception. In performing this lab, students will see the physical limitations of visual sensory processing. The second lab, “Did You Answer My Question?” illustrates the importance of interpretation of a question in responding. Additionally, it provides an opportunity to discuss critical thinking in the context of sensation and perception.

Chapter 6: Cognition

Four labs that explore cognition were created by Amy C. Fineburg and Suzanne C. Baker. The first lab is on Cognitive Biases. In this lab, students collect data that demonstrate common cognitive biases. At the end of the lab, students should be able to: Understand various cognitive biases; identify factors that can influence responses to surveys and questionnaires; summarize data and calculate descriptive statistics; and explain the
cognitive processes underlying their results. The second lab is on Creativity and Divergent Thinking. Students will discuss variables that may relate to creativity and divergent thinking and will collect data on divergent thinking under multiple conditions. The third lab is about Framing Decisions and allows students to discuss the concept of framing and how it applies to decision-making experiences. The final lab is on Confirmation Bias and Custody Decisions. Students in this lab will discuss the concept of confirmation bias and how it applies to decision-making experiences.

Chapter 7: Learning

Garth Neufeld, Kiersten Baughman, Stephanie P. da Silva, and Elyse Hall have created six labs that explore issues in learning. The first is on Classical Conditioning in which students experience classical conditioning firsthand. The second lab provides an opportunity to test students’ understanding of classical Discrimination and Generalization. The third lab addresses operant conditioning and allows students to analyze how operant conditioning principles affect their everyday lives. They will plan and carry out an observational study on their own behavior on popular cell phone applications. The fourth lab provides students with the opportunity to witness the main schedules of reinforcement and test their understanding of principles of operant conditioning. The fifth lab is entitled “Negative Reinforcement and Positive Punishment. In this lab, students will engage in an exercise to help them differentiate and implement negative reinforcement and positive punishment processes/procedures. This lab can be demonstrated (with cooperation) on a fellow lab mate, or it can be done as a genuine training exercise on a pet, small animal in the lab (e.g., lizard, hamster, etc.). The final lab in this section addresses habituation and sensitization. In this lab, students will learn about habituation/sensitization, the simplest form of learning, and how to test and measure it. They also will explain their test to others.

Chapter 8: Memory

Leah Greene and Kristin Habashi Whitlock have created six lab exercises that address principles of learning. In the first, students will learn about confabulation as it relates to schemas. Through this lab, students test if exposure to a themed list of terms will lead to confabulation in recall. The second lab examines how rehearsal prevention can affect short-term memory. The lab exercise allows students to apply the Atkinson-Shiffrin multi-store memory model and compare recall with and without rehearsal. The third lab addresses the issue of multitasking and its effect on the ability to recall material. In the fourth lab, students will examine the effects of depth of processing on memory. The fifth lab examines the effects of organizing material on memory and the final lab in this section allows students to explore the peg-word mnemonic and its impact on memory improvement.

Chapter 9: Intelligence

The five lab exercises created by Anthony E. Coy and Bill Acker explore a variety of topics related to Intelligence. The first lab allows students to explore various theories of intelligence while providing an in-depth analysis of how one person they find successful/admirable defines their own intelligence/success. The second lab examines theories of intelligence and how psychologists measure intelligence. The third lab provides students with the opportunity to explore the relationship between head size and intelligence in both animals and humans. In the fourth lab, students will explore the heritability of intelligence and how genetic factors and environmental factors interact. The final lab exercise in this section allows students to explore the effects of culture on IQ testing.
Chapter 10: Motivation & Emotion

In the first lab exercise created by Deborah Brihl and Michalene Grebski, students are asked to identify facial expressions and in the second to examine the pop-out effect. The third exercise explores facial feedback theory. The fourth lab in this section addresses issues of correlation and confounding variables in the context of music and emotion. The fifth lab provides students with the opportunity to explore gender issues using the Masculinity/Femininity scale of the Personal Attribute Questionnaire created by Spence and Helmreich. The sixth lab addresses the need for achievement and allows students to explore their own motivation.

Chapter 11: Personality

Manyu Li, Jennifer Fayard, D. Lisa Cothran, and Lyra Stein have created six lab exercises on personality. The first allows students to think about the conceptual difference between traits and typology using both the Big 5 and Myers-Briggs. The goal of the second lab is to guide students to conduct a case study of people outside their social/cultural groups in the form of an interview. Through the interview, students will understand what cultural identity is and how people from another cultural group may have a distinct cultural identity and different perceptions. The third lab examines the role of biological differences in personality, specifically introversion-extraversion. In the fourth lab, on adjustment, students will conduct a self-assessment of life challenges and stresses that they are currently experiencing. The goal of this lab is to help students identify sources of stress due to adjustment and discuss ways to cope with the stress. The fifth lab is on identity crisis and identity commitment. In this lab, students will explore personal accounts of the process of identity crisis and commitment via an interview process. The final lab explores self-other agreement in personality or how do others view you and are they right? Specifically, they will examine self- and other-ratings on the Big Five.

Chapter 12: Abnormal

The three lab exercises on abnormal psychology were created by Virginia Welle, Natasha Alston, and Rachael Reavis. The first is about students’ beliefs regarding substance abuse disorders. This lab allows students to collect, organize, and interpret correlational data regarding attitudes toward substance use disorders and their treatment. The second lab addresses the impact of diagnostic labels and allows students to participate in an experiment on the biasing effects of diagnostic labels. The third lab, entitled “YouTube & Psychopathology” is designed to teach students about the role of social media in psychopathology, while giving them experience with coding and calculating inter-rater reliability.

Chapter 13: Social Psychology

Virginia Welle, Natasha Alston, and Rachael Reavis have created two lab exercises about social psychology. The first exercise is on helping behavior. During this lab, students will design and carry out an experiment on helping behavior. The second lab exercise requires students to formulate scientific questions about behaviors associated with environmental sustainability and group dynamics and to use naturalistic observation to investigate.

The third lab is on confirmation bias and was created by Kevin Grobman. By demonstrating the confirmation bias, students discover that even those capable of sophisticated reasoning are nevertheless prone to reasoning errors. Students should be able to recognize how confirmation bias plays a role in the world around them, how people share information on social media, and why people like to watch news sources with particular political leanings.
Chapter 14: Therapy

David Topor and Julia Huston created a lab exercise on therapy entitled “Behavioral Treatment for Anxiety.” In this lab, students identify their own body sensations and experience a relaxation exercise to reduce feelings of anxiety and tension. Claire Burgess and David Topor created a second lab that will aid students in understanding the relationship between thoughts, feelings, and behaviors. Students may be able to apply this knowledge to their own life and conceptualize patterns of thinking/behaviors for themselves.

Chapter 15: Health

Six lab exercises on health were created by Kimberlee Bethany Bonura and Nina L. Dulabaum. The first exercise is on mindfulness and physiological arousal. The second lab addresses posture and wellbeing and allows students to learn the psychological effect of physical posture on psychological health; to try a brief posture intervention first-hand; and to discuss potential benefits of deliberately working on physical posture in their lives. The third lab addresses the relationship between exercise and psychological health. The fourth lab challenges students to research and critically assess levels of stress in their lives and lives of others, and the impact this may have. The fifth lab is entitled “Nutrition and Health” and provides students with the opportunity to write scientific questions about their peers’ eating habits, and to research, critically compare and contrast their data with dietary guidelines from reputable sources. The final lab addresses habits for successful students. In this lab, students will be challenged to address the choices students make that impact their success as a student.

Chapter 16: Research Methods

Charlie Blair-Broeker and Steve Foley have created two lab exercises to help students understand research methods. The first is entitled “Does Random Look Random?” and is designed to increase students’ understanding of why randomness is important in both sampling and assignment of participants. The second lab, “Everyone Knows what a Smile Is. Right?” helps students understand what operational definitions are and why they are important in research.

Acknowledgements

First, I want to acknowledge the work done by the participants in the APA Summit, on High School Psychology Education with special thanks to Eric Amsel and his colleagues at Weber State University who hosted the Summit, and Amy Fineburg and Randy Ernst who co-chaired the Summit. For this e-book, our authors used an early draft of the lab exercises template that Annette Nielsen and Natasha Alston, members of “Strand 1” at the Summit developed. The final version of that template will be made available by APA and can be used to create lab exercises on any topic. The other members of Strand 1 were: Bernard Beins, Suzanne Baker, Charles Blair-Broeker (Co-Chair), Daniel Rozanas, Rachel Wang, and Kristin Whitlock (Co-Chair). Without the efforts of all of the members of the group, this lab manual would not have been possible.

I also want to express my appreciation to Anthony Martinez, my Graduate Teaching Assistant for his invaluable assistance in helping format the e-book. Finally, I especially want to thank our authors for their generous and thoughtful contributions to this e-book. The authors have had firsthand experience in teaching and writing about
psychology. The goal is that the high school teacher will be able to use the materials in this e-book in a very practical way to engage students in empirical investigations. I hope you will find that this book achieves its goal.
Section I
Critical Thinking

1. Conjunction Fallacy
2. Language Bias
3. Fake News in the World of Psychology
4. Find the Present
Lab Title: Examining Conjunction Fallacy

Adapted from/References:

See also:

Section 1: Performance Expectations

What will the student be asked to do?
- Analyze data
- Plan and/or carry out a scientific investigation
- Communicate information in a written report

Main Idea/Concept Demonstrated or Taught by Lab:
This lab allows all students to experience a demonstration of the conjunction fallacy and discuss more broadly how contextual information can influence decision-making.

After concluding this lab, students should be able to:
- Describe how the conjunction fallacy can impact decision-making related to probability.
- Create a graphical representation of quantitative data.

Key Terms and Psychologists Associated with Main Idea/Concept:
Conjunction fallacy (Tversky & Kahneman, 1982), Representativeness heuristic, Stereotypes

Materials:
The lab will require two handouts. The first handout (which will go to half of the students in the class) should have the following “context-free” instructions:

Identify which outcome is most likely:
A) Linda is a bank teller.
B) Linda is a bank teller who is an active feminist.

The second handout (which will go to the other half of the students in the class) should have the following “contextualized” instructions:

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations.

Identify which outcome is most likely:
Instructions:
1. Distribute the handouts to students, making sure that about half get the “context-free” description and half get the “contextualized” description. Do not draw attention to the fact that they are different instructions.
2. Have students make a choice – A or B – and then return their handout.
3. On the board, create the following table to keep count of decisions:

<table>
<thead>
<tr>
<th>Handout #1</th>
<th>Option A</th>
<th>Option B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handout #2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. Once all handouts have been returned, as a class, tally up how many students selected Option A or B for each of the two differing handouts.
5. Using the data from the chart, have students create a bar graph of the results. (If possible, this is a good opportunity to have students practice data entry and graph creation in a desired software program. Microsoft Excel is a good option for this purpose.)
6. Optional: You could also use this activity as an opportunity to have students conduct a Chi-square analysis (if the course covers statistical analyses).
7. Following discussion (see below), develop (and potentially conduct, if time allows) a follow-up study to examine how the decision might be reframed to create a different pattern of decision-making. *Note: If conducting the follow-up study, as students were the ones to generate ideas, ask that they pose the decision to a peer outside of the class and come back with that peer’s choice for the start of the next class/lab period.

Ideas for follow-up:
- Add additional options (i.e., people have to select from at least three possibilities) – e.g., Linda is a social worker.
- Generate a “real-world” example based on current events with or without providing additional context (e.g., which is more likely – a) school is closed due to weather or b) school is closed due to weather and an exam has to be rescheduled)

Follow-up and Discussion:
Presuming there is a differential pattern of decision-making (usually, those who complete Handout #1 recognize that A is more statistically likely in the absence of any other contextual information and those who complete Handout #2 are more likely to select B over A, even though A would be statistically more likely), pose the following questions for students to discuss:
- Why might those who received additional information about Linda have made a different decision about her?
- What might this suggest about how we make decisions about likelihood of events?
- How might this demonstration relate to our everyday decision-making?
- How might the decision be reframed to make context less impactful? (Suggestions: change the number of choices, include context information that is irrelevant to choices)
Section 2: Crosscutting Concepts

Select at Least One

- Students will observe patterns of decision-making related to probability under two types of conditions: context-free and contextualized; they will discuss why the pattern of decision-making may differ under the two conditions.
- Students will discuss cause and effect in terms of factors that can influence how individuals make decisions about the likelihood of events.
- Students will examine how the structure of a choice can impact the decision that is made.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Describe methodology, including materials
  - Identify type of study (experimental)
  - Identify IV (context) and DV (choice of Option A or B)
- Present results (suggested method: bar graph)
- Optional: Discuss Chi-square analysis results
- Discuss implications of findings
- Discuss design of a potential follow-up study (or results from follow-up study if time permits running the additional study)
Lab Title: Evaluative Language Bias

Adapted from/References:

Section 1: Performance Expectations

What will the student be asked to do?
- Analyze data
- Plan and/or carry out a scientific investigation
- Communicate information in a written report

Main Idea/Concept Demonstrated or Taught by Lab:
This lab allows all students to practice identifying errors in news stories related to psychological phenomena by employing critical thinking.

Key Terms and Psychologists Associated with Main Idea/Concept:
Evaluative language bias, Central vs. Peripheral Traits, Solomon Asch

Materials:
The lab will require two handouts. The first handout (which will go to half of the students in the class) should include a list of the following traits:
- Person A: intelligent—skillful—industrious—warm—determined—practical—cautious

The second handout (which will go to the other half of the class) should include a list of the following traits:
- Person B: intelligent—skillful—industrious—cold—determined—practical—cautious

Instructions:
1. Divide the room into two groups – A and B (e.g., left half is A, right half is B).
2. Provide students in Group A with List A, while providing students in Group B with List B.
3. After students have had a chance to read the list, ask everyone to determine whether a person with those characteristics would also have the following traits:
   a. Happy
   b. Imaginative
   c. Humorous
4. Keep track of frequencies and percentages on the board using the following table:

<table>
<thead>
<tr>
<th></th>
<th>Person A</th>
<th>Person B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Happy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imaginative</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humorous</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. Using the data from the chart, have students create a bar graph of the results. (If possible, this is a good opportunity to have students practice data entry and graph creation in a desired software program. Microsoft Excel is a good option for this purpose.)

6. Optional: You could also use this activity as an opportunity to have students conduct a Chi-square analysis (if the course covers statistical analyses).

7. Conduct discussion.

Follow-up and Discussion:
After determining any patterns of preference of Person A, bring up the following questions:

- How does language influence how we judge a situation?
- What are some examples of how others use language with the intention to shape attitudes? (e.g., describing someone as “persistent” vs. “stubborn”)
- How does language play a role in science and collection of data? (e.g., experimenter bias in the writing of survey items)

Section 2: Crosscutting Concepts

Select at Least One

- Students will observe patterns of judgments based on small changes in language.
- Students will discuss cause and effect in terms of the relationship between language and thoughts, including how language can shape evaluations.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Describe methodology, including materials
  - Identify type of study (experimental)
  - Identify IV (warm vs. cold descriptor) and DV (beliefs about other traits)
- Present results (suggested method: bar graph)
- Optional: Discuss Chi-square analysis results
- Discuss implications of findings
Lab Title: Fake News in the World of Psychology
Adapted from assignment by Randi Shedlosky-Shoemaker

Section 1: Performance Expectations

What will the student be asked to do?
- Analyze data
- Plan and/or carry out a scientific investigation
- Communicate information in a written report

Main Idea/Concept Demonstrated or Taught by Lab:
This lab allows all students to practice identifying errors in news stories related to psychological phenomena by employing critical thinking.

Key Terms and Psychologists Associated with Main Idea/Concept:
Confirmation bias

Materials:
Identify at least one news source that conveys a psychological research study incorrectly (e.g., implies causation based on a correlational or descriptive study); ideally, find multiple sources that describe the same research study to compare and contrast. It is great if you can find some news sources that poorly or inaccurately represent a study while others do a better job. For example:
- News claim: Using Facebook causes bad grades.
- News headlines/sources:
  - Facebook use linked to lower grades in college/Science Daily: https://www.sciencedaily.com/releases/2009/04/090413180538.htm

After identifying at least one possible news source, find information related to the original research study, as portrayed by the researcher(s).

You should also prepare a worksheet for students, with space for them to write:
- What claim is being made? (Summarize the news story in one sentence.)
- Do you agree or disagree with the claim that is being made?
- What errors or problems can you identify with the news story? (Note – this is not an explanation of why you agree/disagree; rather list what mistakes you feel the article’s author made in making their claim.)

Instructions:
- Share at least one of the news articles with students; have them read the article and then complete the first three questions from the worksheet.
- Ask students to count how many errors/problems they listed.
• On the board, write “Agree” and “Disagree” and have students write down the number of errors/problems they came up with, either near the “Agree” or “Disagree” based on their own position.
• After collecting the data from students, you can use this as an opportunity to introduce, practice, or review means by having students calculate the mean number of errors for the “Agree” and “Disagree” group.
• Discuss any differences noticed between the two groups’ mean number of errors. (Usually the “Disagree” group will have a slightly higher number of problems they identified.)
• Introduce the original research to students. You may choose to have them read it themselves (this works well if you can do the activity as a two-part lab on separate days). Otherwise, you can provide a brief synopsis yourself.
• After students have been introduced to the original research, have them return to the news story and discuss how well it portrays the original research results.
• Optional: If you have multiple news sources, now is a good time to show how a different news sources portrayed the same research. Have students read the second source and compare and contrast the two news stories’ coverage of the research study.

Follow-up and Discussion:
After determining any patterns of “error-finding” based on students’ personal opinion towards the news story’s claim, pose the following questions for students to discuss:
• How does personal opinion impact judgments about evidence?
• What are the consequences of when attitudes influence the level of critical thinking we invest when exploring evidence for and/or against our beliefs?
• How should one approach be evaluating evidence in light of their own opinions?

Section 2: Crosscutting Concepts

Select at Least One
• Students will observe patterns of judgments of evidence based on whether it supports or contradicts one’s opinion.
• Students will discuss the potential cause and effect between existing attitudes, evidence collection, and maintenance of existing attitudes.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:
• Describe methodology, including materials
• Present results (suggested method: bar graph)
• Optional: Discuss Chi-square analysis results
• Discuss implications of findings
Lab Title: Find the Present

Adapted from/References:
This demonstration was developed by Ronald G. Shapiro, PhD.

Section 1: Performance Expectations

What will the student be asked to do?
Students will:
- Identify a commonly occurring problem such as finding lost keys or a lost document.
- Document an optimal strategy for solving the problem.
- Develop a brief presentation showing people how to optimally solve this type of problem.
- Design a study in which people will be asked to solve the problem with and without the training. Document hypotheses predicting the outcomes of the study.
- Conduct the study observing whether either or both groups of participants select an optimal strategy for problem resolution with the entire class working as a team to collect data.
- Pool and subsequently analyze data.
- Present oral and written report to communicate results and conclusions.

Main Idea/Concept Demonstrated or Taught by Lab:
This lab will illustrate the importance of selecting an optimal strategy in solving problems. Additionally, it will provide an opportunity to develop instructional materials designed to help people solve problems and will provide experience testing the materials.

After concluding the lab students should be able to:
- Communicate more effectively by asking better questions.
- Develop better instructional materials.

Students should also be more likely to stop and think critically before jumping in to solve a problem.

Key Terms and Psychologists Associated with Main Idea/Concept:
- Cause and effect, framing, evaluative bias of language, language bias, critical thinking, confirmation bias, repetitive behavior

Materials for Classroom Demonstration:
- Bandana lined with foil containing a check for $1.01 hidden in the bandana.
- Swivel chair (optional)
Instructions:
Step 1: The Class Demonstration – Instructor:
- Asks an adventuresome student (perhaps one whose birthday is coming up soon) to volunteer for an in a class demonstration.
- Tells the potential volunteer that they will be blindfolded and that you will be touching their head and shoulders. Verifies that this is OK.
- Blindfolds the volunteer with the foil lined bandana (with the $1.01 check hidden inside the foil) and verifies that the volunteer cannot see anything (except possibly a bit of light around the nose).
- Tells the volunteer that you have hidden a present for them to find. Their job is to tell everyone what their present is and where it is located while remaining blindfolded.
- Has the blindfolded participant hold up a sign for everyone to see saying “I need to find a check for $1.01 which is hidden in the bandana.”
- Tells the participant they may ask any Yes/No questions and/or walk around. The class will answer as accurately as possible. Tells the class to also make notes about the problem-solving strategy, errors, inefficiencies, etc.
- Has blindfolded participant sit in swivel chair and spin it around a few times (optional).
- Tells the blindfolded participant to start.
- Leads a discussion once the blindfolded participant identified their prize.
  - In what ways was the participant’s search strategy optimal/suboptimal
  - What would instruction would they provide to another volunteer to help them perform better?

Step 2: Follow on activity -- Experimental design
- Teams of students are to identify real world situations where people spend endless amounts of time looking for lost keys, documents, etc.
Pick one of these scenarios.
Based on observations from the class demonstration, develop a set of predictions about how people will behave finding the object.
Develop a set of general training that could help people better perform this type of task.
Design an experiment to see if the training developed saves people time in trying to complete the scenario.

Step 3: Doing the experiment
Have students on each team each collect data and then pool all data. Distribute data to students to analyze.
Did the instruction work?

Step 4: Students write report and do oral presentation addressing the question.

Follow-up and Discussion:
Discuss the following:
- What have we learned from the demonstration about the way people ask questions?
- How can we apply what we learned from the demonstration and experimentation in our daily lives to make us more efficient at gathering information or finding lost objects?

Section 2: Crosscutting Concepts
We are having students work in teams to improve performance in solve a very common problem that people of all ages encounter each year through more effective critical thinking. I’ve seen statistics that 10% or 20% of a work week is spent looking for lost documents and information. More is spent at home looking for lost objects. People exhibit repetitive, non-productive behaviors. They do not plan their search. Lessons students learn to think more critically rather than just jumping in and acting may have great economic value to them as professionals.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:
- Background information (describe the class demonstration)
- Objectives (Apply critical thinking to solving common problems)
- Questions and hypothesis (concerning instruction effectiveness)
- Materials used (include measurements, where necessary)
- Procedure described in detail (for replication)
- Graphs/tables of collected data
- Findings
  - Was hypothesis supported or not supported? Explain.
  - What do the findings mean?
  - How could the research be improved, if replicated?
- How will you behave differently as a result of what you learned?

Please insure quality methods are employed and share all data collected and lab reports with
DrRonShapiro1981@SigmaXi.Net.

Note: I would like to thank industrial consultant Dr. Margarita Cossuto, Professor Randi Shedlosky and Oklahoma State University Graduate Student Vana Springer for comments on an earlier draft of this activity.
Section II
Biological Bases of Behavior

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1. Structure/Function Relationships within Sensory Systems
2. Modification of Sensory Receptor Structure and Function
3. Appendix
   a. Food Preference Survey
   b. Intensity Rating Scale
   c. Taste Rating Calculations
   d. Intensity Rating Scale: Sweet & Sour
Lab Title: Structure/Function Relationships within Sensory Systems
Suzanne I. Sollars, Ph.D.

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Formulate a directional hypothesis regarding the relationship between anatomical structure (number of taste papillae and associated taste buds) and function (taste intensities).
  - Conduct an experiment that contains both anatomical and behavioral data.
  - Analyze correlational data
  - Write a laboratory report that communicates whether your hypothesis was validated

- At the completion of the lab, students will be able to:
  - Create a directional hypothesis
  - Understand the concepts of how anatomical structure can influence perception and behavior

Main Idea/Concept Demonstrated or Taught by Lab:

Students will examine the way in which individual differences in anatomical structures can influence how the system functions. Perception of a sensory stimulus can vary between individuals. Such structure/function relations in physiological systems can change the way an individual behaves.

In this lab, students will test taste intensity of salt and sugar solutions, quantify fungiform papillae (an indirect measure of the number of taste buds), and determine the correlation between the number of fungiform papillae and taste intensity ratings.

Key Terms and Psychologists Associated with Main Idea/Concept:
fungiform papillae, taste buds, structure/function,

Materials:

- Mirror
- Lamp
- Blue food coloring (large bottles can be obtained from vendors such as Amazon)
- Cotton-tipped applicators (e.g. Q-tips)
- Food scale for measuring salt and sugar
- Beakers (plastic beakers are fine, they do not need to extremely precise)
- Camera (most cell phone cameras are adequate)
- Printer
- Salt (any type)
- Sugar
- Purified water (bottled or large dispenser is fine, tap water is not best) for students to drink and for use in preparing solutions
- Plastic cups (unless students get bottles of water to drink)
- Vials that hold approximately 10 ml (1 tablespoon) of liquid. Each group of 5 – 8 students will need 16 vials.
Taste preference survey (attached Appendix A)
Rating sheets (attached Appendix B; each student needs all 4 pages accounting for vials 1-16)
Trash bag to place in center of each student groups’ table to throw away applicators.
Tissues or paper towels
Recommended: Clock with second hand visible to all students or let students use cell phone clock to watch seconds. Otherwise, you can have students estimate the time mentioned in the instructions.

Instructions:

There are two parts to the experiment. Part 1 will have students taste and rate the intensity of sugar and salt solutions, and they will take a food preference survey. In part 2, students will determine the number of fungiform papillae in a small portion of the front of the tongue.

Prior to part 1, the purpose of the experiment should not be discussed with students. You may tell them that they will taste test sugar and salt solutions and rate the intensity of those solutions.

After the intensity ratings are completed, students may be told the purpose of the experiment and background information. They could be asked to generate hypotheses about the results of the experiment.

Part 2 is best conducted on a day separate from Part 1.

Procedure for Part 1

Preparation (Solutions for Part 1):

The day before the experiment, prepare the following:

Solutions

BEFORE adding solutions to vials, make sure there is lab tape on each vial. You should have multiple sets (depends on class size) each with 16 vials. I recommend each set has 2 different colors of label. 1-8 is one color and 9-16 is another color. Each vial within a set has a unique number from 1 through 16; mark this number on the label with permanent marker.

Follow the filling of vials as listed below. Each vial should be filled about 1/2 to 2/3 full.

<table>
<thead>
<tr>
<th>Salt series</th>
<th>Sugar series</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 = 1%</td>
<td>#9 = 5%</td>
</tr>
<tr>
<td>#2 = water</td>
<td>#10 = 10%</td>
</tr>
<tr>
<td>#3 = 0.5%</td>
<td>#11 = 20%</td>
</tr>
</tbody>
</table>
Make sure to stir the solutions thoroughly prior to putting the solutions in the vials.

Instead of weighing out salt and sugar in grams, you could translate the quantities to teaspoons (there are online converters). This will result in less precision in concentrations, but as long as you give all students solutions that are prepared at the same time, the experiment will be valid.

**Salt series**

- Measure 200 mL water. Add 4 grams salt – this is your 2% solution
- To another 200 mL water, add 2 grams salt – this is your 1% solution
- To another 200 mL water, add 1 grams salt – this is your 0.5% solution.

**Sugar series**

- Measure 200 mL water. Add 40 grams sugar – this is your 20% solution
- To another 200 mL water, add 20 grams sugar – this is your 10% solution
- To another 200 mL water, add 10 grams sugar – this is your 5% solution

Keep extra solutions in case there are any spills during class. Make sure the beakers are labeled (using lab tape and sharpie). Wash out each vial after class is finished. Use water, rinsing thoroughly 2-3 times (more for sugar). Leave them to dry before putting away. Make sure the vials are not sticky before putting away. If any are, rinse these again.

**Experimental Procedure**

Have small groups (approximately 5 to 8) sit at a common table.

Give each group a set of vials (1 – 16)

Have students complete food preference survey (attached Appendix A). Make sure each student puts her or his name (or code name/number) on each element of the study (preference survey, rating sheets and tongue images).
Instructions to Students

In the first part of this experiment, you will be tasting sweet and salty solutions of differing concentrations. After you taste each solution, you will record how intense that taste seems to you. To record the taste intensities, you will choose a number from 0 to 10 on a scale. There will be one scale for each taste solution.

Please make sure to let your teacher know if you are restricted from tasting salt or sugar. You will not be consuming large quantities of these solutions, but if you need to opt out of this experiment, let your teacher know.

1. Remove any gum, candy, etc., from your mouth. During this experiment, do not consume anything other than the materials we provide.

2. Wash your hands well with soap and water.

3. Collect the following materials:
   - 16 cotton swabs (cotton-tipped applicators)
   - 2 Napkins
   - 1 cup of water from dispenser (if you need more water during the experiment, you may get more)
   - 1 set of printed taste intensity rating scales. Make sure you have scales with all numbers (to the left of each scale) from 1 to 16.

4. Set down one napkin and place your cotton swabs on it. Set the other napkin a few inches away from the other one. Put your vials in numerical order in front of a person in the group selected as the “start person.” Write your first and last name on all the intensity rating sheets.

5. Here is what you will be doing, but do not start yet.
   a. Before you start the experiment, take a small sip of the water in your cup, swish it around your mouth and swallow.
   b. You will be opening the vials one at a time in order of the number marked on them.
   c. For each vial make sure the rating sheet number and the vial number match before you begin the rating.
   d. After a vial is open, you will put one end of the cotton applicator into the solution and give it about 10 seconds to absorb the liquid. Remove the swab and close the vial.
   e. You will need to stick out your tongue then apply the solution that is on the swab to about the front third of your tongue, rolling the swab over the entire surface on both sides of your tongue. Do not put the swab back into the solution at any point. Put the used swab on the second napkin, or in the trash bag on the table.
   f. You will keep your tongue out for 10 seconds after the solution is applied, then put your tongue back in and mark the intensity of the solution on the rating sheet, checking again that you are rating on the
scale that corresponds to the solution number you just tasted. If it doesn’t match, contact your teacher.

g. After you rate the solution, take a small amount of the water from your cup (or bottle) and swish it around in your mouth, swallowing after about 10 seconds.

h. Wait 60 seconds. If you can still taste the solution you just rated, take another portion of water, swish it around for 10 seconds and swallow. If you consume more water, wait another 60 seconds. Repeat this procedure until the taste is completely gone.

i. Once you can no longer taste the solution you just rated, move on to the next vial. Repeat the above procedures one vial at a time. STOP after you complete vial #8.

j. Once you complete vials 1 through 8, take a 5-minute break and then start at ‘a’ again in these instructions, but start with the #9 vial.

k. At the end, throw your napkins, swabs and cup into the trash, wipe down the table, and give your ratings sheets to your teacher.

6. Optional

   a. Record the date and the name of the module in data book or notebook page
   b. As you proceed through the experiment, write any comments or problems you may have about the experiment
   c. After you are finished with all the vials, write your overall perception of what you tasted.

**Procedure for Part 2**

**Preparation**

Make a 5% - 10% solution of blue food coloring to water. Add sugar to minimize the taste of the dye. Make sure to use fresh solution each experimental session. Place solution in small vials or plastic containers.

Prepare method for taking pictures and determine the method you will use to have students count papillae. A cell phone camera is sufficient, though best clarity will be achieved with a digital camera equipped with a macro lens. You will need to determine if you plan to download the images to a computer, print them (needs to be color printer), or analyze the images on the phone camera. The more precision you can obtain, the higher the validity of the results, but any of these methods can be adapted to work well for the experiment.

You will need to determine the method of counting papillae from images. If you print images, it is easy to establish a blocked area on one side of each tongue to count. For any method used, consistency across
students is key. You can count only one side of the tongue or both. The counts should be made slightly back from the tip. As you work through the method you will use, papillae count areas for each tongue are sufficient if an average number is around 25 (a range of approximately 15 to 65 per side is standard and shows the anatomical variation across tongue tissue).

If you plan to run this experiment repeated times and with many students, a chin rest may be worth purchasing. Good-Lite has product 705011, a chin rest with table clamp that works well, but any similar product would be fine. A chin rest helps to prevent excess head motion while the tongue images are photographed.

In advance of the experiment, test lighting conditions; a small lamp may be necessary.

**Experimental Procedure**

Students can work in pairs or groups. The camera and lighting should be ready to take a photograph.

One student will take a cotton-tipped applicator and dip it into the blue dye solution. That student will stick out her or his tongue and apply the solution over the front third. If the solution is too dark, a tissue or paper towel can be used to dab some off. The blue dye will stain the areas around the fungiform papillae more intensely than the papillae themselves, which should appear pink.

Once the student has the tongue properly dyed, the student should press down slightly with her or his front teeth onto the outstretched tongue. This will help stabilize the tongue and plump the tongue tissue which will help during the papillae counting procedure.

Another student should take two or three images, making sure that the images are clear. The picture should be close as possible to the tongue that also allows for a clearly focused picture. If the images are not in focus, it will be difficult to obtain data from them. Make sure images are labeled with student names or code used on the intensity ratings, since you will compare the student papillae counts with their taste intensity data.

Have students use the procedure you determined to count papillae.

**Analysis**

Use the attached Excel sheet format (Appendix C) to obtain correlations and figures for the taste intensity ratings and the papillae counts. Note the initial calculations add the preference numbers on the rating scale for the 1% and 2% salt solutions for each student, and the 10% and 20% solutions of sucrose. For a large class, this is the simplest measure to obtain reliable preference data. You may instead decide to determine the correlations for each taste and concentration for a more precise measure.

The food preference surveys are used for student discussion. Once they determine their papillae counts, the survey can be useful for them to reflect upon their individual anatomical and intensity rating results to see if their preferences correspond to what is predicted.
Information for each question on the food preference survey:

1. Bitter is a primary taste. Caffeine is bitter.
2. Deep green vegetables are often bitter.
3. Fats are considered by some researchers to be a primary taste.
4. Sugar is a primary taste.
5. Although “spiciness” is not a taste, spicy hot peppers have a substance called capsaicin. Capsaicin affects somatosensory receptors in the filiform papillae and in the connective tissue surround of the fungiform papillae (areas around, but not in, the taste buds).
6. Salt is a primary taste.
7. All foods tend to seem more intense to those with more papillae (and thus more taste buds). Lifelong food selection is sometimes guided by individual differences.

If there was strong agreement with these questions, did the student have a high papillae count? Were intensity ratings high? Conversely, if strong disagreement, did the student have a low papillae count and low intensity ratings?

Follow-up and Discussion:

- **Think about the following questions to guide discussion and check for understanding:**
  - There is a common error on the internet which suggests taste buds occur on the lips, cheeks and hard palates of humans, as well as on the tongue. Often, the soft palate of the roof of the mouth, where there are taste buds, is ignored. While there are taste buds in areas other than the tongue and soft palate in other species, this is not the case in humans. What perpetuates the myth? To explore the differences between “popular press” and scientific research, students could explore both avenues of information and see how they differ.
  - The taste map is another myth long perpetuated. The concept of the map is that there are specific locations across the tongue where each individual taste is intensely concentrated. The myth of the taste map resulted from a mistranslation of research published by David Hänig in 1901. The true nature of taste is that all tastes are represented in every area of the tongue (and soft palate), with only moderate variations noted in taste responses profiles. Have students research how taste is conveyed across the tongue and soft palate. Make sure they use peer-reviewed research and not simply internet searches!
Section 2: Crosscutting Concepts

Select at Least One

- Structure and Function, Cause and Effect, Systems and Model
  - Structure/function relations exist in many physiological systems. Have students explore other sensory systems to determine how other systems may reflect individual differences in function based on anatomical differences.
  - How could diet and health be influenced by the individual differences in food selection that results from individual differences in taste buds and perceptual intensity of tastes? Are there other influences that could override food selection?
  - The foundation of the study is based in genetic differences and the concept of “tasters” and “non-tasters.” How do the studies and concepts relate?

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Introduction to include basic information about the taste system (both in structure, e.g. taste buds, innervation of taste and trigeminal nerves, brain pathways) and function (e.g., taste receptor cell functions, perception of taste intensity, food selection).
- Objectives: Understanding how individual differences in anatomical structure can reflect individual differences in perception and behavior.
- Hypotheses formulated after taste intensity tests.
- Study design and materials
- Experimental procedure including all instructions given during the experiment
- Figures of correlations of taste intensities and taste papillae counts
- Results and Discussion
  - Were the results supportive of the hypotheses?
  - What do these findings suggest about the role of genetic influences in the way we perceive sensory stimuli?
  - What are other ideas to build further upon the concepts contained within this laboratory?

References, recommended readings and video:


Lab Title: Modification of Sensory Receptor Structure and Function
Suzanne I. Sollars, Ph.D.

Section 1: Performance Expectations

What will the student be asked to do?

- Conduct and/or participate in a study that examines cellular function.
- Analyze response data from modified Likert Scales.
- After completing the lab, students will understand:
  - Sensory receptor cells interact with chemicals in the environment; through these interactions, cellular structure may be modified.
  - Modification of cellular structure may result in changes in neural function and perception.
  - Nonparametric analysis of data.
  - Communication of experimental ideas through a lab report.

Main Idea/Concept Demonstrated or Taught by Lab:
Students will understand how modification of cellular function may lead to changes in sensory perception.

Key Terms and Psychologists Associated with Main Idea/Concept:
sensory receptor; miraculin; Likert scale; blind coding of data

Materials:
- Miracle Berry (Miraculin Tablets) 300 mg (can break 600 mg tablets in half)
  - Available on Amazon, Think Geek, and other vendors (slight preference for Miracle Frooties brand)

Solutions
- Fruit
- Lemons
- Limes
- Grapefruit (yellow pulp works best)
- Oranges
- Salt (any kind is fine)
- Bottle of purified (reverse osmosis) water
- 6 Plastic food containers – 1 cup or greater capacity
- Vials (small cups or other small containers that hold about a tablespoon of liquid)
Label tape
Juicer (juice reamer or juicing by hand is fine)
Food coloring (yellow preferred; any color is fine)
Fine mesh strainer
Coffee filter papers
Coding sheets (attached Appendix D)
Q-tips
Napkins/paper towels

Drinking water. Could be individual bottles, or large jug (give students cups). Preferably reverse osmosis water, but any type will be fine. Should be room temperature at time of experiment.

Trash bags for the Q-tips.

Clock with second hand available for students to watch. Alternatively, they can use any type of device that will allow them to observe time in seconds.

**Preparation for Lab**

**Solution preparation**
You will need 6 food containers for: lime juice, lemon juice, orange juice, grapefruit juice, salt water, and water. Use label tape to mark each one.

No more than two days in advance of the experiment, juice the citrus fruit into plastic food containers. Place the fine mesh strainer over a plastic food container and juice each citrus fruit into its own container. If mesh is large enough to allow pulp to get through, use coffee filter paper to strain out remaining pulp.

Make a salt solution with 1/8 teaspoon of salt to 1/2 cup of bottled water. This is approximately equivalent to 0.1 Molar (0.1 M) or 0.6% weight per volume.

Put bottled water separately into a food container.

To each container, add approximately 1 - 3 drops of food coloring. The goal of the food coloring is to try to mask the type of solution.

Decide upon an order to present the solutions. Randomization works best. All students will get the solutions in the same order. Solutions will be given in the same randomized order in the pre-miraculin condition and the
post-miraculin condition. Make sure to record the order of solution delivery and keep it hidden from participants until after the experiment is complete.

**Vial preparation**
For each set of 5 to 6 students, you will need a set of 12 vials (or small food containers). In advance of adding solutions to the vials, use label tape to number each vial (1 through 12). Different colors of label tape could be used to help distinguish the vials for each set of students. Do not record any indication of the solution type on the label.

Fill vials 1 through 6 approximately half full, making sure to match the vial label number to the randomized order you decided for solution presentation. Fill vials 7 through 12 in the same manner, again matching the vial number to the order of solution presentation. As an example: Vial #1 = lime; #2 = grapefruit; #3 = salt; #4 = orange; #5 = water; #6 = lemon; #7 = lime; #8 = grapefruit; #9 = salt; #10 = orange; #11 = water; #12 = lemon.

Refrigerate solutions if they are prepared in advance of the experiment day. Be sure to remove the vials from the refrigerator in time for the solutions to obtain room temperature prior to the start of the experiment.

** Coding sheet preparation**
Each student will need one set of Likert-style coding sheets (attached Appendix D; all 6 pages for each student).

**Miraculin preparation**
If 600 mg miraculin is purchased, break each tablet in half. Pushing on the center of the tablet with a knife works well. Put miraculin tablets in a separate food container that is does not have an identifying label.

**Experiment Instructions:**

*General procedure:* During the experiment, students will dip a cotton-tipped applicator into a solution apply it to their tongue, record both the sweet intensity and the sour intensity of the solution on the coding sheet, rinse with water, then move to the next solution. After all students have tasted all solutions in vials 1 - 6, they will let a tablet of miraculin dissolve on their tongue, then wait 15 minutes. Afterwards, they will taste the solutions in vials 7 – 12 and record both sweet intensity and sour intensity on their coding sheets.

{At the start of the experiment, and before using the words “cotton-tipped applicator,” hold up a Q-tip and ask students if they know the ‘scientific’ name for it. It is a lesson in learning that brand names are not used in research methods.}
Specific Procedures

Students sit at tables in groups of approximately 4 to 8. They should have a pen.

Ask students to rid their mouths of any gum or food.

Have each student collect supplies:

1 set of coding sheets (each student needs all pages accounting for vials 1 - 12)
12 cotton-tipped applicators (Q-tips)
Bottle (or cup) of water
1-2 napkins (they place Q-tips on the napkins)

Tell students that if they consumed any food or drink within the previous half-hour, they should take a drink of water, swish it around their mouth and swallow.

Place one set of vials (1 through 6) on each table.

Set one trash bag in the middle of each table.

Have students choose a code name/number and have them record this on each page of their coding sheets.

If you plan to have the students write a report based on the experiment, you may tell them to write down all instructions you give them or give them a handout of the instructions.

Ask anyone who has a food allergy or sensitivity to raise his or her hand. Take each student who raises their hand out of hearing range of the group, and ask about the nature of the allergy/sensitivity. If the allergy/sensitivity is to citrus fruit, salt, or potato (potato starch is the base of the Frooties – if you use a different brand, determine the base substance of the tablet), excuse them from the data collection portion of the experiment.

Tell students the following instructions:

Students may, at any time, opt out of the experiment by raising a hand and letting you know she or he would like to opt out.

They will taste several food-based substances. After the experiment is completed, you will tell them what the substances are.

During the experiment, students may talk to members in their group, except any discussion about the tastes.

Throughout the experiment, they should be careful to avoid making facial reactions or any other indication about the tastes.

In order to ensure individual experiences are recorded on the rating sheets, looking at the responses to tastes recorded on other students’ coding sheets is not allowed.
It is very important to note that for each taste solution, they will be recording BOTH the sweet intensity and the sour intensity perceived. Have them look at the coding sheets and note the scale from “not at all” to “strongest imaginable.”

Make sure coding sheets are in order from 1 to 12. As they are tasting the substances, they should double-check each time that the coding sheet scale and the vial number match before recording ratings. If a mistake is recorded, they should raise a hand and let you know right away. A simple correction in rating can be made by putting an ‘X’ through the mistake and circling the new intensity selection. Changes in ratings should be made only if the next solution has not yet been tasted.

Each group will choose a start person.

This person starts with vial 1. Other students wait, such that each student receives the solutions to taste in the same order 1 through 6 (i.e., all students taste the solutions in the same randomized order that you decided in advance of the experiment).

When told to start, everyone will take a sip of water, swish it around in her or his mouth and swallow.

Then, the start person from each group will select vial 1, open it, and insert one cotton-tipped applicator, making sure to absorb the solution.

The start person will hold their tongue out of the mouth with their mouth open.

The student will roll the cotton-tipped applicator with the solution across the front 1/3 or more of the tongue, making sure to contact all of this area of the tongue with the solution.

The tongue should be left out for 5 seconds, getting a sense of the intensity of the taste.

After the 5 seconds, the tongue should be placed fully back in the mouth and then a rating made on the Likert Scale for both the sweet intensity and the sour intensity of the solution, checking first to make sure the vial number and the scale number match. Emphasize that both the sweet intensity and the sour intensity should be rated for each solution, even if the solution cannot be characterized as either taste. As an example, suppose they taste something intensely sweet that has no sour taste. They might record a ‘9’ on the sweetness scale and a ‘0’ on the sour scale.

The start person passes the solution vial to the person on the right, who can start the procedure.

After recording intensity responses, she or he takes a drink of water, swishes it around the mouth, swallows, and waits 30 seconds (watching the time on the clock).

If the taste of the solution remains after 30 seconds, the student takes another drink of water and waits an additional 30 seconds. This rinse procedure is repeated until the taste no longer remains.

Once the taste of the solution no longer remains, they open vial 2 and repeat the procedure.

Each student follows the same procedure when receiving the vial passed to her or him.

Students pass the vials in numerical order until all students have tasted and recorded the intensities of all 6 solutions.
After all groups have completed tasting solutions in vials 1 through 6, students each take another sip of water and wait 5 minutes.

Give each student one of the ½ tablets (300 mg) of miraculin. Have them place it on their napkin. Do not tell them what it is; you may explain it is a food-based substance.

Tell them to place the tablet in their mouth and let it dissolve. They should not chew. The tablet should be moved around the mouth especially focusing on letting it dissolve on the areas on the tongue where they applied the solution in the vials.

Have each student raise his or her hand once the tablet is dissolved. This will let you know when all the tablets have dissolved.

Once all tablets are dissolved, tell the students they will get a 15-minute break. [They can get a break up to 30 minutes, but no shorter than 15 minutes.] During this time, they should not eat or drink anything, not even water.

Clear each table of the first sets of vials and place the vials 7 through 12 on the tables. Do not tell them this set is the same as the first set of vials.

Have students repeat the above procedures, recording taste intensity responses for the solutions in vials 7 - 12. Remind them to check the vial number against the recording sheet to make sure they match.

Collect coding sheets.

Prior to debriefing students after the experiment, ask them what they experienced while tasting the solutions in the vials.

For each type of solution, ask their prediction for the direction of ratings after miraculin as compared to those before miraculin.

Debriefing:

Tell students about the solutions they tasted, the order of solutions, and how miraculin affects taste receptor cells.

After you debrief them, ask them if they thought the solutions tasted sweeter after miraculin, and if so, whether all the solutions tasted sweeter.

Let them know that miraculin’s effects to the taste system will wear off in approximately 2 hours.

Possible Further Procedures:

Cut pieces of fruit such as lime, lemon and grapefruit into small pieces. After the experiment is completed and you have explained the function of miraculin, offer the students the fruit. Have them describe their experience.
Follow-up and Discussion:

Data Analysis

The procedure for data analysis can involve the students, or the data can be computed, and the results given to them.

Statistical software may be used, though data analysis is easily accomplished without statistical software.

The Wilcoxon Signed-Ranks Test is a nonparametric test. This test is appropriate for ordinal data [the order of the variable is important (e.g., a rank of ‘2’ suggests a *less* intense taste than a value of ‘6’), but the differences between the rankings are not necessarily equivalent (e.g., the intensity differences between a rank of ‘2’ and ‘4’ is not necessarily equivalent to the difference in intensity between ranks ‘5’ and ‘7’)]. The Wilcoxon is used when the comparison is between two non-independent variables. In the case of the miraculin study, the rating for solution in vial ‘1’ will be compared to the rating for vial ‘7,’ rating for ‘2’ compared to the rating for ‘8,’ etc.

For each student, assign a letter and record the pre-miraculin ratings and post-miraculin ratings for each solution. Place the numbers to be compared next to each other.

Calculate the difference for each participant and each solution as a before-miraculin minus post-miraculin measure as in the following example for lemon sour taste rating.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Before Miraculin</th>
<th>After Miraculin</th>
<th>Difference Score</th>
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<tr>
<td>A</td>
<td>9</td>
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<td>9</td>
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<td>B</td>
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<td>5</td>
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<td>J</td>
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<td>4</td>
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<td>K</td>
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<td>L</td>
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<td>M</td>
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</table>

Rank order the participants using the absolute value of the difference score. When the difference scores are the same (e.g., C, E, F, and H), add their rank numbers and calculate the average. The average of the ranks becomes the rank for *each* of those participants. All difference scores of zero get ranked as zero. In other
words, when using this particular way to calculate, you ignore the participants who reported the same rating before miraculin as they did after miraculin.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Difference Score</th>
<th>Rank</th>
<th>Recalculated Rank</th>
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The statistic you calculate \( W \) is a sum of the recalculated ranks. However, you sum the ranks that had negative difference scores separately from the ranks that had positive difference scores.

In the example, add H and J’s ranks \( W = 2.5 + 5 = 7.5 \). Add C, E, F, I, L, K, B, G, M, and A’s ranks \( W^* = 2.5 + 2.5 + 6.5 + 6.5 + 8 + 9.5 + 9.5 + 11 + 12 = 70.5 \). Take the lowest of the calculated scores (7.5 in this example). This becomes your \( T \) value in the following formula.

\[
z = \frac{T - \frac{n(n + 1)}{4}}{\sqrt{n(n + 1)(2n + 1)/24}}
\]

The \( n \) equals the total number of participants minus any that had a zero rank \( n = 12 \) in this example).

Thus, in the example for ratings of sour for lemon,

\[
z = \frac{7.5 - \frac{12(12 + 1)}{4}}{\sqrt{12(12 + 1)(2x12 + 1)/24}}
\]

\[
z = \frac{7.5 - \frac{156}{4}}{\sqrt{156x25/24}}
\]
\[ z = \frac{7.5 - 39}{\sqrt{3900/24}} \]

\[ z = \frac{-31.5}{12.74} \]

\[ z = -2.47 \]

Use z table look-up for \( p \) value. Here, \( p \)-value = 0.00676. The alpha level is \( p < .05 \)

Resources: There are online calculators for the Wilcoxon Signed-Ranks Test. One good one can be found here: [http://www.socscistatistics.com/tests/signedranks/Default.aspx](http://www.socscistatistics.com/tests/signedranks/Default.aspx)

**Prepare Figures**

Prepare 2 figures. One will have the results of the sweetness ratings and the other will have the results of the sour intensity ratings. Figures will have the y-axis representing intensity ratings, and the x-axis representing substances tasted. Data will be plotted as bars. Below is an example.

![Sweet Intensity Ratings](#)

![Sour Intensity Ratings](#)

* \( p < .05 \); ** \( p < .01 \)

Prior to debriefing students after the experiment, ask them what they experienced while tasting the solutions in the vials.

For each type of solution, what is their prediction for the direction of ratings after miraculin as compared to those before miraculin?
After you debrief them, ask them if they thought the solutions tasted sweeter after miraculin, and if so, whether all the solutions tasted sweeter.

Discussion

Miraculin works to change sweet receptors on taste receptor cells of the taste buds. After miraculin contacts taste buds, the sweet receptors will allow sour substances to bind to them. Since sweet taste receptors convey the perception of “sweet” to the brain, even when the receptors bind sour substances the brain still interprets the information as “sweet.” Although sometimes there are noted changes in taste of substances other than sour components, the mechanism of miraculin works primarily with sour components (Kant, 2005; Koizumi et al., 2011; Sato, 1987). Thus, the salt and water solution likely did not taste sweeter.

Acidic substances such as citrus fruit are still perceived as sour after miraculin because sour taste receptors remain functional. The overall perception of sourness may decrease when the sweetness of a substance is perceived as stronger after miraculin. This does not mean that the sour receptors change. Rather, the brain perceives sweet as stronger which can mask some of the brain’s interpretation of intensity of the sour taste (Capitanio, Lucci and Tommasi, 2011).

Taste sensory receptors have receptor subtypes on them that are responsive to the basic tastes. When these receptors are activated, they signal information to the brain that encodes our interpretation of whether something is sweet, sour, salty or bitter. Sensory experience is, in part, a product of what sensory receptors are activated and the locations where their circuits activate the brain. Sometimes, like in this study, a stimulus (sour in this example) is able to activate a sensory receptor that it usually does not activate. Since the sensory receptor is of a particular type (sweet receptor in this example), the brain circuits signal to produce a sensation of “sweet” even though humans do not usually consider the chemical components in sour substances sweet (see Breslin, 2013 for review).

Section 2: Crosscutting Concepts

Select at Least One

- Patterns, Structure and Function, Stability and Change
- Students will discuss ways other types of sensory systems encode information and how the information might be modified by experience, drugs, or individual differences.
- Students will explore and report on differences and similarities in sensory system receptor types across species.
- Students will discuss the concept of taste as a construct. We often say a food has a taste quality, such as sweet or sour. Do the results of the experiment suggest otherwise (e.g., is a lime “sour”?).
Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:
The laboratory report should include the following:

- Introduction, including background information on the taste system, taste sensory receptors, and miraculin history and effects on taste receptors
- Experimental questions posed by the study
- Study design and materials
- Experimental procedure including all instructions given during the experiment
- Results of the experiment including the statistical findings
- A figure of the results
- Discussion including
  - Why some of the ratings may have changed pre-miraculin as compared to post-miraculin and why others did not.
  - Other experiments that have used miraculin in different species and their findings
  - Alternate methods to test receptor function and/or how the brain processes that information

References and Suggested Readings


Appendix A. Food Preference Survey

PLEASE CIRCLE MOST ACCURATE RESPONSE ON THE LINES BELOW THE QUESTIONS:

Strongly Disagree = 1    Disagree = 2    Neutral = 3    Agree = 4    Strongly Agree = 5

1. I don’t like coffee, or I drink coffee only if there is cream and/or sugar in it.

   1  2  3  4  5

2. I avoid foods such as raw broccoli, dark leafy greens or brussels sprouts because they are bitter.

   1  2  3  4  5

3. Strictly from a taste perspective, I prefer skim milk to the taste of whole or 2% milk.

   1  2  3  4  5

4. When I drink pop, I prefer the tastes of those with less sugar (diet, clear sodas, etc.).

   1  2  3  4  5

5. If a waiter asks me how spicy I would like my dish, I would request it to be mild or unseasoned.

   1  2  3  4  5

6. I like chips, fries or popcorn when they are unsalted or have a minimal amount of salt.

   1  2  3  4  5

7. I have been called a picky eater and/or I tend to prefer bland foods.

   1  2  3  4  5
## Appendix B. Intensity Rating Scale

**Intensity Rating Scale**

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<tr>
<td>1</td>
<td>Tastes Like Water</td>
<td>Barely Detectable</td>
<td>Weak Taste</td>
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Tastes Like Water
Barely Detectable
Weak Taste
Moderate
Strong

Strongest Imaginable Taste
Appendix C. Taste Rating Calculations

Taste Ratings calculations

Calculate the total of SALT ratings for each student.
Use data from ratings 1, 4, 6, 7 and 8 ONLY == add the numbers for each student

Calculate the total of SUGAR ratings for each student
Use data from ratings 10, 11, 13, and 15 ONLY == add the numbers for each student

Match each student’s papillae counts with their overall salt rating & enter below
Match each student’s papillae counts with their overall sugar rating and enter below

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Select Papillae & Salt Columns

y = 0.7065x + 6.8925
R² = 0.7354

Select Papillae & Sugar Columns

y = 1.0616x - 2.3262
R² = 0.8605
Appendix D. Intensity Rating Scale Sweet & Sour

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### Table: Taste Intensity Scale

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- **Barely Detectable**
- **Weak**
- **Moderate**
- **Strong**
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Section III
Consciousness

Joe Swope
Montgomery County Northwest High School
Joseph_m_swope@mcpsmd.org

John Mohl
Bucks County Community College
John.Mohl@bucks.edu

1. Task Switching
2. Hypnotic Suggestibility
3. Sleep
Lab Title: Task Switching

Adapted from/References:
http://www.learningscientists.org/blog/2017/7/28-1

Section 1: Performance Expectation

What will the student be asked to do?
When instruction is complete, students will have formulated questions about attention and the inability to split it on different tasks. This will be done by carrying out an investigation by personally exploring the difference in performance between task-switching exercises and non-task-switching exercises. Terminology associated with attention and consciousness will be used.

Main Idea/Concept Demonstrated or Taught by Lab:
After concluding this lab, students understand:

- All multitasking is actually task-switching
- Task switching is inefficient and prone to errors.
- Basic concepts of data analysis

After concluding this lab, students are able to (performance standards):

- Describe how task switching affects cognitive performance
- Explain the difference between multitasking and task switching
- Interpret graphical representations of data as used in both quantitative and qualitative methods

This lab allows all students to explore their own experiences as they work through task-switching exercises and non-task-switching exercises. This lab will also allow students to observe others and record data regarding the performance of others on such tasks.

Key Terms and Psychologists Associated with Main Idea/Concept:
Multitasking, independent variable, dependent variable, task switching, attention, consciousness, Hawthorne Effect, Observer bias, Single blind, Histogram, extrapolation, dual level processing, Teachers can add additional terms as well

Materials:
Students will need a device to record time. A stop-watch app on a phone will work well
Instructions:

Students can work in pairs or in small groups. The group shouldn’t be too large to facilitate data collection. The students can rotate roles so that each student gets a turn at timing his or her partner and attempting the attention-based exercises. One student will say the alphabet as quickly as possible while a group member records the time it takes to say all 26 letters. Note, students should be cautioned to say each letter distinctly, rather than rush through in a blur. Then, that same student will count to 26, again making sure to say each number carefully, lest we dip into procedural memory. On the third trial, the student is to alternate between saying the letters and saying the numbers. (i.e. 1, a, 2, b, 3, c, 4, d) Of course, the time it takes to complete that exercise should be recorded. Obviously, the completion time to complete the third exercise will be much larger.

Some resources and considerations before the lab is assigned:

Videos
- [https://www.youtube.com/watch?v=hEPCTFuuggY](https://www.youtube.com/watch?v=hEPCTFuuggY) John Green talks about the myth of multitasking
- TED talks: [https://www.ted.com/talks/paolo_cardini_forget_multitasking_try_monotasking](https://www.ted.com/talks/paolo_cardini_forget_multitasking_try_monotasking) Paolo Cardini explains why multitasking is bad.

Section 2: Crosscutting Concepts

- **Before this lab**, students should collect data from adults and peers via interview. Students should also answer their own interview questions. Teachers should create a short pre-lab interview questions for students to use. Some ideas are:

  A. How well do you multitask?

  ![Ratings Scale](image)

  Not well  | about average  | very well

  B. How many things do you do (on average) while you are on your computer?

  C. How many things can you do while you are on your computer

  D. Can you listen to music and concentrate on your homework?

  E. Have you ever re-read a line in a book you were reading

  - How does school affect encourage or discourage multitasking?
    - Students could develop a school policy regarding cell phone use that is based on their completion of this exercise.
  - How does Society affect encourage or discourage multitasking?
    - Students could research state laws regarding use of cell phones and driving
  - What connections to the Common Core State Standards (CCSS) could be emphasized as students engage in the instructional sequence?
    - Again, waiting for Standards Strand deliverables
Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

Students will summarize their findings in either the included data recordation sheet, a different report, or a verbal presentation that includes the following:

- **Background information**
  - Again, waiting for Standards Strand deliverables
  - Students should include their interview findings regarding ideas on multitasking
- **Objectives of this study**
- **Questions that were answered**
- **Why didn’t we form a hypothesis at the beginning? What would have happened had you known you were going to be tested for hypnotic susceptibility?**
- **All materials used**
- **Procedures**
- **Appropriate graphs/tables**
- **Findings** – What was the result of the task switching exercise?
- **Analysis** – what are ways to interpret and present the data?
- **Discussion** must include relevant terminology
- **Discussion of surprises or new understandings about hypnotic susceptibility**
- **How could the experiment be improved?**

References:

1. Template adapted from:

2. Lab model adapted from:
Task Switching
Data Recordation Sheet

On a separate sheet of paper, answer the following:

1. Summarize the group’s interview data for adults.
2. Summarize the group’s interview data for teens.
3. Why do you think it was important that group members did not know about the lab details when they answered the interview questions?
4. What confounding variables might have influence the validity of the exercises?
5. Find the mean of the group member’s times for the exercises.
   - counting to 26
   - saying the alphabet
   - combining the tasks
6. Create a histogram that represents this data?
7. Divide the combing tasks group mean with the group mean for counting. How many times less efficient is task switching than focusing on one task.
8. Explain the procedure in such way that it could be replicated. Use appropriate terminology from the research methods unit and from the hypnosis unit.
9. Can these results be extrapolated to driving and phone usage?
10. What might some confounding variables of such extrapolation be?
Lab Title: Hypnotic Suggestibility

Adapted from/References:
- Mohl, J. Activities for Teaching about Hypnosis Without Using Hypnosis.

Section 1: Performance Expectation

What will the student be asked to do?
When instruction is complete, students will have formulated questions about hypnotic suggestibility, carried out an investigation by personally exploring suggestibility phenomenon and by recording empirical data related to hypnotic suggestibility. Terminology associated with hypnotic suggestibility will be applied to this report.

Main Idea/Concept Demonstrated or Taught by Lab:
After concluding this lab, students understand:
- Hypnotic Suggestibility
- Basic concepts of data analysis
After concluding this lab, students are able to (performance standards):
- Describe the principles hypnotic suggestibility
- Describe the difference between the phenomenological approach and the empirical approach
- Interpret graphical representations of data as used in both quantitative and qualitative methods

This lab allows all students to explore personal suggestibility experiences while recording observable suggestibility indicators

Key Terms and Psychologists Associated with Main Idea/Concept:
Induction, Suggestibility, Role Theory, State Theory, unconscious Hidden Observer, Dissociation, Ernest Hilgard, Milton Erickson, volition, Hawthorne Effect, Observer bias, Single blind, Histogram, Scatterplot, correlation coefficient

Materials:
You will need Suggestibility Script, data recordation sheets
Instructions:

Students can work in pairs or in small groups. The group should be no larger than 4 participants to facilitate data collection. One student will be the script reader, observer, and data collector. The script reader will read the arm movement suggestibility test to his or her partner or to the group. After the script is read, he or she will record the score on the data recordation sheet. It is important to note that knowledge of what will be observed might influence the students who are participating in the arm movement suggestibility exercise. Thus, only the script reader should see the data recordation sheet beforehand.

After the script reader reads the “Arm Movement Suggestibility” script, he or she will record the distance the arms moved.

Then the student group will work through the Spiegel eye roll exercise. After the script reader records the data for the eye roll exercise, he or she will share the finding with the group.

As a group, the student will complete the data sheet.

Arm Movement Suggestibility Test

Have students stand or sit with both arms stretched out in front of them, left arm with the palm facing up and the right palm facing down. Ask them to close their eyes and describe the following:

I want you to imagine that I have before me one of those old huge dictionaries. You know, one of those dictionaries with thousands of pages. It must weigh 40 pounds. Also imagine that I am holding a bunch of balloons. Many balloons. So many that you may wonder whether I might just float away just holding them. In a moment, I am going to place this heavy dictionary on top of your left hand. How heavy it will feel. I wonder how much effort you will have to exert just trying to hold on to that book. Just feel how heavy that book is as I place it on your hand now.

Pause for a few seconds, and then continue:

Now as you feel that heavy book, it is quite natural for your arm to grow tired and heavy trying to hold up that book. The heavier the book gets, the more tired your arm becomes, and the more tired your arm becomes, the heavier that book is.
In a moment, as you struggle to hold up that book, I am going to tie those balloons to your right wrist. You may find it quite odd that those balloons are going to pull your right hand up in the air as if your arm is as light as a feather. Just experience how light your arm feels as I tie those balloons to your right wrist now.

Pause for a few seconds, and then continue:

As the left hand gets heavier holding that dictionary, your right hand grows lighter as the balloons pull it up, and as your right hand grows lighter, your left hand gets heavier. In fact, in a moment, I am going to place another dictionary on your left and tie another set of balloons on your right wrist now.

Pause for a few seconds, and then continue:

In a moment, I am going to ask you to open your eyes, there will be no more balloons and no more dictionaries, your right hand will no longer feel light and your left hand will no longer feel heavy. Your arms will be back to normal, but you will see how much your arms moved. Open your eyes now and see how they have moved. Again, your arms are completely back to normal, but notice how much they have moved.

Some students’ arms will have moved considerably, the left arm may be all the way down and the right arm all the way up. Some students’ arms will have moved somewhat, while others not at all. Generally speaking, the more one’s arms move, the more suggestible and hypnotizable) one is.

Spiegel Test of Hypnotizability

Let students partner up. One student is the participant while the other does the rating. Instruct the participant to keep his or her head straightforward while rolling his or her eyes as far up and back as the can go. The rater notes how much sclera (the white part of the eye) is visible between the lower eyelid and the iris during this upgaze using the Spiegel scale see below. Ask the participant to slowly close his or her eyes while, as best as possible, keeping the eyes rolled back they may want to roll forward at least somewhat. The rater should note how much sclera there is just as the eyes begin to close the roll) using the Spiegel scale. Average the two numbers for one’s score between 0 and 4. The higher the number, the more hypnotizable one might be.

Follow-up and Discussion:

A data recordation sheet is provided with this lesson. The sheet has follow up questions for students to demonstrate their understanding of the concepts that were to be explored by the activity. Teachers are invited to adjust the data recordation sheet to fit their needs.

Discussion:
Prompt the students to discuss what they noticed about the process and write down any questions they have after the process is complete.
Were the results of the two suggestibility exercises valid?
Would scoring high on such exercises be correlated with a rich fantasy life or imagination?
What confounding variables might have affected the results of the two exercises?

Additional Considerations: Questions to Ask

- What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?
  - The differences between stimuli and responses
  - How the terminology applies
  - How classical conditioning applies to real-life situations
- What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?
  - They will need to formulate questions together as a class following the experiment.
  - Core ideas to be applied from standards strand
  - Would benefit from reading about Pavlov, Watson and Raynor’s Little Albert experiments, and definitions of learning and associative learning
- What representations or media help students make sense of core ideas?
  - Following the experiment and discussion, it might be helpful to show footage of the Spiegel eye roll test

- [https://www.youtube.com/watch?v=vERxtmCz-K8](https://www.youtube.com/watch?v=vERxtmCz-K8) Sean Michael Andrews Demonstrates the Spiegel Eye Roll Test
- What practices could students engage in to explore phenomena and/or representations of this concept?
  - Students could evaluate their family and compare with ideas regarding relaxation, sleep and attention.
- What connections to the Common Core State Standards (CCSS) could be emphasized as students engage in the instructional sequence?
  - Again, waiting for Standards Strand deliverables

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

Students will summarize their findings in either the included data recordation sheet, a different report, or a verbal presentation that includes the following

- Background information (about theories of hypnosis and theorists)
- Objectives of this study
- Questions that were answered
- Why didn’t we form a hypothesis at the beginning? What would have happened had you known you were going to be tested for hypnotic susceptibility?
- All materials used
- Procedures
- Appropriate graphs/tables
- Findings - How many students? How long did it take? Subsequent trial outcomes?
- Discussion must include relevant terminology
- Discussion of surprises or new understandings about hypnotic susceptibility

How could the experiment be improved?
References:
1. Template adapted from:

2. Lab model adapted from:
   from  https://www.nap.edu/read/11311/chapter/6#119
Data Recordation Sheet

Arm Movement Suggestibility Recordation
How far apart were the hands of the participant?

0 the hands are at the same level.
1 the hands have moved but are less than 6 inches apart
2 the hands are over 6 inches apart
3 the hands are over 12 inches apart
4 the hands are as far apart as they can be

Spiegel Eye Roll recordation
How much of the white sclera did you see?

0 no sclera is showing
1 more iris than sclera is showing
3 the sclera and iris are equally visible
4 more sclera than iris is showing
5 only sclera is showing

Plot a point for each student on the scatterplot below.
On a separate sheet of paper, answer the following:

1. How would you describe the relationship between the variables?
2. What do you estimate the correlation coefficient of the variables to be?_______
3. Why do you think it was important that only one person saw this data recordation sheet until after the exercise was over?
4. What confounding variables might have influence the validity of the exercises?
5. What is your conclusion about the data from the two hypnotic suggestibility tests?
6. Explain the procedure in such way that it could be replicated. Use appropriate terminology from the research methods unit and from the hypnosis unit.
7. If this lab could be changed, what changes do you think could be made to improve the validity of the exercises?
Lab Title: Sleep Lab

Adapted from/References: Linda Cobb, Shoreline Schools, WA

Section 1: Performance Expectation

What will the student be asked to do?

When instruction is complete, students will have formulated questions about variables that might affect the qualitative phenomenon feeling rested. This will be done by carrying out an investigation of observing data connected to their own sleep habits. Terminology associated with sleep will be used.

Main Idea/Concept Demonstrated or Taught by Lab:

After concluding this lab, students understand:

- The phenomenon of feeling rested is phenomenological
- Correlation does not equal causation.
- Basic concepts of data collection

After concluding this lab, students are able to (performance standards):

- Describe how causality can be multi-dimensional
- Explain the difference between total sleep hours and hours of REM sleep
- Explain the difficulty of “feeling rested.”
- Create and interpret graphical representations of data as used in both quantitative and qualitative methods

The concept behind this lab is twofold. The first is to investigate aspects of sleep that might relate to the feeling of being rested upon waking. The second is to investigate the concepts related to gathering data and analyzing data. Because this lab asks students to collect quite a bit of data, there is ample room for discussion of how this lab’s research design might be changed.

Key Terms and Psychologists Associated with Main Idea/Concept:

independent variable, dependent variable, Scatterplot Histogram, extrapolation, hypothesis, correlation coefficient, REM, teachers can add additional terms as well

Materials:

Version 1: Students do NOT need to use a phone with a sleep monitoring App.
**Version 2:** Students will use a phone with a sleep monitoring App. At the time this lab exercise was written, there were multiple free Apps that record information about a person’s sleeping habits. Teachers should research which apps are free and whether it is feasible to include cell phone tracking into this lab exercise.

**Instructions:**

*Note:* While this is loosely called a lab, this exercise is actually a field experiment. This distinction and the pro’s and con’s of such a research method can be used to spur discussion. Similarly, Students should be prodded to think about the lab critically rather than passively complete the tasks. Guiding questions to promote such critical thinking are below.

Students will be given a data recordation sheet with the instructions to begin recording the appropriate data as soon as the unit begins. While students record their own data, it is suggested that for the data analysis phase, students work together. This will increase the sample size and thereby might produce a clearer picture of the relationships between variables. Of course, teachers are encouraged to modify this lab to fit their needs. It is important to note that the use of cell phones to gather data does not need to be included. If it is feasible, then the added dimension of cell phone data can help this lab. If it is not feasible, then a robust educational experience can still be had.

Teachers are encouraged to modify the specifics of the assignment requirements regarding length and depth of student responses.

**Section 2: Crosscutting Concepts**

Teachers might want to “read up” on sleep apps (Lewis, 2013) (Calderone, 2016). Also, teachers might want to do some “pre-research” to investigate which apps are still on the market, which ones are free, etc.

Students should be familiar with the basic concepts of sleep stages and biological aspects of sleep. As such, this lab might be assigned towards the end of the sleep and consciousness unit.

**Some resources and considerations before the lab is assigned:**

**Articles:**


**Videos:**

- [https://www.youtube.com/watch?v=R65vEvFAtEM](https://www.youtube.com/watch?v=R65vEvFAtEM)
- [https://www.youtube.com/watch?v=Caq74d8NznM](https://www.youtube.com/watch?v=Caq74d8NznM)
Guiding Questions

- Students should be prompted to question the definition of the dependent variable “feeling Rested.”
- Student should be prompted to discuss whether they are qualified recorders of their own behavior, whether it is sleep behavior or any behavior.
- Students should be prompted to critically think about the lab
  + What additional variables could be included?
  + What variables that are collected should not be?
  + Does knowing one’s sleep will be monitored affect the sleep?
  + How would one guard against the placebo effect?
  + What flaws might the APP have that might be overlooked?
- What connections to the Common Core State Standards (CCSS) could be emphasized as students engage in the instructional sequence?
  o Again, waiting for Standards Strand deliverables

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

Students will summarize their findings in either the included data recordation sheet, a different report, or a verbal presentation that includes the following:

- Background information
  - Again, waiting for Standards Strand deliverables
  - Students should include their interview findings regarding ideas on multitasking
- Objectives of this study
- Questions that were answered
- What was the alternate hypothesis? What was the null hypothesis
- All materials used
- Procedures
- Appropriate graphs/tables
- Findings – was there a difference in “feeling rested” at the end of the study?
- Analysis – what are ways to interpret and present the data?
- Discussion must include relevant terminology
- Discussion of surprises or new understandings about sleep tracking

How could the experiment be improved?
## Data Recordation Sheet

<table>
<thead>
<tr>
<th>Day/date 4 hours before</th>
<th>Body Temp at bedtime</th>
<th>Bed Time</th>
<th>Use App to wake?</th>
<th>Wake Time</th>
<th>Did you wake up during?</th>
<th>Did you get up during?</th>
<th>Total hours slept</th>
<th>How Much REM time</th>
<th>Feel Rested?</th>
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Average Average Average Average Average Average Average Average Average Average
Follow up Questions:

1. Research how much sleep teenagers should get per night? Is your source reliable?
2. What is your average hours of sleep?
3. Make the following Scatterplots:
   + Total hours sleep feeling rested
   + Use App to wake up feeling rested
   + Estimate the correlational coefficient
4. Make one histogram and one bar chart using the data collected.
5. What relationships do you see between the data?
6. Do you think there is a connection between feeling rested and academic performance? How would you test it? Design a study to test your hypothesis.
7. Do you think there is a connection between feeling rested and emotional health? Design a study to test your hypothesis.
8. How can this lab be improved?
Section IV
Developmental Psychology

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1. Cognitive Development
2. Language Development
3. Moral Development
4. Parenting Styles
5. Product Evaluation
6. Understanding the Complexities of Development
Lab Title: Cognitive Development

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Plan and carry out a scientific investigation relating to cognitive development
  - Analyze data from their experiments with two subjects
  - Communicate their findings and identify which cognitive stage applies

Main Idea/Concept Demonstrated or Taught by Lab:
This lab will require students to collect and present data on Jean Piaget’s Cognitive Developmental Stages.

At the end of this lab, students should be able to:

- Demonstrate an understanding of the Jean Piaget’s Cognitive Developmental Stages
- Identify which subject would coincide with which cognitive developmental stage
- Identify the developmental phenomena (or milestones) which apply to their subjects

Key Terms and Psychologists Associated with Main Idea/Concept:
cognitive development, Jean Piaget, schemas, assimilation, accommodation, sensorimotor, preoperational, concrete operational, formal operational, stranger anxiety, object permanence, egocentrism, conservation, mathematical transformations, abstract thinking

Materials:
Students will need to find two subjects ranging from 8 months – 13 years old. Students will create experiments that would identify which cognitive developmental stage the subjects are in. Students will need to get parental consent to use the children in their experiments.

Instructions:

1. **Students should plan in advance which children they would like to observe and get parental permission.**
2. Students should hypothesize which age the child is in according to Piaget’s stages.
3. Students should create experiments to test the child’s cognitive stage.
   a. **Sensorimotor** - For example, if a student chooses an 8-month-old, assess object permanence. The student could hide an object under a blanket and see if the infant still thinks it exists or not. A student could observe whether or not the infant exemplifies stranger anxiety.
   b. **Preoperational** - For example, if a student chooses a 4-year old, the student could ask the child specific questions about the world around them. Why is the grass green? Do you have a brother? The students would look for egocentrism.
   c. **Concrete Operational** - Another experiment could be for conservation; a student could ask a 4-year-old how many pennies are on the table in front of the child. The child
responds. Then, spread out another row of equal amount of pennies on the table (above the previous row) and as which row has more. The student could also do an experiment with liquid. Have two glasses holding equal amounts of liquid. Then, pour the liquid into a taller glass. Ask the child about the amount of liquid. Is the amount the same or not? This would identify a lack of conservation. Then, do the same experiment with an 8-year-old. The student would then compare and contrast the results.

4. Students have the flexibility to choose which ages they would like to work with to take advantage of the relationships they may already have (may be easier to find subjects). Ideally, students should video the children doing the experiments. The students could discuss their follow-up questions and findings in the video and submit the video as an assignment. The videos should include the following: the experiments with both subjects, the follow up discussion regarding both subjects relating to Jean Piaget’s Cognitive Developmental Stages.

Follow-up and Discussion:
- Ask students to apply Piaget’s stages to the children they observed. Students should identify the correct Piaget stage the children are currently in.
- Ask students to identify any developmental phenomena or milestones they witnesses or did not observe. For example, lack of conservation or egocentrism.
- Ask students to reflect how they would have conducted the experiment differently.

Section 2: Crosscutting Concepts

Select at Least One
- Select one or more of the following cross-cutting concepts central to the phenomena that students will investigate:
  - Does cognitive development remain stable over time or change over time with experience?
- Describe how the cross-cutting concept(s) will factor into the lab.
  - Students will be able to observe how a stage theory is stable or changes over time.
  - Students will be able to observe patterns if they choose two similar ages for the experiments.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:
- Students will create experiments to identify which cognitive development stage the subjects are in.
- Students will identify the developmental phenomena in each stage, whether present or not. For example, lack of conservation or egocentrism.
- Students could video the experiments and their follow up discussion relating to Piaget’s stages and submit to the teacher for an assignment.
- Students should reflect how they would have modified the experiment.
Lab Title: Language Development

Section 1: Performance Expectations

What will the student be asked to do?
- Select one or more performance standards:
  - Plan and carry out a scientific investigation
  - Describe the data
  - Communicate findings

Main Idea/Concept Demonstrated or Taught by Lab:
This lab requires students to collect and present data on the language development of children.

After concluding this lab, students should be able to:
- Describe the scientific method
- Describe naturalistic observation
- Describe what language is
- Describe the development of communication and language
- Identify ways in which language development may be perceived as continuous
- Identify ways in which language development may be perceived as stage-like
- Identify stages of learning including babbling, one-word stage (holophrastic), two-word stage (telegraphic)
- Explain language development using operant learning (Skinner) and nativist perspective (Chomsky)

Key Terms and Psychologists Associated with Main Idea/Concept:
Scientific method, naturalistic observation, language, babbling, one-word stage, two-word stage, explaining language development from the learning and nativist perspectives, continuous development, stage-like development

Materials:
Instructions below, access to young children (or videos of young children talking)

Instructions:
Take a 10-minute language sample of two children (one who is younger than 2 years of age and one who is 3-4 years of age). Watch the child while they play with another child or adult and try to write down what the child says. How many words does the child put together: one, two, three, or more? Look at the progression of language development and decide where the child’s language development fits. If the child is using single words, how do they make themselves understood (e.g., using gestures as well)? If the child puts words together, are they grammatically correct (e.g., as an adult would use)? Do the words the child uses have appropriate endings (e.g., for past tense and plurals)?

Write a brief report of each of your observations. This report should include information that would be important if someone else were to try to replicate your experiment. For example, be sure to include the
age of each child. Be sure to include what you would expect for each age based on your understanding of language development and explain the set-up of your experiment. Identify the type of method you used to collect your data.

Follow-up and Discussion:

- **Think about the following questions to guide discussion and check for understanding:**
  - What did you notice about the ways in which children younger than 2 and 3- to 4-year-olds speak? Did they use different numbers of words? Was there variability in the number of unique words the children used? Did the complexity of their speech differ?
  - How can you explain language development from the learning perspective (Skinner) and from the nativist perspective (Chomsky)? Which view do you believe provides a better understanding of how language develops?
  - Can language development be described as continuous? Can language development be described as stage-like? Could it be described as both? Explain.
  - Identify the stage of language learning that each child is in. How do you know?
  - What factors may contribute to language development? In what ways may language development be impacted by nature? In what ways may language development be impacted by nurture? In what ways may language development be impacted by the interaction of nature and nurture?

Section 2: Crosscutting Concepts

- Students will use the scientific method of naturalistic observation to identify patterns as well as variables of behavior as related to language development.
- Students will explore the causes and effects of language development.

Section 3: Lab Report (written, verbal, or recorded)

- Background information on what language is
- Describe the purpose of the study
- Questions and hypothesis
  - Based on what you know about language development, what do you expect to find from the different aged children?
- Materials used (include measurements, where necessary)
- Procedure described in detail (for replication)
- Graphs/tables of collected data (e.g., the number of words each child said)
- Findings
  - Was hypothesis supported? Explain.
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the research be improved, if replicated?
Lab Title: Moral Development

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Communicate information about their personal belief regarding moral scenarios.
  - Identify the moral developmental stages and apply them to their decisions.

Main Idea/Concept Demonstrated or Taught by Lab:

This lab will require students to discuss moral decisions with their peers in a discussion format and apply Lawrence Kohlberg’s Moral Development Theory.

At the end of this lab, students should be able to:

- Demonstrate an understanding of Lawrence Kohlberg’s Moral Developmental Stages
- Identify which individual responses would coincide with each moral developmental stage

Key Terms and Psychologists Associated with Main Idea/Concept:

- Moral Development
- Lawrence Kohlberg
- Preconventional
- Conventional
- Postconventional
- Reinforcement
- Conformity
- Carol Gilligan
- Gender differences

Materials:

Moral Dilemma sheet (approximately 4 scenarios that students can discuss for a 50-minute class period).

Below are three sample scenarios. Find a moral dilemma which has occurred in your school, these topics tend to be relatable for students.

Scenario #1


A woman was near death from a very bad disease, a special kind of cancer. There was one drug that the doctors thought might save her. It was a form of radium that a druggist in the same town had recently discovered. The drug was expensive to make, but the druggist was charging ten times what the drug cost him to make. He paid $200 for the radium and charged $2,000 for a small dose of the drug. The sick woman’s husband, Heinz, went to everyone he knew to borrow the money, but he could get together only $500. He told the druggist that his wife was dying and asked him to sell it cheaper or let him pay later. But the druggist said, “No, I discovered the drug and I’m going to make money from it.” Heinz got desperate and broke into the man’s store to steal the drug for his wife. Was Heinz right or wrong to steal the drug? Explain your answer.

Sample Scenario #2
You do not like your math teacher. You think that he is unfair and does not help students when they are unsure of how to do a problem. You went in to ask him a question after school and he was not in his room (after telling you that he would be there to help you). Standing by his desk, you notice the test that you will be taking tomorrow set on his desk. Would you look at the test and glance over the questions? Explain your answer.

Sample Scenario #3

Your favorite aunt, Sally, is eighty years old. Her husband, your uncle, died two years ago. Since that time, she has been feeling very down, you might even say depressed. She has confided in you that she wants to talk to a doctor about assisted suicide. What should you do? Explain your answer.

Instructions:

- Have students put everything away on their desks and pass out the scenario sheet.
- Have students read scenario #1 the Heinz Dilemma scenario and decide whether or not it was right or wrong to steal the drug.
- Have students go to one side of the classroom if they believe Heinz was right to steal the drug and go to the other side of the classroom if they believe Heinz was wrong to steal the drug.
- Students should discuss their rationale for standing on the side of room they are on as a class.
- Once you feel students have discussed the topic, then move on to scenario #2. Repeat the instructions above.
- Once the class has discussed multiple scenarios, you can introduce Lawrence Kohlberg’s Moral Developmental Stages (Preconventional, Conventional & Postconventional).
- State, define and explain each stage of Lawrence Kohlberg’s Moral Development.

Follow-up and Discussion:

- Ask students to apply Kohlberg’s stages to their decision regarding the Heinz scenario.
- Ask students to discuss the stages, help students identify the correct stage for their moral thinking.
- Have students reflect on how their moral belief system might have been established. (possible discussion terms parenting, behaviorism, reinforcement, modeling, conformity, social-cultural, roles, obedience, etc.).
- Ask students if gender may influence moral decision making based on what they noticed in the class discussion (may reference Carol Gilligan’s work).

Section 2: Crosscutting Concepts

Select at Least One

- Select one or more of the following cross-cutting concepts central to the phenomena that students will investigate:
  - Does moral development remain stable over time or change over time with personal experience?
  - Are their patterns when discussing moral development with age?
- Describe how the cross-cutting concept(s) will factor into the lab.
  - Students should discuss if moral decisions making is stable over time or changes with personal experience.
Students could report if they see any patterns of moral decision making.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:
- Students could ask at least 5 different participants (such as their peers and family members) what they would do in the Heinz scenario.
- Students should record the participants’ responses.
- Students should write a report of the findings, including the ages of the participants, the participants’ responses, and the appropriate moral developmental stage each subject.
- Students should reflect on the accuracy of Kohlberg’s moral developmental stages in relation to the class discussion and their findings.
Lab Title: Parenting Styles

Section 1: Performance Expectations

What will the student be asked to do?
- Select one or more performance standards:
  - Engage in discussion regarding parenting styles
  - Communicate information gathered regarding parenting styles

Main Idea/Concept Demonstrated or Taught by Lab:
This lab will require students to collect and present data on parenting styles.
At the end of this lab, students should be able to:
- Demonstrate an understanding of the parenting styles
- Identify parenting styles (authoritarian, authoritative, permissive)
- Reflect on patterns in parenting styles and why one parent might parent a specific way

Key Terms and Psychologists Associated with Main Idea/Concept:
- parenting styles, authoritarian, authoritative, permissive, reinforcement, punishment, conformity, moral ethics (Lawrence Kohlberg’s post conventional stage)

Materials:
Students will discuss the parenting styles they experienced. Students will compare and contrast the parenting styles relating to their lives.

Instructions:
1. Teach the three types parenting styles to the class.
   a. Authoritarian, Authoritative, Permissive
2. Students should partner up with another student in the class.
3. Students will reflect on their parents/guardians and their upbringing.
4. Students should identify which parenting style applied to their guardians.
5. Students should identify specific behaviors that may be a result of the parenting style they experienced.
6. Students should hypothesize how they may have been different being raised under an alternate parenting style.

Follow-up and Discussion:
- Ask students to reflect what individual behaviors they have may be a result from the parenting style experienced.
- Students should hypothesize why their parents/guardians used a specific parenting style over another.
• Students should discuss how they may have turned out differently if their parents used a different style.

Section 2: Crosscutting Concepts

Select at Least One

• Select one or more of the following cross-cutting concepts central to the phenomena that students will investigate:
  o Does parenting style effect the personality of the child? Is there a cause and effect relationships?
  o Is there a pattern when choosing which parenting style one uses? Do individuals parent how they were parented? If not, is there another pattern?

• Describe how the cross-cutting concept(s) will factor into the lab.
  o Students will be able to reflect if there is a pattern to choosing a parenting style over another.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

• Students share out their findings with their peers to the class.
• Students will have recorded the different behaviors, attitudes, beliefs, etc. that may have been influenced by their parenting style upbringing.
• Students will have compared and contrasted their experiences with one another. They will report examples to the class.
Lab Title: Product Evaluation

Section 1: Performance Expectations

What will the student be asked to do?
- Select one or more performance standards:
  - Formulate a scientific question about BabyPlus (http://babyplus.com/).
  - Plan a scientific investigation
  - Communicate information in a written report

Main Idea/Concept Demonstrated or Taught by Lab:
This lab requires students to evaluate the BabyPlus product and develop a method to evaluate its effectiveness.

After concluding this lab, students should be able to:
- Describe the scientific method and its role in evaluating the effectiveness of BabyPlus
- Define systematic procedures used to improve the validity of research findings as they relate to BabyPlus
- Explain the role of environmental and biological factors in development as they related to the claims of BabyPlus
- Explain the interaction of environmental and biological factors in development as they relate to the claims of BabyPlus
- Describe newborns’ abilities

Key Terms and Psychologists Associated with Main Idea/Concept:
scientific method, operational definition, experimental design, random assignment, independent and dependent variables, prenatal development, newborns’ abilities, infant perceptual development, infant memory, environmental factors that contribute to development, biological factors that contribute to development, interaction of environmental and biological factors

Materials:
You will need the handout/instructions.

Instructions:
Explore the BabyPlus (http://babyplus.com) website. Be sure to pay particular attention to the following information:
- Home: describes the benefits of using BabyPlus
- FAQ: describes the product, where you can listen to the lessons, and see the lesson plans
- Advisors: describes professional advisors for BabyPlus
- Supporting science: describes research related to prenatal learning
- Testimonials: describes what parents are saying about the product

Design an experiment that would allow you to measure one of the benefits of BabyPlus on effects at birth, during infancy, or later in life.
Be sure to describe your proposed experiment so that others would be able to replicate it. This means you should include details about the procedures you plan to use, including the independent and dependent variables.

Next, look at the excerpts below from testimonials from parents (you can find the complete testimonials on the “Testimonials” tab).

“What made it firm for us that BabyPlus really works was when our second son was born. 17 months after the first birth, we had another boy. This time we were convinced BabyPlus worked because we did absolutely NOTHING for Taikyo (prenatal education) except for BabyPlus and this baby was even easier – he just ate and slept all day for the first 2 months!! When he was awake, he would just laugh or smile all the time.”

Lexie “started Kindergarten when she was three and half at a private prep school and enters first grade this fall before she even turns five. She had tested at 3 1/2 years at first grade level and is the youngest person ever to be enrolled at this K-12 performing arts and science preparatory school. Lexie has been a star student and is well liked by students of all ages.”

Provide two factors, other than BabyPlus, that could have contributed for the outcomes the parents describe.

Reason 1:

Reason 2:
Follow-up and Discussion:

- Think about the following questions to guide discussion and check for understanding:
  - Based on your research, would you recommend that parents buy BabyPlus?
  - Based on what you know about newborn abilities, are there potential benefits or drawbacks to using BabyPlus?

Section 2: Crosscutting Concepts

Select at Least One

- Select one or more of the following cross-cutting concepts central to the phenomena that students will investigate:
  - Describe potential problems associated with the \textit{causal effects} described in the claims of the benefits of BabyPlus. Explain how your experiment addresses some of those problems.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Background information
  - Briefly describe the BabyPlus produce, including the claims that it makes.
- Questions and hypothesis
  - Clearly state your hypothesis for testing one of the benefits of the BabyPlus product.
- Materials used (include measurements, where necessary)
- Procedure described in detail (for replication)
  - Describe your procedure in detail including your independent and dependent variables.
- Findings
  - Explain what you would expect your results to look like if your hypothesis was supported. What would the results mean about BabyPlus?
  - Explain what the results may look like if your hypothesis was not supported. What would the results mean about BabyPlus?
- Provide two factors other than BabyPlus that could contribute to the benefits that parents describe in their testimonials.
Lab Title: Understanding the complexities of development


Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Communicate information about the relationship between physical, cognitive, and social development in infancy, childhood, adolescence, and adulthood.

Main Idea/Concept Demonstrated or Taught by Lab:

This lab will require students to demonstrate their understanding of the ways in which physical, cognitive, and social aspects of development interact.

At the end of this lab, students should be able to:

- Demonstrate an understanding of physical, cognitive, and social development across the lifespan
- Explain how physical, cognitive, and social development interact with each other across the lifespan

Key Terms and Psychologists Associated with Main Idea/Concept:

Physical development (e.g., brain maturation, motor development, puberty, menopause, sensory changes, memory), cognitive development (e.g., Piaget’s theory of cognitive development, morality), social development (e.g., attachment, identity, social influences)

Materials:

Instructions below

Instructions:

Physical, cognitive, and social development take place across the lifespan. These aspects of development do not occur in isolation but interact with each other to produce developmental outcomes. For each of the age groups below, identify one way in which physical, cognitive, and social development interact. Note that there are many examples at each age group, but you need to only present one for each one.

Infancy, Childhood, Adolescence, Adulthood

Follow-up and Discussion:

- Think about the following questions to guide discussion and check for understanding:
  - Was it easy or difficult to provide examples of how the domains interact? What is different across the age groups?
  - In what ways has this lab been helpful in understanding the complexities of development?
Section 2: Crosscutting Concepts

Select at Least One

- Select one or more of the following cross-cutting concepts central to the phenomena that students will investigate:
  - Do you recognize any particular patterns in how physical, cognitive, and social aspects of development interact at each age?
  - Are there some aspects of development that remain stable over time and others that change over time?
- Describe how the cross-cutting concept(s) will factor into the lab.
- For detailed explanations about each one, visit http://ngss.nsta.org/CrosscuttingConceptsFull.aspx

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:
- Descriptions of the relationship across physical, cognitive, and social development at each age group.
- What is the importance of understanding the interactive nature of development?
1. Location of Cones and Rods

2. Did You Answer My Question?
Lab Title: Location of Cones and Rods

Adapted from/References:


Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Formulate a scientific question
  - Construct expectations or develop models

- After concluding this lab, students understand:
  1. The processes of sensation and perception
  2. The capabilities and limitations of sensory processes
  3. Interaction of the person and the environment in determining perception.

- After concluding this lab, students are able to (performance standards):
  1. Discuss processes of sensation and perception and how they interact.
  2. Explain the concepts of threshold and adaptation.

Main Idea/Concept Demonstrated or Taught by Lab:

This lab assists students with understanding the relationship between environmental stimuli and experienced perception. Students will see the physical limitations of visual sensory processing.

Key Terms and Psychologists Associated with Main Idea/Concept:

Cones, Rods, color vision

Materials:

Colored pencils or similar visual stimuli of various colors.

Instructions:

This process works best by demonstrating up front with a single student and having the class work in pairs or trios to duplicate the process.

1. One student begins as the subject. This student should sit and look at a focal object directly in front of them.
2. The student’s partner stands directly behind, chooses a colored pencil, and slowly moves the pencil into the subjects peripheral vision.
3. The subject should say “stop” at the point at which the pencil becomes visible while still focusing directly ahead at the focal object.
4. At the point where the subject says stop, ask them to identify the color of the pencil. Instruct the subject to indicate they are unable to answer rather than attempting a random guess.
5. Holding the pencil in the same location, move it wiggle it slightly to see if the subject can detect movement.
6. Repeat this process five more times from alternating sides of the subject’s periphery.
7. Each trial should be recorded as a hit (for correct response) or a miss (for no/incorrect response)
8. Student’s switch roles and repeat.

Follow-up and Discussion:

Additional Considerations: Questions to Ask

- What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?
  - A common explanation of Rods and Cones indicates that while Cones respond to “color”, Rods respond to “black and white”. How is this concept incorrect based on your experience?

- What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?
  - Students should be familiar with the anatomy of the eye, in particular, cones and rods.
  - Students should be familiar with the difference in sensation and perception.
  - Students should know the basic theories of color vision processing.

- What representations or media help students make sense of core ideas?
  - A visual diagram or picture of the anatomy of the eye

- What practices could students engage in to explore phenomena and/or representations of this concept?
  - Students may look into how this experience relates to the concept of “night vision” and/or how rods affect the ability to drive at night.

Section 2: Crosscutting Concepts

Select at Least One

- Students will see the *Cause and effect* relationship between the environmental stimulus and visual perception. Students will understand the *Structure and Function* of the eye and how they relate to different visual experiences.
  - Structure and Function
  - Stability and Change
- Describe how the cross-cutting concept(s) will factor into the lab.
- For detailed explanations about each one, visit [http://ngss.nsta.org/CrosscuttingConceptsFull.aspx](http://ngss.nsta.org/CrosscuttingConceptsFull.aspx)
Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

Students will summarize their findings in a written report that includes:

- Background information on the function and location of cones and rods in the eye.
- Objectives of this experience:
  - How did this experience seek to isolate the functions of cones and rods in the eye?
  - How does this experience provide information on the location and distribution of cones and rods on the retina?
- Questions and hypothesis
  - What hypothesis did this exercise test?
- Graphs/tables of collected data
  - Students should include a chart of the recorded data on hits and misses.
- Findings
  - Was hypothesis supported or not supported? Explain. (if not, what design flaws are likely responsible)
  - What do the findings mean? (use appropriate terminology related to concept)

References:

1. Template adapted from:

2. Lab model adapted from:
Lab Title: Did You Answer My Question?
This demonstration was developed by Ronald G. Shapiro, PhD.

Section 1: Performance Expectations

What will the student be asked to do?
Students will:
- Formulate one or more scientific questions.
- Construct expectations or develop models.
- Plan the methods for collecting and analyzing the data, including writing protocol, selecting appropriate sample sizes and statistical methods to be used to analyze the data.
- Carry out the scientific investigation with the entire class working as a team to collect data.
- Pool and subsequently analyze data.
- Present oral and written report to communicate results and conclusions.

Main Idea/Concept Demonstrated or Taught by Lab:
This lab will illustrate the importance of interpretation of a question in responding. Additionally, it will provide an opportunity to discuss critical thinking in the context of sensation and perception.

After concluding the lab students should be able to:
- Communicate more effectively by responding to a question which was asked rather than the listener’s reinterpretation of a question.
- Describe adaptation, perceptual set, cause and effect, framing, bias in interpreting broadly worded questions, critical thinking, confirmation bias

Key Terms and Psychologists Associated with Main Idea/Concept:
- Perceptual set, adaptation, cause and effect, framing, evaluative bias of language, language bias, critical thinking, confirmation bias

Materials:
- Two tubes of different scents of hand lotion for class demonstration. Two tubes of different scent lotions for each student in the class for take home exercise.
- New 3D blindfold in factory sealed package for each study participant (note: do not reuse blindfolds due to risk of spreading eye infections. Need to be sure blindfold prevents participant from seeing anything through or under blindfold.) (3D blindfolds may be ordered on eBay from China for less than a dollar each. Alternatively, plain cloth or bandanas may be used, but they need to be clean and lined with foil so one cannot see through them).
- Cloth rings (small hair scrunchies which fit like a ring when placed around finger) for each participant
**Instructions:**

**Step 1: The Class Demonstration – Instructor:**

- Asks an adventuresome student who wears a ring (such as a class ring) on a regular basis to volunteer for an in a class demonstration. Note: In the event you do not have a student who regularly wears a ring, nail polish will do.
- Tell the potential volunteer that they will be blindfolded and that you will be touching their hands. Verifies that this is OK and that the volunteer does not have any adverse reactions to soaps, lotions, etc.
- Asks volunteer to rest both hands on the back of a chair in front of the room.
- Blindfolds the volunteer with a new 3D blindfold and verifies that the volunteer cannot see anything (except possibly a bit of light around the nose).
- Talks with the volunteer for a minute or two about almost anything not relevant to this demonstration.
- Places some lotion on back of the volunteer’s hand without the ring on it.
- Asks the volunteer “What is on your hand?” Volunteer probably says lotion or something like lotion.
- Asks the volunteer for more detail about the lotion, encouraging the volunteer to smell hand. Volunteer is probably pretty accurate. Instructor tells them so.
- Possibly repeats the previous few steps with another type of lotion (optional).
- Touches back of volunteer’s other hand just briefly (the one with the ring) and after removing hand asks, “What is on your hand?” Volunteer probably says lotion or nothing.
- Repeat previous step a few times, possibly suggesting volunteer smell hand. May get a variety of answers including air (in which case ask, “What else is on your hand?”), skin or hair (in which case remind volunteer that is part of their hand), lotion (in which case suggest they smell hand again). It is highly unlikely volunteer will answer their ring on first few trials. I’ve never had a participant answer correctly while doing demonstration on the first trial and have rarely had them answer correctly on the second trial. Frequently they do not answer correctly at all in this phase.
- Ask volunteer what question you asked them. They may say “You asked what you put on my hand!”
- Try to change the volunteer’s perceptual set by asking them to spread fingers on hand which you applied lotion to and placing a cloth ring on finger corresponding to finger with ring on other hand (skip this step and the next two if volunteer has nail polish but does not have a ring).
- Ask volunteer what is on hand. They will likely say scrunchie or ring. If they say scrunchie just say or cloth ring.
- Repeat touching hand with ring and see how many trials it takes for volunteer to say, “my ring.”
- Give additional hints such as asking where they went to high school if it is a high school ring, are you wearing anything blue today if it is a blue ring, etc. until they answer correctly.
- Have students other than the volunteer observe the demonstration (takes about 5 minutes) and prepare to discuss why this task was so difficult). Optionally, students
might make notes on the participant’s performance. What clues helped, and which ones did not help? I’ve always found that all students are very attentive during this demonstration. (Many also have difficulty resisting calling out the answer.)

- Discuss what caused the volunteer to require as many trials as they did to answer the question “What is on your hand?” Did they interpret the question incorrectly? Was that an important factor? Did they adapt to the ring? Was that an important factor? Do we know that question interpretation and/or adaptation were important factors in not answering the question as asked on the first trial? Did the hint of a cloth ring help? If so, was this because it changed the volunteer’s set? If not, what would have changed the set?

Step 2: Follow on activity -- Experimental design

- There are at least two explanations why the volunteer did not immediately respond “my ring” or “my nail polish” on the first trial. One explanation, when doing the activity with a ring is that the participant adapted to their ring. While this seems very likely, this demonstration alone does not prove that ring adaptation was a cause of the incorrect responses. A second explanation is that the participant misinterpreted the question “What is on your hand?” This misinterpretation may have been caused, at least in part, by the “set” created through the lotion part of the activity. While this explanation seems very likely, this demonstration does not prove that misinterpretation of the question was a cause of the incorrect response. So, a follow-
on activity would be to design a study which would show in a more definitive manner whether adaptation or misinterpretation of the question or both caused the incorrect responses.

- To keep the study simpler, just design the follow-on study to determine if one of the above, adaptation or question misinterpretation (perhaps influenced by the “set” created by the lotion activity) contributed to the incorrect responses. The follow-on study might involve students repeating the ring activity with friends, relatives, etc. who touch their rings a lot vs. people who do not, people who have new rings vs. people who have worn the same ring for years (e.g., wedding rings), etc. to determine the role that adaptation may play. Similarly, a follow-on study might involve simply asking volunteer to look away or close their eyes and then answer the question “What is on your hand?” and comparing data with people who did the full study to see what role set played.

Step 3: Doing the experiment

- Have students each collect data and then pool all data. Distribute data to students to analyze.
- Have the students come closer to explaining what caused the effect? Was it adaptation and/or question misinterpretation? Did “set” play a role in the misinterpretation?

Step 4: Students write report and do oral presentation addressing the question.

Follow-up and Discussion:
Discuss the following:

- What have we learned from the demonstration about the way people address questions?
- What did the additional experimentation teach us about cause and effect? Did adaptation, question misinterpretation (and “set”) play a role, or was it just one of these factors? Are you sure?
- How can you apply what we learned from the demonstration and experimentation in our daily lives to make us better students? Teachers? Team members? Will we ask better questions? Answer questions more precisely? Be more cautious about saying “this was caused by...”?

Section 2: Crosscutting Concepts

The Next Generation Science Standards (NGSS) tell us that “Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.”

In this study we have seen an interesting response to a question. We have also seen there may be may causes for this response and have attempted to find out which of our hypothesized causes applied here and which did not. The diagnostic skills we learned here may be very useful to you, the students, as you move into your chosen professions. For example, a patient’s symptoms may or may not have multiple causes. Water coming into a home may or may not have multiple causes.
Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Background information (describe the class demonstration)
- Objectives (understand adaptation, interpretation, and cause and effect)
- Questions and hypothesis (concerning adaptation, set and interpretation)
- Materials used (include measurements, where necessary)
- Procedure described in detail (for replication)
- Graphs/tables of collected data
- Findings
  - Was hypothesis supported or not supported? Explain.
  - What do the findings mean?
  - How could the research be improved, if replicated?
- How will you behave differently as a result of what you learned?

Please insure quality methods are employed and share all data collected and lab reports with DrRonShapiro1981@SigmaXi.Net. While this demonstration always “works”, you and your students would be doing novel work carrying out the experimental work. The data collected may help to explain our observations to future students.

References:
- Video of the activity at a chamber of commerce event
- Illustrated guide to doing the activity with a high school teacher participant

Note:
I would like to thank industrial consultant Dr. Margarita Cossuto and Professor Randi Shedlosky for comments on an earlier draft of this activity.
Section VI
Cognition

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1. Cognitive Biases
2. Creativity and Divergent Thinking
3. Framing Decisions
4. Confirmation Bias and Custody Decisions
Lab Title: Cognitive Biases

Section 1: Performance Expectations

What will the student be asked to do?
- Select one or more performance standards:
  - Plan and/or carry out a scientific investigation related to cognitive biases
  - Summarize data
  - Communicate their findings and generate possible explanations

Main Idea/Concept Demonstrated or Taught by Lab:
Students will collect data that demonstrate common cognitive biases. At the end of the lab, students should be able to:

Understand various cognitive biases.

Identify factors that can influence responses to surveys and questionnaires.

Summarize data and calculate descriptive statistics.

Explain the cognitive processes underlying their results.

Key Terms and Psychologists Associated with Main Idea/Concept:
Cognitive biases, representativeness heuristic, availability heuristic, framing effect, anchoring effect, confirmation bias, hindsight bias, Amos Tversky, Daniel Kahneman

Materials:
Students will need to identify a small group of participants who will complete a questionnaire, either in written or oral form. Depending on the specific goals of the lab, participants may need to vary in age. Parental consent will be needed if any children serve as participants. Copies of questionnaires and data collection sheets will be needed once the questionnaire is constructed.

Instructions:
1. Students should construct a questionnaire consisting of questions that elicit cognitive biases. This activity could be done as an in-class project, with students drawing examples from their textbook and other resources. For a more advanced exercise, have students develop their own examples of these cognitive biases and translate these into questions. Issues for the teacher and student to consider include:
   - Which cognitive biases to focus on and include in the questionnaire.
   - Optimum length of the questionnaire and how this influences response.
   - Order of questions and how this influences responses.
2. The class should develop a plan for data collection. Questions to consider include:
   - Number of participants needed
   - Age and other demographic characteristics of participants
• Ethical considerations, including informed consent and debriefing
3. Students may collect data as individuals or in pairs or small groups, depending on the size and nature of the class.
4. Students should bring data collection sheets or questionnaires back to class by a specified due date. In class, have students pool their data.
5. Students can then calculate descriptive statistics, analyze the data, and construct appropriate figures to summarize the data. This could be done as homework or as a small group project within the class, depending on the level of the class and the number of students.
6. Have the students write a report summarizing the results of tests of each concept.
7. Age may affect responses to some of the questions. For example, older adults may be more susceptible to framing effects than younger adults. The students could examine the data for this effect if their sample size is large enough.

Sample questions:
(Examples from Cacioppo & Freberg, 2013)

*Availability heuristic*
Which is more common, being killed by a shark or by falling airplane parts?

*Representativeness heuristic*
Thomas is short, slim, and loves poetry. Which of the following is most likely to be Thomas’ occupation?
- Truck driver
- Professor of Greek and Classics

**Follow-up and Discussion:**

- Have students discuss their overall findings and why they were consistent with (or not consistent with) research data on these phenomena.
- Ask students to describe how their understanding of cognitive biases has changed now that they have hands-on experience asking people about them.
- Have students identify limitations with this exercise (e.g. sampling issues), and how it could be modified.

**Section 2: Crosscutting Concepts**

**Select at Least One**
- Select one or more of the following cross-cutting concepts central to the phenomena that students will investigate:
  - What patterns underlie responses to the questions? Are there patterns in cognitive processes that help explain biases?
Stability and Change: what factors might influence susceptibility to cognitive errors (e.g. experience, age, mental processing)?

- Describe how the cross-cutting concept(s) will factor into the lab.
  - Students will be discussing these concepts when summarizing and analyzing the data.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:
The sections below could be included in a written report of this lab, depending on the teacher’s specific goal for this activity. See above for more details.

- Background information
- Objectives
- Questions and hypothesis
- Materials used (include measurements, where necessary)
- Procedure described in detail (for replication)
- Graphs/tables of collected data
- Findings
  - Was hypothesis supported or not supported? Explain.
    - If inferential statistics are not calculated, students could discuss whether the data are consistent with findings in the research literature.
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the research be improved, if replicated?

References:


Lab Title: Creativity and Divergent Thinking

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Discuss operational definitions of creativity
  - Hypothesize about factors that may contribute to creativity and divergent thinking
  - Collect and summarize data
  - Communicate their findings and generate possible explanations

Main Idea/Concept Demonstrated or Taught by Lab:
Students will discuss variables that may relate to creativity and divergent thinking and will collect data on divergent thinking under multiple conditions. At the end of the lab, students should be able to:

- Demonstrate an understanding of creativity and divergent thinking.
- Identify some potential variables that affect divergent thinking.
- Summarize data and calculate descriptive statistics; interpret inferential statistics

Key Terms and Psychologists Associated with Main Idea/Concept:
Creativity, divergent thinking, convergent thinking, cognition, problem-solving, insight, flow, Czikszentmihalyi

Materials:
Students will need to identify participants. The number of participants required will depend on the specific goals of the lab exercise. Teachers can adjust the lab based on availability of participants.

Instructions:
8. Some studies indicate that creativity and divergent thinking can be elicited by simply instructing people to “be creative” or to think more abstractly about a particular problem. This lab explores that hypothesis.

9. Students should work together to generate a test for divergent thinking. Common tests ask a participant to generate as many uses as possible for a common item within a given time frame (e.g. “come up with as many different uses of a brick as you can”). The class should develop a script for two groups of participants – a group that receives the prompt to “be creative” (experimental group) and a group that is simply told to come up with uses for the item (control group). The experimental group may also be prompted to “think abstractly” and might be encouraged to continue to come up with ideas if they pause during the data collection period. Other issues for the class to consider include:
  - How long to allow for participants to respond?
• How to record responses. Responses could simply be counted using paper and pencil, or students may use some other method.

10. The class should develop a plan for data collection. Questions to consider include:
   • Number of participants needed
   • Age and other demographic characteristics of participants
   • Ethical considerations, including informed consent and debriefing

11. Students may collect data as individuals or in pairs or small groups, depending on the size and nature of the class.

12. Each student or small group should collect data on approximately an equal number of participants in each group.

13. Students should bring data back to class by a specified due date. In class, have students tabulate the number of unique responses generated by each participate, and then pool their data for the control and experimental groups.

14. Students can then calculate descriptive statistics, analyze the data, and construct appropriate figures to summarize the data. This could be done as homework or as a small group project within the class, depending on the level of the class and the number of students.

15. Have the students write a report summarizing the results of tests of each concept.

16. The students might want to look at other factors that could affect the dependent variable, such as age. The students could examine the data for this effect if their sample size is large enough.

Follow-up and Discussion:
• Have students discuss their findings and why they were consistent with (or not consistent with) other reported data on factors that contribute to divergent thinking.
• Have students discuss how these findings can be useful in their daily lives. Can individuals become more creative simply by “prompting” themselves?
• Ask students to describe how their understanding of creativity and divergent thinking has changed now that they have hands-on experience collecting data on these concepts.
• If the students examined age as a factor, they could discuss how divergent thinking might be related to fluid vs. crystallized intelligence and age-related changes in these abilities.
• Another important point for discussion could be whether divergent thinking and creativity are the same or different processes.
• Have students identify limitations with this exercise (e.g. sampling issues; measurement of variables), and how it could be modified.
Section 2: Crosscutting Concepts

Select at Least One
- Select one or more of the following cross-cutting concepts central to the phenomena that students will investigate:
  - What patterns underlie responses to the questions?
  - Cause and effect: Students should be able to discuss how some factors may affect divergent thinking.

- Describe how the cross-cutting concept(s) will factor into the lab.
  - Students will be discussing these concepts when summarizing and analyzing the data.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:
The sections below could be included in a written report of this lab, depending on the teacher’s specific goal for this activity. See above for more details.

- Background information
- Objectives
- Questions and hypothesis
- Materials used (include measurements, where necessary)
- Procedure described in detail (for replication)
- Graphs/tables of collected data
- Findings
  - Was hypothesis supported or not supported? Explain.
    - If inferential statistics are not calculated, students could discuss whether the data are consistent with findings in the research literature.
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the research be improved, if replicated?

References:

Lab Title: Framing Decisions

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Explain how framing influences decision making
  - Analyze how risk aversion can influence decision making
  - Practice random sampling and/or assignment as appropriate
  - Calculate descriptive and inferential statistics from data collected

Main Idea/Concept Demonstrated or Taught by Lab:

Students will discuss the concept of framing and how it applies to decision-making experiences. At the end of the lab, students should be able to:

- Demonstrate an understanding of framing and its influence on decision making.
- Identify some potential variables that affect framing.
- Summarize data and calculate descriptive statistics; interpret inferential statistics

Key Terms and Psychologists Associated with Main Idea/Concept:

Framing; risk aversion

Materials:

Students will need to identify participants. The number of participants required will depend on the specific goals of the lab exercise. Teachers can adjust the lab based on availability of participants.

Instructions:

1. Students often believe that decisions are not influenced by situational factors. Tversky and Kahneman (1981) show that decision making is usually not governed by rationality and often influenced by risk aversion. This lab explores that hypothesis.

2. Students should work together to craft two scenarios – one with a decision framed as a gain and the other framed as a loss. Teachers can use the accompanying Example 1 as a model for students to use as they craft their own examples. Half of the participants should respond to the “gain” option and the other half will respond to the “loss” option. Other issues for the class to consider include:
   - How long to allow for participants to respond?
   - How to record responses. Responses could simply be counted using paper and pencil, or students may use some other method.

3. The class should develop a plan for data collection. Questions to consider include:
   - Number of participants needed
   - Age and other demographic characteristics of participants
   - Ethical considerations, including informed consent and debriefing
4. Students may collect data as individuals or in pairs or small groups, depending on the size and nature of the class.

5. Each student or small group should collect data on approximately an equal number of participants in each group.

6. Students should bring data back to class by a specified due date. In class, have students tabulate the number of unique responses generated by each participate, and then pool their data for the control and experimental groups.

7. Students can then calculate descriptive statistics, analyze the data, and construct appropriate figures to summarize the data. This could be done as homework or as a small group project within the class, depending on the level of the class and the number of students.

8. Have the students write a report summarizing the results of tests of each concept.

9. The students might want to look at other factors that could affect the dependent variable, such as age. The students could examine the data for this effect if their sample size is large enough.

Follow-up and Discussion:
- Have students discuss their findings and why they were consistent with (or not consistent with) other reported data on factors that contribute to framing.
- Have students discuss how these findings can be useful in their daily lives. What factors can lead people to become more or less “risk averse”?
- Ask students to describe how their understanding of framing has changed now that they have hands-on experience collecting data on these concepts.
- Have students generate further hypotheses based on the findings of the lab that can be tested with more or different participants.
- Have students identify limitations with this exercise (e.g. sampling issues; measurement of variables), and how it could be modified.

Section 2: Crosscutting Concepts

Select at Least One
- Select one or more of the following cross-cutting concepts central to the phenomena that students will investigate:
  - What patterns underlie responses to the questions?
  - Cause and effect: Students should be able to discuss how some factors may affect framing.

- Describe how the cross-cutting concept(s) will factor into the lab.
  - Students will be discussing these concepts when summarizing and analyzing the data.
Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:
The sections below could be included in a written report of this lab, depending on the teacher’s specific goal for this activity. See above for more details.

- Background information
- Objectives
- Questions and hypothesis
- Materials used (include measurements, where necessary)
- Procedure described in detail (for replication)
- Graphs/tables of collected data
- Findings
  - Was hypothesis supported or not supported? Explain.
    - If inferential statistics are not calculated, students could discuss whether the data are consistent with findings in the research literature.
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the research be improved, if replicated?

References:

EXAMPLE 1 — Copyright Worth Publishers (will need permission)

Framing Decisions – Gain Scenario

Directions: In each case, circle either a or b.

1. Threatened by a superior enemy force, the general faces a dilemma. His intelligence officers say his soldiers will be caught in an ambush in which 600 of them will die unless he leads them to safety by one of two available routes. If he takes the first route, 200 soldiers will be saved. If he takes the second, there’s a one-third chance that 600 soldiers will be saved and a two-thirds chance that none will be saved. Which route should he take?
   a. Route 1
   b. Route 2

2. Choose between:
   a. a sure gain of $3000
   b. an 80 percent chance of winning $4000 and a 20 percent chance of winning nothing


Framing Decisions – Loss Scenario

Directions: In each case, circle either a or b.

1. Threatened by a superior enemy force, the general faces a dilemma. His intelligence officers say his soldiers will be caught in an ambush in which 600 of them will die unless he leads them to safety by one of two available routes. If he takes the first, 400 soldiers will die. If he takes the second, there’s a one-third chance that no soldiers will die, and a two-thirds chance that 600 soldiers will die. Which route should he take?
   a. Route 1
   b. Route 2

2. Choose between:
   a. a sure loss of $3000
   b. an 80 percent chance of losing $4000 and a 20 percent chance of losing nothing

Lab Title: Confirmation Bias and Custody Decisions

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Explain how confirmation bias influences decision making
  - Analyze how confirmation bias can influence decision making
  - Practice random sampling and/or assignment as appropriate
  - Calculate descriptive and inferential statistics from data collected

Main Idea/Concept Demonstrated or Taught by Lab:
Students will discuss the concept of confirmation bias and how it applies to decision-making experiences. At the end of the lab, students should be able to:

- Demonstrate an understanding of confirmation bias and its influence on decision making.
- Identify some potential variables that affect confirmation bias.
- Summarize data and calculate descriptive statistics; interpret inferential statistics

Key Terms and Psychologists Associated with Main Idea/Concept:

- Confirmation bias

Materials:
Students will need to identify participants. The number of participants required will depend on the specific goals of the lab exercise. Teachers can adjust the lab based on availability of participants.

Instructions:
1. Students often believe that decisions are not influenced by situational factors. Researcher Elder Shafir (1993) presented participants with two identical scenarios about a child custody situation. One scenario asked participants to determine which parent should be awarded custody, and the other scenario asked participants to determine which parent should be denied custody. Participants in the study choose the same parent (Parent B) for both scenarios. Shafir explained that the results could be explained by confirmation bias. Participants looked at only the positive qualities when deciding to award custody and the negative qualities when deciding to deny custody. This lab replicates this research.
2. Teachers may wish to have students read the original research article (cited below) as a reference for structuring the experimental conditions.
3. Students should present one scenario to each participant and record the response. Other issues for the class to consider include:
   - How long to allow for participants to respond?
• How to record responses. Responses could simply be counted using paper and pencil, or students may use some other method.
4. The class should develop a plan for data collection. Questions to consider include:
   • Number of participants needed
   • Age and other demographic characteristics of participants
   • Ethical considerations, including informed consent and debriefing
5. Students may collect data as individuals or in pairs or small groups, depending on the size and nature of the class.
6. Each student or small group should collect data on approximately an equal number of participants in each group.
7. Students should bring data back to class by a specified due date. In class, have students tabulate the number of unique responses generated by each participate, and then pool their data for the control and experimental groups.
8. Students can then calculate descriptive statistics, analyze the data, and construct appropriate figures to summarize the data. This could be done as homework or as a small group project within the class, depending on the level of the class and the number of students.
9. Have the students write a report summarizing the results of tests of each concept.
10. The students might want to look at other factors that could affect the dependent variable, such as age. The students could examine the data for this effect if their sample size is large enough.

Follow-up and Discussion:

• Have students discuss their findings and why they were consistent with (or not consistent with) the original research that was being replicated.
• Have students discuss how these findings can be useful in their daily lives. What factors can lead people to rely heavily on confirmation bias? How can people overcome this bias?
• Ask students to describe how their understanding of confirmation bias has changed now that they have hands-on experience collecting data on these concepts.
• Have students generate further hypotheses based on the findings of the lab that can be tested with more or different participants.
• Have students identify limitations with this exercise (e.g. sampling issues; measurement of variables), and how it could be modified.
Section 2: Crosscutting Concepts

Select at Least One

- Select one or more of the following cross-cutting concepts central to the phenomena that students will investigate:
  - What patterns underlie responses to the questions?
  - Cause and effect: Students should be able to discuss how some factors may affect framing.

- Describe how the cross-cutting concept(s) will factor into the lab.
  - Students will be discussing these concepts when summarizing and analyzing the data.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:
The sections below could be included in a written report of this lab, depending on the teacher’s specific goal for this activity. See above for more details.

- Background information
- Objectives
- Questions and hypothesis
- Materials used (include measurements, where necessary)
- Procedure described in detail (for replication)
- Graphs/tables of collected data
- Findings
  - Was hypothesis supported or not supported? Explain.
    - If inferential statistics are not calculated, students could discuss whether the data are consistent with findings in the research literature.
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the research be improved, if replicated?

References:

Section VII
Learning

1. Classical Conditioning
2. Discrimination and Generalization
3. Operant Conditioning
4. Schedules of Reinforcement
5. Negative Reinforcement and Positive Punishment
6. Habituation and Sensitization
Lab Title: Classical Conditioning

Adapted from/References:

○ Activity 1.2 Salivating to Music

Section 1: Performance Expectations

What will the student be asked to do?

● Carry out a scientific investigation by experiencing classical conditioning as a class
● Communicate the experience in a written, scientific, lab report

Main Idea/Concept Demonstrated or Taught by Lab:

This lab allows all students to experience classical conditioning firsthand and tests students’ understanding of classical conditioning principles.

After concluding this lab, students should be able to:

● Describe the principles of classical conditioning.
● Apply classical conditioning to everyday life.
● Interpret graphical representations of data as used in both quantitative and qualitative methods.

Key Terms and Psychologists Associated with Main Idea/Concept:

associative learning, classical conditioning, neutral stimulus, unconditioned stimulus, unconditioned response, conditioned stimulus, conditioned response, acquisition, extinction, spontaneous recovery, discrimination, generalization, Ivan Pavlov, John B. Watson

Materials:

You will need lemonade drink mix powder (one teaspoon per student), and each student will need a blank sheet of paper. Student should also have a pen and paper for recording data.

Instructions:

Please read all instructions before beginning this lab.
1. Have students create two columns a sheet of paper, one column labeled “trial #” and the other labeled “# of students”.

2. Have students fold up the edges of a blank piece of paper to be used as a container for a small amount of lemonade drink mix powder (about a teaspoon).
   a. Be sure to check with students about food allergies before introducing any substance to be tasted in a class demonstration.

3. Have students lick the tip of their finger and taste the lemonade powder (UCS), which will cause salivation (UCR).

4. Instruct students to have some lemonade powder ready on their fingertip so they can lick their fingertip as soon as they hear the music begin playing.

5. Play 3-4 seconds of a song with a pronounced musical introduction (e.g., “Don’t Stop Believin”). The first note of the song should be paired with the lemonade powder for 8-10 trials, waiting about 20 seconds between pairings.

6. Then, play the music only (without the lemonade powder). Students should note if they start salivating. See #7.

7. Have students collect data at each trial. You might say, “By show of hands, how many students salivated to the music?”

8. Play the song again and again, between 20 second rests (inter-trial intervals), until salivation no longer occurs (extinction). Collect data by show of hands.

9. Play the music again at the start of the next class period to see if spontaneous recovery occurs.

10. Have students complete their lab reports (directions below.)

Follow-up and Discussion:

- At the end of the first day of this activity, ask students to discuss what they noticed about the process and write down any questions they have after the process is complete. Answer these questions in a class discussion.
- As they discuss, share, and identify questions, help students identify and define the UCS (lemonade powder), UCR (salivation), CS (music), and CR (salivation). You can also discuss the timing of the stimuli during the acquisition process, as well as extinction.

What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?

- Helpful: There are certain automatic behaviors that are difficult to explain, like fear.
- Helpful: Advertisers try to sell us one thing, like a car, by associating it with another, like a sexy person
- Troublesome: generalizability - ‘this only has to do with salivating’ - instructor should help students apply this to a variety of conditioned physical and emotional responses

What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?

- Students should understand the scientific method.
- Students will need to be able to think like a scientist by identifying variables and thinking critically.
- Students would benefit from reading about Pavlov’s, and Watson and Raynor’s experiments
- Students would benefit by identifying the Classical Conditioning labels in these experiments.
What representations or media help students make sense of core ideas?

- John Watson - Little Albert
- Ivan Pavlov’s - Classical Conditioning

What practices could students engage in to explore phenomena and/or representations of this concept?

- Students could evaluate their own classically conditioned responses
  - Fears
  - Taste aversions

**Section 2: Crosscutting Concepts**

Select at Least One

- Students will identify patterns of association between NS and UCS.
- Students will evaluate the cause and effect of pairing the NS with the UCS over and over again.
- If the music is played during subsequent classes, students will also be able to determine the stability of the learned response over time.

**Section 3: Lab Report (written, verbal, or recorded)**

Suggested Content to be Included in Student Report:

Students will summarize their findings in a written report according to the following questions:

- Describe Pavlov’s discovery of classical conditioning?
- What were the objectives of this study?
- Can you think of any reason that we didn’t collectively attempt to form a hypothesis at the beginning of the study?
- What materials were used?
- What was the step-by-step procedure of this study?
- How would you best represent this data? Produce appropriate graphs/tables to display the data that you collected.
- What were the findings of this study? (i.e., discuss your data, draw conclusions.)
- From a scientific perspective, how could the experiment be improved?
- Was this an experiment, a correlation, a study, or something else? Explain your answer.

Note: This lab can be adjusted for individual self-data collection by asking students to rate the strength of the CR from 1-10 and graphing that data by trial.
Lab Title: Stimulus Generalization and Discrimination

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Formulate a scientific question about stimulus generalization and discrimination.
  - Plan and/or carry out a scientific investigation involving stimulus generalization and discrimination.
  - Communicate information about stimulus generalization and discrimination.

Main Idea/Concept Demonstrated or Taught by Lab:

This lab will allow students to experience stimulus generalization and discrimination firsthand and apply their knowledge of classical conditioning.

Key Terms and Psychologists Associated with Main Idea/Concept:

generalization, discrimination, classical conditioning, stimuli, Ivan Pavlov, stimulus control

Materials:

Paper bag with 5 ink pens of various textures, additional pen to serve as the target pen

Instructions:

1. Ask for a volunteer to come forward to the front of the classroom.

2. Show the class a target pen and inform the volunteer that their task is to pick out the pen in the bag most similar to the target pen while avoiding pens that are different from the target pen.

3. Ask the volunteer to place a hand in the bag and feel the different pens, choosing the one that most resembles the target pen in texture, size, and shape.

4. Compare the pen that the student pulls out to the target. (If not the one that most closely resembles the target pen, replace and repeat the selection process.)

5. Have the student pull out pens until the one that most closely resembles the target is selected.

6. Repeat with 4 other students.

7. Have the students complete the report.

Follow-up and Discussion:

- What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?
Students commonly hear the terms discrimination and generalization in other contexts such as social psychology, and they do not realize that they are different terms in the realm of learning. Discussing the terms in the context of conditioning can help to make the distinction clear.

Students sometimes believe that discrimination is bad because of hearing it used in connection with treating someone unfairly, but it is helpful to discuss a synonym of “telling the difference” when talking about discrimination in connection with conditioning.

Transfer is a buzz word that students might be more familiar with than generalization, and it can be helpful to discuss with them that it applies to many different situations.

- What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?

Students should be familiar with the basics of classical conditioning in order to fully grasp the difference between discrimination and generalization. Knowing about acquisition, extinction, and spontaneous recovery are also helpful.

Students will discuss as a class how the volunteers performed on the discrimination task.

- What representations or media help students make sense of core ideas?

Discussing confusing people or calling them by the wrong name of someone who looks very similar to them, whether friends or celebrities, is useful in teaching discrimination and generalization. For example, having two friends who both have dark hair and encountering one but calling them by the name of the other because they look alike is a common example of generalization, or thinking you spot a friend in a crowd but it’s just a stranger doppelganger.

This video also can be helpful to show as a demonstration of how an animal learns to respond differently to different stimuli: http://www.youtube.com/watch?v=1kqVxgPBIX0

- What practices could students engage in to explore phenomena and/or representations of this concept?

Students can consider phenomena in other areas of psychology such as interference and amnesia in connection with memory to better understand real-world occurrences of generalization.

Section 2: Crosscutting Concepts

Select at Least One

- Students will examine patterns of classical conditioning responses.
- Students will understand the Cause and effect relationship between stimuli and responses.
Students will understand how Stability and Change relate to classical conditioning principles of generalization and discrimination.

- Students will explore the nature of stimuli that lead to differences (discrimination) or similarities (generalization) in judgments.
- Students will investigate how stimuli in classical conditioning cause effects (responses), and whether these are the same or different effects from one another.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

Students will summarize their findings in either a written report or a verbal presentation that includes the following:

- Background information (about classical conditioning/Pavlov)
- Objectives of this study
- Questions that were answered
- Why didn’t we form a hypothesis at the beginning? What would have happened had you known you were going to demonstrate discrimination or generalization?
- Materials used
- Procedures
- Findings - How many students correctly chose the pen that most closely matched the target? How many times did they pull out the wrong pen?
- Discussion tied to relevant terminology
- Discussion of surprises or new understandings about generalization and discrimination
- How could the experiment be improved?

References:

1. Template adapted from:

2. Lab model adapted from:
Lab Title: Operant Conditioning

Section 1: Performance Expectations

What will the student be asked to do?

- Students will plan and carry out a scientific investigation about operant conditioning.
- Students will analyze data to draw conclusions about their own behavior and use this analysis to develop a model to improve their daily behavior.
- Students will communicate information about their findings.

After concluding this lab, students understand:

- Law of Effect
- Principles of operant conditioning
- Types of punishment and reinforcement
- Clinical and experimental examples of operant conditioning

After concluding this lab, students are able to (performance standards):

- Explain the principles of operant conditioning
- Apply operant conditioning to their everyday lives
- Analyze the effect of learning theories on their behavior
- Develop systems of operant conditioning that modify and improve behavior

Main Idea/Concept Demonstrated or Taught by Lab:

This lab allows students to analyze how operant conditioning principles affect their everyday lives. They will plan and carry out an observational study on their own behavior on popular cell phone applications.

Key Terms and Psychologists Associated with Main Idea/Concept:

operant conditioning, B.F. Skinner, emitted behavior, positive reinforcement, negative reinforcement, positive punishment, negative punishment, schedules of reinforcement, discriminative stimulus

Materials:

Students will use their personal smartphones for this lab (or any other electronic device they use for games, online shopping, and/or social media). They will also need a notebook, phone, or laptop to record their observations.

Instructions:

Prior to this lab, students should be familiar with basic concepts of operant conditioning and types of consequences. Videos are provided under “Follow Up and Discussion” that may help explain these concepts.

Students will work with a partner (or group of three) and to complete the following steps:
1. First, choose one smartphone application (app) or online activity to analyze. Select an app that you are both familiar with and spend a lot of time using daily. You may select any appropriate online activity that you can do in class, such as a social media app, game, or online shopping.

2. Next, discuss how you use this app, making a list of your emitted behaviors and the responses you receive in the following categories: positive reinforcement, negative reinforcement, positive punishment, and negative punishment.
   a. This can be done in a chart, or simply four separate lists for each of the categories. Each addition to the list must include a behavior and response.
   b. It may be helpful to discuss a few examples as a whole class before students begin their lists. You may ask them to choose an app, and list at least one example under each category. Here are a few examples you may use for Snapchat:
      i. Positive Reinforcement: Clicking through a friend's story on Snapchat (emitted behavior) - seeing a funny picture (response)
      ii. Negative Reinforcement: Clicking on a Snapchat picture (emitted behavior) - the notification goes away (response)
      iii. Positive Punishment: Ignoring Snapchat during the school day (emitted behavior) - your friend is mad at you because you didn’t respond to them (response)
      iv. Negative Punishment: Ignoring Snapchat during the school day (emitted behavior) - you miss out on an inside joke sent among your friends (response)

3. Choose one or two behaviors and responses from each category to observe in your lab.

4. With your partner, take turns using this application for 5 minutes or less, with your partner observing and recording your behavior.
   a. Make a tally next to each behavior-response pair when it occurs.
   b. Keep in mind that—though you are trying to simulate natural, unobserved behavior—it will likely be necessary to communicate with your partner while you are using the app. For example, you would need to tell them if you find a specific tweet funny (and therefore positive reinforcement), as you are scrolling through your feed.

5. Compile and analyze your data.

Follow-up and Discussion:

- As a class, discuss how operant conditioning principles are integrated into smartphone apps. What patterns are there across applications? How does operant conditioning contribute to making smartphones so addicting?
- Using these findings, each pair of students should devise a new system that will reduce use of this app. Their goal is to make the app less addicting by changing its structure or creating a new smartphone program. Some things to consider:
  - How can you extinguish your trained responses?
  - How can you alter notifications (discriminative stimuli)?
  - How can the schedules of reinforcement be altered to decrease responsiveness?
• These new systems can be integrated into students’ lab report or communicated in a separate format. Students may extend this project by writing out formal business proposals or letters, intended for the designers of their chosen app. These letters would need to correctly explain psychological terms, while still presenting a clear argument to the designers. Students will need to defend why these changes are in the best interests of the users and/or will not make the app any less fun and popular.

What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?

• The difference between types of consequences (specifically, the use of ‘positive’ and ‘negative’ in these terms)
• Students likely already know that smartphones are addicting, and this activity may help them explain this previous knowledge. Students may explore research on this topic before or after completing their labs. The following articles may be utilized as resources:
  ○ The Binge Breaker (Bosker 2016)
  ○ Smartphone Addiction (Archer 2013)
  ○ Internet Addiction (Beato 2010)
  ○ Relationship between Psychological Well-Being and Smartphone Addiction of University Students (Kumcagiz, H., & Gündüz, Y. 2016)

What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?

• Students will need to have a fundamental understanding of processes and procedures of scientific inquiry.
• Law of effect and principles of operant conditioning
• Types of consequences in operant conditioning (reinforcement and punishment)
• Schedules of reinforcement

What representations or media help students make sense of core ideas?

• Crash Course Psychology #11: How to Train a Brain
• Operant Conditioning (interview with Skinner; discusses research with pigeons, schedules of reinforcement, and Behaviorist views of free will)

What practices could students engage in to explore phenomena and/or representations of this concept?

• Students could watch the videos linked above to better understand the basic principles of operant conditioning.
• Students could apply operant conditioning terminology to other areas of their lives.
  ○ Rewards and punishments they receive from their parents
  ○ Training their own pets
• Students could expand this lab to include classical conditioning examples (to better explain the difference between the two types of learning).

Section 2: Crosscutting Concepts

• Students will observe and identify patterns in their use of smartphone applications.
• Students will analyze and develop new systems that can impact and improve their behavior.
Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Background information (principles of operant conditioning, discussion of use of this app)
- Objectives
- Questions and hypothesis
- Materials used
- Procedure described in detail (for replication)
- Collected data and observations
- Findings
  - Was hypothesis supported or not supported? Explain.
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the research be improved, if replicated?
- Recommendations
  - In this section, students should describe a new system they have designed that will reduce use of this app. Their goal is to make the app less addicting by changing its structure or creating a new smartphone program.

References:


Additional Recommendations:

This lab is designed to focus on basic operant conditioning principles. However, it can easily be adapted to include other terminology and examples. Students may take note of the schedules of reinforcement on each app, or they may analyze the ways that that have been classically conditioned to feel towards and respond to the app they have chosen to study (notification sounds/icons, logos, etc.).
Lab Title: Schedules of Reinforcement

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Formulate a scientific question about the type of schedule that is being utilized.
  - Plan and/or carry out a scientific investigation related to schedules of reinforcement.
  - Analyze data to determine the patterns of responding associated with each schedule.
  - Communicate information about schedules of reinforcement.

Main Idea/Concept Demonstrated or Taught by Lab:

This lab allows students the opportunity to witness the main schedules of reinforcement and tests their understanding of principles of operant conditioning.

After concluding this lab, students should be able to:

- Describe the 4 basic schedules of reinforcement
- Apply some basic reinforcement schedules to everyday life
- Distinguish between the 4 basic schedules of reinforcement in real-world examples

Key Terms and Psychologists Associated with Main Idea/Concept:

fixed ratio, variable ratio, fixed interval, variable interval, continuous schedule, intermittent schedule, reinforcement, operant conditioning, B.F. Skinner, John B. Watson, Edward Thorndike

Materials:

Blindfolds, written instructions, and a reward of some sort (to be hidden from the students; for example, a candy bar)

Written Instructions will include 1 of the following:

- “Every second step your partner takes, say ‘keep going’ or ‘turn (indicate which direction)”’
- “Approximately every third step your partner takes, say ‘keep going’ or ‘turn (indicate which direction)”’ (Begin with the 2\textsuperscript{nd} step, then the 4\textsuperscript{th} step, then the next step, then the 3\textsuperscript{rd} step, then the 5\textsuperscript{th} step)”
- “Every 5 seconds, say ‘keep going’ or ‘turn (indicate which direction)”’
- “Approximately every 3 seconds, say ‘keep going’ or ‘turn (indicate which direction)”’ (Begin after 2 seconds, then after 4 seconds, then the next second, then after 3 seconds, then after 5 seconds)”
Instructions: (Note that you will need ample space to perform this activity such as a hallway, library, cafeteria, or your classroom provided that students will not be too tightly confined with the arrangement of the desks. A class “field trip” to another nearby location will likely serve best for this activity.)

1. Divide students into pairs, letting them know that one will be blindfolded.
2. Distribute the blindfolds and instructions to the partners who will be guiding.
3. Blindfold the student partners who have agreed to be blindfolded.
4. Verbally instruct the partners who have the instructions to begin, letting all students know they are seeking a reward somewhere in the classroom. (Make sure the partners who are guiding do not allow their blindfolded partners to bump into one another.)
5. Allow students 5 minutes to attempt to find the reward.
6. Call time after 5 minutes and remove the blindfolds.
7. Have the pairs discuss the type of schedule they used.
8. Pair 2 groups together to discuss the differences in the instructions they were provided.
9. Discuss all 4 schedules as a class.
10. Have students complete the report.

Follow-up and Discussion:

What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?

Students commonly misunderstand the terminology of schedules of reinforcement. Students generally benefit from learning simple words that are linked to the terms. For example, learning that “fixed” is associated with “exactly,” whereas “variable” indicates “approximately” helps students make a distinction. Similarly, learning that “ratio” refers to “number of responses” (the R’s go together - ratio and response) and “interval” refers to “after an amount of time” also helps clarify.

Students frequently believe that interval schedules require the behavior to be performed for the entire amount of time but emphasizing that the reinforcers are delivered for the first response after the time has elapsed helps to clarify this confusion.

It is important to point out that schedules apply not only to reinforcement, but to punishment as well, and providing common examples such as not studying for pop quizzes can help make that connection for them.
Conditioned and unconditioned reinforcers can also be discussed with this activity, as it has both. Conditioned reinforcers are the verbal instructions given such as “keep going” and “turn right, while the candy bar as the ultimate reward is an unconditioned reinforcer.

This lab also has the ability to generate a thoughtful discussion about short-term and long-term rewards as well as the magnitude (size) of the reinforcer. As a relatable example for students, they have more frequent homework assignments or quizzes which are typically worth less points than larger more delayed reinforcers such as exams or even final grades in a class leading them to continue on the path until they successfully reach the ultimate goal of graduation.

What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?

Students should be familiar with the principles of operant conditioning and understand the difference between reinforcement and punishment.

What representations or media help students make sense of core ideas?

https://www.youtube.com/watch?v=Mt4N9GSoM1 This clip from the Big Bang Theory is helpful in illustrating the principles of operant conditioning and can be useful in a discussion of continuous versus intermittent schedules.

What practices could students engage in to explore phenomena and/or representations of this concept?

Students could evaluate the different schedules of reinforcement they’re exposed to in their lives such as how often their studying is rewarded with a pop quiz or test, how often they receive a text message reply from a friend, and how often they check their email or mail.

Section 2: Crosscutting Concepts

Select at Least One

- Students will recognize the Patterns of responding based on various schedules of reinforcement.
- Students will recognize the cause and effect of different schedules of reinforcement.
Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

Students will summarize their findings in either a written report or a verbal presentation that includes the following:

- Background information (about operant conditioning/Skinner)
- Objectives of this study
- Questions that were answered
- Why didn’t we form a hypothesis at the beginning? What would have happened had you known you were going to be placed on a specific schedule of reinforcement?
- All materials used
- Procedures
- Findings - How many students ultimately found the reward? How long did it take each? Which schedule seemed to work the best at finding the reward the fastest?
- Discussion tied to relevant terminology
- Discussion of surprises or new understandings about schedules of reinforcement
- Which schedule seems to be optimal in generating consistent responding?
- How could the experiment be improved?

References:

1. Template adapted from:

2. Lab model adapted from:
Lab Title: Negative Reinforcement and Positive Punishment

Section 1: Performance Expectations

What will the student be asked to do?
- Students will identify examples of negative reinforcement and positive punishment from their lives.
- Students will distinguish between examples of negative reinforcement and positive punishment.
- Students will identify target behaviors to increase or decrease.
- Students will design and carry out negative reinforcement and positive punishment procedures.
- Students will summarize and compare their procedures.
- Students may review and evaluate other students’ demonstrations.
- Students may reflect on their prediction, design, execution, and teamwork.

What will the student be able to do after completing this lab?
- Students will be able to define and distinguish negative reinforcement and positive punishment.
- Students will be able to design and use negative reinforcement and positive punishment procedures.
- Students will be able to video record and communicate their work to an audience.
- Students will be able to identify everyday situations when they rely on negative reinforcement and positive punishment, and perhaps when they could use positive reinforcement instead.
- Students will be able to evaluate and discuss their work and others’ work.

Main Idea/Concept Demonstrated or Taught by Lab:
Students will engage in an exercise to help them differentiate and implement negative reinforcement and positive punishment processes/procedures.

Key Terms and Psychologists Associated with Main Idea/Concept:
Reinforcement, punishment, negative reinforcement, positive punishment, aversive stimuli, escape and avoidance, target behavior

Materials:
Timing device (or cell phone);
Lab Worksheet (with planning table and reflection items);
Paper (provided as lab worksheet)
Video mechanism -- Something to record the training demonstration (e.g., smart phone, GoPro)

The following materials will be needed, and are addressed on the lab worksheet:

Test Subject -- This lab can be demonstrated (with cooperation) on a fellow lab mate, or it can be done as a genuine training exercise on a pet, small animal in the lab (e.g., lizard, hamster, etc.). It might be easiest to use a person and “coach” them to play along...the demonstration will be somewhat artificial.

Test Stimulus -- One other item might be needed or provided by students as the aversive stimulus to be used in the negative reinforcement / positive punishment lab. Aversive stimuli might include saying something like, “Don’t do that”, a repeated tongue click, cell phone sound (think about the seatbelt ding in a car), tap on the shoulder, ice cube on skin, bad tasting bite or sip of something, bright light in eyes. (Just make sure students know not to select something potentially harmful.)

Target Behaviors -- Two targets will be identified and required for this lab:
• A target behavior to increase (reinforce).
• A target behavior to decrease (punish).

Instructions (for Instructors):

Introduction to Main Concepts

Be sure that students have a good understanding of **reinforcement** and **punishment** in terms of their impact on behavior. This means to review the broad processes and make sure they realize one process/procedure increases probability of behavior and the other process/procedure decreases probability of behavior. Other recommended things to discuss prior to demonstration:

• Negative reinforcement and positive punishment often are confused because both procedures involve aversive stimulation. Discuss how the aversive stimulus plays a different role/function in each case. That is, in negative reinforcement, the aversive stimulation is occurring regularly until the behavior occurs (and the behavior is reinforced by its removal, delay, or prevention). In positive punishment, the aversive stimulation is not occurring until the behavior occurs (and the behavior is punished by its presentation, increased immediacy, or increased intensity).

• Ask students to reiterate the meaning of negative and positive in this technical context, and how they do not indicate “good” or “bad”. Remind them that the terms positive and negative refer to the direct of change (as in addition or subtraction along a number line) in stimulus intensity or probability.

• Define and provide examples of **target behavior**. Discuss how and why interventionist identify targets. Explain that it is imperative to anchor any example of reinforcement or punishment according to a particular behavior. I have to identify clearly specific target behavior before determining its antecedents, consequences, and changes in its probability.

• Ask students to think about and write down an example of a negative reinforcement and positive punishment they encounter regularly (at home, practice, job, etc.)

• Ask students to share their examples in a class discussion, and correct any mistaken examples. (A list of examples is provided as an appendix to this lab exercise.)

• Allow students to ask questions about negative reinforcement and positive punishment based on the definitions and your discussion thus far.

• Remind students to always focus on the target behavior to “anchor” examples of processes, procedures, etc. when analyzing behavior.

• After you’ve gone through some examples, it’s probably worthwhile to introduce the concepts of **escape** and **avoidance** to students. Ask them to look back to the examples of negative reinforcement you’ve reviewed thus far and compare whether the behavior terminated/lessened or prevented aversive stimulation.

Pre-Test

Now assess students’ understanding of negative reinforcement and positive punishment with a quiz via paper or online (using something like [Kahoot](https://kahoot.com)).

• This will give you another chance to correct students’ misunderstandings.

Lab Exercise/Demonstration
Now that you have discussed the definitions and many examples, use the lab demonstration to challenge students’ design and implementation of negative reinforcement and positive punishment procedures.

I recommend using teams of 2-3 students. The goal of the lab is to ask student teams to identify a target behavior to increase, target behavior to decrease, and a procedure to change those targets. The operant technique must involve use of aversive stimuli, but the stimuli must be mild in intensity.

Feel free to use the chart on the next page in all or altered form.

You might want to ask students to identify a single target behavior for both demonstrations or two target behaviors that are incompatible (or, opposites) of each other, although this might not always work depending on students’ level of understanding and based on the aversive stimulus and place where conditioning occurs. Examples include:

- Chewing with mouth open vs. Chewing with mouth closed
- Talking during movie vs. Watching quietly
- Walking quickly vs. Walking slowly
- Eye contact vs. Looking away

To clarify for instructors:

-- **The negative reinforcement demonstration would involve students to repeatedly present (or make constantly present) some aversive stimulus until the target behavior occurs.**

**Examples:**

- Let’s say a person repeatedly gets tickled with a feather until they say the words, “Stop” or “I don’t like being tickled”... whatever types of phrases might be acceptable according to the students’ target behavior.
- If students are moving about a space, you could present an aversive cell phone sound until they sit down or walk faster (depending on a target selected).

-- **The positive punishment demonstration would involve students presenting no aversive stimulation until a particular behavior occurs.**

**Examples (to correspond with above examples):**

- Let’s say a person is asked to discuss their drive to school each morning and the traffic signs they encounter. Any time they say “Stop” the aversive stimulus would be presented. (There might be a better scenario for getting them to say a particular word or phrase.) Over the course of the conversation, their use of “stop” or the target phrase should decrease.
• Aversive stimulation would be presented only after students stand up. Standing (getting out of seat) should become less likely.
Negative Reinforcement & Positive Punishment

Planning & Demonstration Worksheet

Lab Students / Researchers: ________________________________________________

Subject to be Trained: _____________________________

Aversive Stimulus used during Training: _______________________________________

(Note: I think it works well to have students choose the same aversive stimulus for their negative reinforcement and positive punishment demonstrations. This requires them to comparatively use the same stimulus in different ways -- i.e., for different behavioral functions.)

<table>
<thead>
<tr>
<th>Identify Target Behavior</th>
<th>Negative Reinforcement</th>
<th>Positive Punishment</th>
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<tr>
<th>Desired Direction of Behavior Change</th>
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<tr>
<th>Narrative Description of your Procedure/ What stimulus changes will occur?... when?...based on what?</th>
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<tr>
<th>Scheduled Implementation (When, where, and by whom will your demonstration take place?)</th>
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<tr>
<th>Embed a link that directs the audience to a video of your demonstration. (Links to YouTube.com channels or Drive folders are preferred.)</th>
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<tr>
<th>Summary of your demonstration and resulting behavior changes.</th>
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</table>

Answer the following items after your demonstration is complete:
1. Did your planned procedures work in the way they were designed or intended to work? Explain.
2. How would you answer your friend if s/he asked you, “What’s the difference in negative reinforcement and positive punishment?”

Follow-up and Discussion:

Think about the following questions to guide discussion and check for understanding:

- What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?

Some of these topics overlap with the suggested conversations to have prior to the lab demonstration.

Students often identify behavior in terms of its absence (e.g., when the child “does not throw a tantrum”). This is a big mistake and will lead analyst astray when trying to identify controlling variables and processes, such as negative reinforcement and punishment. As a check throughout, discuss the importance of identifying the actions that are taking place (rather than the actions that are missing). Consequences can only influence behavior that occurs; they cannot impact the absence of behavior. A person could reword “did not throw a tantrum” into “asked politely”, for example.

Discuss with students the importance of using other behavior-change strategies besides those included in this lab exercise/demo. While humans and other animals are predisposed to attend and respond to aversive stimulation and others’ behavior that annoys us, we can work and practice to focus, instead, on what others do that pleases us. This puts us in a positive reinforcement frame of mind rather than relying on negative reinforcement and positive punishment to alter others’ behavior.

You also can re-raise your discussion of escape and avoidance. Ask students whether their demonstration of negative reinforcement was a case of escape or avoidance and have them explain why.

OPTIONAL lab extension -- Ask students to keep their videos free of any labels regarding the procedure they use. After student teams have submitted their demo’s, ask them to review the video demo’s of other groups. (This can be done as a group in class, or on their own.) Ask students to identify and explain the other groups’ use of negative reinforcement and positive punishment. This exercise aims to improve their recognition of negative reinforcement and positive punishment techniques.

Administer another paper exercise or Kahoot! exercise. Intermix some of the original pre-test items, but also include new examples of negative reinforcement and positive punishment. Determine if students’ overall understanding has improved from the lab experience and if it has reached satisfactory levels.

- What prior concepts do students need to learn to understand the core ideas?
- What level of abstraction is expected of them?

It will be helpful if students can/will:
- Define operant conditioning or instrumental learning.
- Distinguish behavior/response, and environmental stimuli.
- Define and distinguish reinforcement and punishment.
- Understand and identify stimuli typically labelled as aversive or appetitive.
- Describe the meaning of “positive” and “negative” in operant conditioning.
- Extend definitions and instructor-provided examples into student designs.
- Record video of their demonstrations.
- Recognize the importance of precision and consistency in experimental tests.
What representations or media help students make sense of core ideas?

- The following clip from Big Bang Theory contains a discussion of negative reinforcement and positive punishment: [https://www.youtube.com/watch?v=LhI5h5JZi-U](https://www.youtube.com/watch?v=LhI5h5JZi-U). **Be careful when you use the video since it contains an errored description.** Watch the video with students and use it as a springboard of discussion:
  - Prevalent misunderstanding of negative reinforcement.
  - Misuse of “positive” and “negative” to describe stimuli... this can create great confusion. It’s better to stick with aversive and appetitive as adjectives describing stimuli.
  - Importance of defining the processes by their impact on behavior rather than by their structural procedures (designed a priori). Discuss how the tape-pulling appears to be an ineffective procedure (i.e., it is not functioning as punishment) since side conversation does not decrease (perhaps because they are using it response independently or noncontingently).

- Though somewhat boring, this video distinguishing reinforcement and punishment quite well: [https://www.youtube.com/watch?v=imkbuKomPXI](https://www.youtube.com/watch?v=imkbuKomPXI).

What practices could students engage in to explore phenomena and/or representations of this concept?

- Through casual suggestion or a follow-up assignment, students can be asked to utilize negative reinforcement or positive punishment on themselves for some behavior they would like to change. (Be sure to discuss limitations of self-management programs since they can “cheat”.
  - They would walk through the same procedures, beginning with a target behavior they wish to increase or decrease.
  - Then they could describe the planned procedure in written form.
  - A final step could be to ask students to submit data records to indicate whether their procedure worked (over a course of 4-5 days or one week).

- You can ask students to critically evaluate times when they use negative reinforcement or positive punishment procedures. Perhaps it is when their siblings take their things, enter their room, or when their parents ask them 20 questions right when they walk in the door. Discuss how they can shift their mindset away from focusing on the behaviors they dislike in their siblings and parents. Instead of punishing those acts, challenge students to develop positive reinforcement procedures for their family members’ behaviors. Maybe the can play a game with their younger sibling when the sibling keeps hands to herself, stays in shared areas of the home, etc. Maybe they can agree to sit down with their moms for 15 minutes of devoted conversation if mom lets them have silence and friend time to decompress after the day. (Same can apply to pets, also.)

Section 2: Crosscutting Concepts

- Students will identify *patterns* of association between behaviors and their consequences
- Students will *effect* change in behavior by exposing subjects to an aversive stimulus
Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Background information
  Define the procedures of negative reinforcement and positive punishment.
  Describe how behavior is affected by each procedure.
  Provide an everyday example of each procedure. If possible, use an example from your life.
  (Example: I clean my bedroom so my Dad will stop nagging me.)

- Objectives
  The purpose of your negative reinforcement procedure is to ________ a target behavior.
  The purpose of your positive punishment procedure is to ________ a target behavior.

- Questions and hypothesis
  Do you think your negative reinforcement and positive punishment procedures will work? Why or why not? What possible limitations could occur?

- Materials used (include measurements, where necessary)
  Identify and describe all materials, as well as your participant/subject, used to conduct your demonstration and record & analyze data.

- Procedure described in detail (for replication)
  What did you do to your participant during the test? What did you record?
  Be sure to include the timing of stimulus presentations or delays.

- Graphs/tables of collected data
  No graphs will be used for the main lab demonstrations (but students could be asked to graph the follow-up/extension exercise based on a demonstration at home). Data/Results will be described in narrative form as part of the provided worksheet.

- Findings
  o Was hypothesis supported or not supported? Explain.
  o What do the findings mean? (use appropriate terminology related to concept)
    ▪ Compare the impact of negative reinforcement and positive reinforcement on behavior.
  o How could the research be improved, if replicated?
    ▪ If you were to redesign this demonstration, what would you change?
    ▪ What factors impact the efficacy of negative reinforcement and positive punishment? (Think about your own experiences or find evidence from textbooks or Internet sources.)

- Self-Reported Learning/Growth & Enjoyment
  o One key thing I learned about negative reinforcement from this lab is:
  o One key thing I learned about positive punishment from this lab is:
  o The hardest part of distinguishing between negative reinforcement and positive punishment is:
If I could redo this lab (or if I were in next year’s class of students), I would want to know ________________ before starting this lab.

What insights did you gain about the use of reinforcement or punishment to change behavior? (Was it harder than you expected? Why?)

My enjoyment of this lab was ___ based on a 1-5 scale, where 1 is the least enjoyment possible and 5 is the most enjoyment possible.

The most enjoyable part of this lab was:

- Peer Evaluations
  - Which of your classmates’ demonstrations of negative reinforcement and positive punishment helped you most to understand the procedures? Why?
  - Who, on your team, do you think contributed the most to this lab exercise? Why?
  - Who, on your team, do you think contributed the least to this lab exercise? Why?
  - What more could you have done to make this lab exercise more successful for your team? Explain your answer.

- Future Applications
  - Do you think you understand negative reinforcement and positive punishment to distinguish it as you might see it in everyday settings? Explain.
  - How likely are you to analyze your own interactions with your pets, peers, or loved ones and ask yourself whether you are using aversives to effect behavior?
  - Identify at least 2 limitations or concerns to consider when using negative reinforcement and positive punishment procedures.

References:
1. Template adapted from:
2. Lab model adapted from:
Appendix:

List of examples that may be used to help students recognize cases of negative reinforcement and positive punishment.

The negative reinforcement examples might also be used to provide practice for students in differentiating between escape and avoidance.

1. I put on my seatbelt when I enter my car so that I don’t have to hear that annoying beeping sound.
2. I put on my seatbelt in my car to remove that annoying beeping sound.
3. Sara’s unprotected sexual behavior decreased after she contracted chlamydia.
4. Tinesha remains abstinent to keep from getting pregnant.
5. Jessie wore a new skirt to school and she received lots of attention (comments, etc.) for it. She was less likely to wear the skirt again. (*You can discuss here how consequences are defined, not by their structure, but by their impact on behavior.)
6. Jose wore a new shirt and the zipper lines bothered his skin all day. He didn’t wear that shirt again.
7. The child screamed in the store, the mother gave her candy, and the screaming ceased. The mother’s behavior of giving the child candy is more probably in the future due to __.
8. The child asked for candy in the checkout line and the mother responded, “no”. The child then screamed. Both the child’s asking nicely and the mother’s saying “no” are less probable in the future due to what process?
9. Stephanie takes an Aleve after tennis matches to prevent leg soreness the next day.
10. Stephanie takes an Aleve when her legs feel sore so that the soreness dissipates.
11. Stephanie played 3 tennis matches in one day and could barely walk the next morning. Her participation in 3 matches in such a short time frame is much less likely now.
12. Helen was so cold. She turned on her electric blanket to get rid of her cold feet. (*You can discuss here how it is important for students to focus on the wording. This is an example of negative reinforcement because cold sensation is removed; if worded “she turned on her electric blanket to add warmth”, it would be positive reinforcement.)
Lab Title: Habituation and Sensitization

Section 1: Performance Expectations

What will the student be asked to do?
- Students will design a test of habituation/sensitization and articulate its predicted outcome.
- Students will plan and carry out a scientific investigation of habituation or sensitization.
- Students will record and analyze data in visual (tabular and graphic) mode.
- Students will summarize and describe their procedure, findings, and conclusions.
- Students will review and evaluate other students' tests of habituation/sensitization.
- Students will reflect on their prediction, design, execution, and teamwork.

What will the student be able to do after completing this lab?
- Students will be able to define and distinguish habituation and sensitization.
- Students will be able to describe procedures/experiences that produce habituation/sensitization.
- Students will be able to conduct an experimental test of habituation/sensitization.
- Students will be able to communicate their work to an audience.
- Students will be able to identify everyday instances of habituation/sensitization from their lives.
- Students will be able to evaluate and discuss their work and others’ work.

Main Idea/Concept Demonstrated or Taught by Lab:
Students will learn about habituation/sensitization, the simplest form of learning, and how to test and measure it. They also will explain their test to others.

Key Terms and Psychologists Associated with Main Idea/Concept:
habituation, sensitization, non-associative learning, implicit learning, stimulus generalization, dishabituation

Materials:
- **Timing device** (or cell phone);
- **Data sheet** (with *a priori* estimates of response strength 0-100%);
- **Paper/Graph paper** (and ruler or other materials needed to make a graph)

**Test Stimulus** -- One other item should be selected or provided by students for the repeated stimulation. Some items to have or recommend could be a feather, ice cube, led flashlight, or train whistle. Students also can create all sorts of stimuli manually or electronically (usually with cell phones); examples include buzz of bees, aversive alarm, a video playing with obnoxious line running through it or with a skip in the sound.

**Video mechanism** -- Something to record the test (if you want students to show video)
Instructions (for Instructors):

Brady Phelps of South Dakota State University (brady.phelps@sdstate.edu) has video records of this laboratory exercise. He uses loud sounds in his test, and shows the habituation curve, as well as spontaneous recovery and dishabituation. He has requested that these videos not be posted publicly but will share the video(s) directly with you for use in your classroom. The video of habituation will help the students see an example of the habituation test they are expected to design and complete in this lab exercise.

These steps are written to instructors and would be supported by the elements of the Lab Report (see Section 3 of this doc) as you go. You could ask students to complete the report all at once, at the end of the experience, but it is probably easier for them to complete it in parts across these steps.

Step 1 -- Divide students into groups of 2-3 students.
Step 2 -- Introduce the concepts of habituation/sensitization.
Step 3 -- Tell students they will need to design, complete, and present a test of habituation/sensitization.
Step 4 -- Provide “Rules of the Test”
   The test cannot take more than 5 minutes.
   The test cannot involve harmful or embarrassing stimulation.
   The test can involve ___ (enter whatever type of subjects you will allow) subjects.
   Human subjects cannot be from within your group.
   (I allow small animals, such as fish, to be used and also myself/instructor to be used.
   If you will allow only humans, then just make sure students know they will test one person.)
   The test may involve any sensory mode, but be warned that taste can be hard with only 5 minutes.
Step 5 -- Discuss key points to remember about habituation/sensitization before they begin designing.
   It requires repeated stimulation, the presentations usually vary in timing, etc.
Step 6 -- Allow groups to discuss the assignment and begin designing their test.
   Provide them the initial sections of the Lab Report to complete, if you wish.
   What subject will they use?
   What stimuli will they use?
   At what time intervals will the stimulus be presented?
   Where will they obtain materials?
   What are the responsibilities of each group member during the test (timing, presentations)?
   How will they measure responding?
   (I usually recommend they use a 0-100% intensity scale, and create operational definitions for what would be considered a 0% response, 100% response, and at least 2 other levels in between.)
Step 7 -- Bring the whole class back together. Ask groups to share their plans/ideas with the rest of the class.
   This will be a good time for students to ask questions about others’ plans and also refine their own ideas as they hear what other groups are doing.
Step 8 -- Review: Distinguish between habituation/sensitization and conditions that usually produce them.
Step 9 -- Divide students into their groups again to address:
   What are their predicted results (habituation or sensitization)? Make them explain the prediction.
   What data table-sheet will be used to record a score on each trial?
   How will they graph their results?
   Make sure they understand that they will be asked to graph their findings,
   where response intensity (y axis) is plotted as a function of test trials (x axis).
   What will their graphed results look like if they obtain habituation?
What will their graphed results look like if they obtain sensitization?

Step 10 -- Ask students to practice a “pilot run” of their test on one of their own team members.

Step 11 -- Give students time to tweak anything based on their pilot.
Step 12 -- Students complete their test of habituation/sensitization.
   (This can be done live in front of the class or done during a similar time window (or in their own
time) and video recorded.
   If tests are not done live, there will be a designated time to share the recorded tests with the class.

Step 13 -- Students work in groups to complete their graphs from the data collected during their tests.
Step 14 -- Students will be given time to present their test and findings to the class.
   (They can show videos at this time if live testing was not used.)
   I recommend using a peer evaluation sheet or other scoring mechanism, so students are invested in
   listening to their peers’ presentations.
Step 15 -- Direct students to complete the final sections of the Lab Report.

Follow-up and Discussion:

Think about the following questions to guide discussion and check for understanding:
0 What are some commonly held student ideas (both troublesome and helpful) about this
topic? How could instruction build on them?
Students often confuse habituation and sensory adaptation (or, sensory fatigue). It will be important to
distinguish these terms before and after the demonstrations/tests by students. Emphasizing the
different conditions that produce the phenomena -- repeated stimulation versus constant stimulation --
will help. (One mnemonic that might work is to remind students that a “habit” is something that is
repeated; thus, habituation comes from repeated stimulation.) Students often cite adjustments to pool
or bath water as cases of habituation, for example, when those represent sensory adaptation. You could
provide a formative assessment where students are asked to discriminate between examples of
habituation and sensory adaptation. I recommend using Kahoot! or another e-game to display the class
results publicly until consistent consensus is reached.

Students often have a working knowledge of desensitization. When using the term desensitization to
refer to lessened response to repeated stimulation (e.g., desensitization to violent images after
repeated exposure to violent films or games), desensitization is being used synonymously with
habituation. You can discuss this. Another use of the term desensitization, however, is within the
framework of therapy -- as in, “systematic desensitization” of a fear response. Desensitization refers to
more than just habituation in this therapeutic context.

If you have already covered the Developmental Psychology chapter, you may have already discussed
habituation or referred to it indirectly within your discussion of infant learning and cognition. This might
be a good time to revisit that material, or remind students about it, and even provide examples of
habituation tests in infants. This will give students a connection across chapters, and also show them
applied uses of habituation. There are various video demonstrations available on YouTube.com or with
your instructor ancillaries.
What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?

It will be helpful if students can/will:

- define learning.
- distinguish behavior/response, and environmental stimuli.
- create and read a graph (with guidance).
- search Internet for examples and additional information where needed.
- initiate conversations and ask questions related to the assignment.
- create novel tests using stimulus examples they have not seen.
- record in written or video form their test.
- develop and deliver methods and findings.

What representations or media help students make sense of core ideas?

- The following video provides a basic, but good, introduction to habituation: https://www.youtube.com/watch?v=oSRJCAFDDvo. It also includes an applied example.
- Videos of habituation in the laboratory:
  - RAT: https://www.youtube.com/watch?v=BLwcjDQm66Q
  - SNAIL: https://www.youtube.com/watch?v=3g87P6eJpoE

What practices could students engage in to explore phenomena and/or representations of this concept?

- Through casual suggestion or a follow-up assignment, students can be asked to pay attention to instances of habituation or sensitization in their worlds. Students could report back in one week any instances of habituation/sensitization they noticed in themselves, their pets, siblings, etc.
  - Perhaps a classmate’s pen clicking drove them increasingly batty throughout an exam.
  - Perhaps their new puppy was really scared of plastic grocery bags the first time they heard them. (Maybe have students explore the importance of using habituation processes to train/socialize puppies and other pets for life with humans.)
- You could have the students repeat the test independently (without their group) in their homes on a family member, and then report back the findings.
- You can ask students to critically consider why habituation/sensitization occur, and then ask them to submit a creative essay or story about a person or animal that never habituated. They could imagine what life would be like without habituation.
- Students could create mock graphs to represent three basic outcomes of their test: habituation, no learning, sensitization. They will narratively compare and explain the various curves or line. They then can write the names of (repeated presented) stimuli they believe would lead to habituation or sensitization on the graphs.

Section 2: Crosscutting Concepts

Select at Least One

- Select one or more of the following cross-cutting concepts central to the phenomena that students will investigate:
  - Patterns
  - Cause and effect
  - Stability and Change
- Describe how the cross-cutting concept(s) will factor into the lab.
Patterns -- Students and Instructor can discuss the pattern of behavior change that represents habituation and the pattern of behavior change that represents sensitization. They can compare the behavior change patterns across the student demonstrations and discuss why they vary. Perhaps the stimuli differ in intensity or survival relevance; perhaps the intervals between stimulus presentations were different. They also can discuss individual differences (based on learning history) that might exist in their level of habituation or sensitization to stimuli.

Cause and Effect -- Students and Instructor can discuss the causes of habituation and sensitization, including the stimulus conditions that tend to produce one versus the other. The lab generally emphasizes the repeated stimulation necessary to cause habituation or sensitization.

Stability and Change -- Students and Instructor can discuss the fact that any type of learning involves behavior change. In habituation and sensitization, there is transition in intensity of reflexive response to a stimulus. If exposure to the stimulus is infrequent or inconsistent, one’s reflexive response to the stimulus usually remains the same and no learning (i.e., no habituation or sensitization) occurs. If stimulus presentations are presented consistently enough (in a context, episode, etc.), response to the stimulus either increases or decreases -- an example of learning (i.e., behavior change) we call sensitization or habituation.

For detailed explanations about each one, visit http://ngss.nsta.org/CrosscuttingConceptsFull.aspx

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Background information
  Define habituation and sensitization and distinguish between them. Provide an everyday example of each.

- Objectives
  State your purpose of the experimental test.

- Questions and hypothesis
  Identify the variables you are testing and a predicted relationship between them.

- Materials used (include measurements, where necessary)
  Identify and describe all materials, as well as your participant, used to conduct your test and record & analyze data.

- Procedure described in detail (for replication)
  What did you do to your participant during the test? What did you record?

- Graphs/tables of collected data
  Create a graph of response intensity (0-100%, y axis) across test trials (x axis).

- Findings
  o Was hypothesis supported or not supported? Explain.
  
    - Visually assess your results shown in the graph. What can you conclude from the data? Did you obtain habituation or sensitization as expected? Explain.
  
  o What do the findings mean? (use appropriate terminology related to concept)
• Why do you think habituation or sensitization occurred in this situation? If no learning occurred, can you develop a plausible explanation for why? Was there anything unusual about the data or the patterns you observed? If so, note them and offer potential explanation of them.
  o How could the research be improved, if replicated?
    • If you were to redesign this test, what would you do differently? Would you change your stimulus, Interstimulus Intervals (ISIs), measurement?

• Self-Reported Learning/Growth & Enjoyment
  o Before completing this lab, my understanding of habituation/sensitization was ___ based on a 1-5 scale, where 1 is no knowledge of the topic at all and 5 is the highest level of understanding possible.
  o After completing this lab, my understanding of habituation/sensitization was ___ based on a 1-5 scale, where 1 is no knowledge of the topic at all and 5 is the highest level of understanding possible.
  o The hardest part of designing a test of habituation/sensitization was:
  o If I could redo this lab (or if I were in next year’s class of students), I would want to know _________________ before starting this lab.
  o My enjoyment of this lab was ___ based on a 1-5 scale, where 1 is the least enjoyment possible and 5 is the most enjoyment possible.
  o The most enjoyable part of this lab was:

• Peer Evaluations
  o Which of your classmates’ tests of habituation/sensitization did you enjoy the most? Why was this demonstration enjoyable?
  o Which of your classmates’ tests of habituation/sensitization did you learn the most from watching? Why was it an effective demonstration for you?
  o Which of your classmates’ tests of habituation/sensitization was hardest for you to follow or understand? Why?
  o Which of your classmates’ tests of habituation/sensitization was the most creative? Why?
  o Who, on your team, do you think contributed the most to this lab exercise? Why?
  o Who, on your team, do you think contributed the least to this lab exercise? Why?
  o What more could you have done to make this lab exercise more successful for your group? Explain your answer.
  o Do you think your team worked well together? Explain your answer with examples.

References:
Section VIII
Memory

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1. Do we confabulate because of schemas?
2. How does rehearsal prevention impact short term memory?
3. Does multitasking negatively impact the ability to recall?
4. How does the depth of processing impact memory recall?
5. Does organizing information into groups improve memory recall?
6. Does use of the peg word mnemonic lead to memory improvement?
Lab Title: Do we confabulate because of schemas?

Section 1: Performance Expectations

What will the student be asked to do?

- Plan and/or carry out a scientific investigation
- Analyze data
- Engage in argument or communicate information

Main Idea/Concept Demonstrated or Taught by Lab:

Through this lab, students test if exposure to a themed list of terms will lead to confabulation in recall.

After concluding this lab, students should be able to:

- Consider times of confabulation in daily life
- Participate in the lab as either experimenter or subject
- Interpret collected data and communicate results

Key Terms and Psychologists Associated with Main Idea/Concept:

Roedinger and McDermott (1995), confabulation, schema, short term memory, independent variable, dependent variable, repeated measures, descriptive statistics, recall, recognition

Materials:

Copy instructions for the lab to distribute to each student. Google slides of terms.

What students should know for the lab:

Students should already be familiar with the concept of confabulation. Ideally, the students would have been exposed to Elizabeth Loftus’s work on confabulation. The students should also be able to explain schema as an organizational set; in this lesson, schema refers to a list with a common theme.

Instructions:

- Pass to each student, who is willing to participate, a lab worksheet.
Instructor begins the Google Slide presentation, located at [https://docs.google.com/presentation/d/1eweWVksd1FxGJS8bAVySB05JSb4JxowcVNLjg8cI/edit#slide=id.ga226a309894d585_51](https://docs.google.com/presentation/d/1eweWVksd1FxGJS8bAVySB05JSb4JxowcVNLjg8cI/edit#slide=id.ga226a309894d585_51), and will need to follow the verbal cues in the instruction and found in the notes section of the slides.

- Subjects will check their papers for confabulation.
- At the conclusion of the testing, the teacher (or students) collects the data for the classroom.

The class then discusses the results of the experiment and its ecological validity. The teacher (or students) can also analyze the data with descriptive statistics to determine the mean, mode, or median trigrams recalled and graph the data.

**Follow-up and Discussion**

- When the testing is complete, and the assignments collected, calculate the results for each test and compare. As a class discuss the following questions:
  1. Does our data support our hypothesis? Explain.
  2. In general, what is the impact of interference on short term memory?
  3. How could the research be improved, if replicated?

**Section 2: Crosscutting Concepts**

Students will examine the cause and effect relationship between a list with a schematic theme and confabulation of terms in recall.

**Section 3: Lab Report**

**Introduction to Psychological Science: Memory**

**Lab: Do we confabulate because of schemas?**

Instructions for the Experimenter:

#1: Read the following to your subject:

“Confabulation is when a person fills in the gaps of their memory with ideas that are not truthful; however, it is not a purposeful lie. The aim of this experiment is to investigate if confabulation increases with a schema-based set of terms. We will use repeated measures; therefore, you all will be presented with two sets of terms. I will show you a slideshow presentation where you will see 12 words for 1-second each. After the first set of terms, you will have a short story to read. Then, you will select words from a list that you believe you saw in the presentation. We will then repeat the procedure one more time. If you would like to participate, please place your left hand on your desk. [The experimenter passes out the consent forms to those students]. Ready? Please look toward the screen and go [experimenter will begin the slide show].

#2: The experimenter begins the Google Slide show that is on automatic advance.
#3: When the slide show stops, ask the participants to turn their consent papers over. “You will now write down words on your paper that you did NOT see in the original presentation from the list on the screen in the left column of your paper.”

#4: Repeat steps #2 and #3 again, except for the repeat of step 3, you will ask them the write in the right column.

#5: When the subjects have gone through both lists, the experimenter shows the original lists. Experimenter says, “Please place a checkmark next to terms that were on the original lists and circle the terms that were not on the original lists. We will tally our results in a moment.”

#6: Record results (How many words did your subjects confabulate that were on the list, but actually were not?)

- Control condition (list one): ________________
- Experimental condition (list two): ________________

As a team, answer the following questions.

1. Does the data support the hypothesis? Explain.

2. What were some of the terms that were most likely to be confabulated in list two?
3. What were the independent variable and dependent variable in the experiment?

4. What ethical considerations were present in the experiment?

5. How could the research be improved, if replicated?

6. Subjects used recognition as a means of remembering the terms from the presented lists. Predict what differences would exist if subjects were asked to use recall.
Section 4: List 1 (Control condition without a theme)
Mad
White
Table
Hot
Nurse
Shoe
Apple
Water
Thread
Note
Hill
Queen

Section 5: List 2 (Experimental condition with a theme)
Butter
Food
Eat
Sandwich
Rye
Jam
Milk
Flour
Jelly
Dough
Crust
Slice
Section 6: List 3 (Control condition recognition list)
Cloth
Thread
White
Mad
Apple
Table
Bike
Hot
Queen
Nurse
Cushion
Shoe
Water
Salad
Fear
Note
Hill
Boat

Section 7: List 4 (Experimental condition recognition list)
Butter
Dough
Lunch
Orange
Food
Eat
Bread
Sandwich
Bagel
Section 8: List 3 (Control condition recognition list with confabulated terms highlighted)

Cloth
Thread
White
Mad
Apple
Table
Bike
Hot
Queen
Nurse
Cushion
Shoe
Water
Salad
Fear
Note
Hill
Boat
Section 9: List 4 (Experimental condition recognition list with confabulated terms highlighted)

Butter
Dough
Lunch
Orange
Food
Eat
Bread
Sandwich
Bagel
Rye
Jam
Salad
Flour
Milk
Jelly
Crust
Slice
Tuna

Section 10: Subject worksheet

- I have been informed about the nature of the research.
- I understand that I have the right to withdraw from the research at any time, and that any information/data about me will remain confidential.
- My anonymity will be protected as my name will not be identifiable.
- The research will be conducted so that I will not be demeaned in any way.
- I will be debriefed at the end and have the opportunity to find out the results at a later date.

I give my informed consent to participating in this research.

Name: __________________________________________________________

Date: ___________________________________________________________________
Lab Title: How does rehearsal prevention impact short term memory?

Section 1: Performance Expectations

What will the student be asked to do?

- Plan and/or carry out a scientific investigation
- Analyze data
- Engage in argument or communicate information

Main Idea/Concept Demonstrated or Taught by Lab:

Through this lab, students examine the impact of interference activities on maintenance rehearsal and encoding information into short term memory. The exercise allows students to apply the Atkinson-Shiffrin multistore memory model and compare recall with and without rehearsal.

After concluding this lab, students should be able to:

- Explain the maintenance rehearsal
- Consider the impact of interference on encoding of information into short term memory
- Examine sources of interference in their own memory
- Participate in the lab as either experimenter or subject
- Interpret collected data and communicate results

Key Terms and Psychologists Associated with Main Idea/Concept:

Peterson and Peterson (1959, Atkinson and Shiffrin (1968), short term memory, interference activity, encoding, maintenance rehearsal

Materials:

Copy instructions for the lab to distribute to the experimenter in each trio of students. The students assigned to be the subjects will need paper and a writing utensil. Students will also need access to a timing device and a coin to flip for heads-tails.

What students should know for the lab:

Students should already be familiar with the Atkinson-Shiffrin memory model and the terms encoding, storage, and retrieval. A basic understanding of the experimental design is also needed.
Instructions:

- Divide students into groups of three. Have students decide who will play the experimenter or subjects. Using a coin for heads-tails, randomly assign the subjects into the control condition and the experimental condition.
- Have the subjects sit back to back, so they cannot see each other.
- Pass out the instructions to the experimenters.
- Experimenters conduct one memory test. Both subjects will read, silently, the printed list of trigrams for 30-seconds. After 30-seconds passes, subjects flip over the list and begin counting backward from 99 by threes (the interference activity). After 3 seconds pass, the subject in the control condition will begin to write out recalled trigrams. After 18-seconds of counting, the subject in the experimental condition will begin to write out recalled trigrams. Have subjects stop recalling after 30-seconds of writing trigrams.
- The experimenter collects both subjects’ paper and totals the correct number of trigrams recalled. The team then compares the subjects’ performance, discusses the results, and comments on the impact of interference activities. Students will also brainstorm the ecological validity of the experiment and its potential connection to an academic setting.
- At the conclusion of the testing, the teacher (or students) collects the data for the classroom. The class then discusses the results of the experiment and its ecological validity. The teacher (or students) can also analyze the data with descriptive statistics to determine the mean, mode, or median trigrams recalled and graph the data.

Follow-up and Discussion

- When the testing is complete, and the assignments collected, calculate the results for each test and compare. As a class discuss the following questions:
  1. Does our data support our hypothesis? Explain.
  2. In general, what is the impact of interference on short term memory?
  4. How could the research be improved, if replicated?

Section 2: Crosscutting Concepts

Students will examine the cause and effect relationship between an interference activity and recall.

Section 3: Lab Report

Introduction to Psychological Science: Memory

Lab: How does rehearsal prevention impact short term memory?

In your trio, decide who will play the role of experimenter or subjects. Flip a coin to assign subjects to the control or experimental condition.

Experimenter:
Control Subject:

Experimental Subject:

Instructions for the Experimenter:

#1: Read the following to your subject:

“Maintenance rehearsal is a means for encoding information into the short-term memory store. Today my hypothesis is that length of time maintenance rehearsal is prevented is negatively correlated to number of trigrams recalled. We will randomly assign you to the control and experimental condition with a coin toss. You will each read the same list of trigrams and silently try to memorize them for 30-seconds. When I say time, you will turn your paper over to the bank side and you will begin counting backward from 99 by threes, such as 99, 96, 93, 90, 87. I will touch your arm when you can begin writing down the remembered trigrams. I will touch your arm again when it is time to put your pencil down. Are you willing to participate in the experiment? [Flip coin to determine conditions. Then hand paper to participants upside down.] Ready? Please turn your paper over.”

#2: Begin timer for 30-seconds. Participants silently read the trigrams.

#3: After 30 seconds, say, “Please turn your paper over and begin counting backward from 99 by threes. Do so out loud, but quietly.” After 3-seconds, tap the control participant on the arm for them to begin writing down the trigrams. After 18-seconds, tap the experimental participant on the arm for them to begin writing down the trigrams. Stop each participant after 30-seconds of recall.

#4: Read the following to your subject, “Thank you for participating in this psychological experiment. Now we will check to see if you recall the trigrams correctly. Please place a check next to correctly recalled letter combinations. Ready?”

Trigram list:

KRP
ZTH
DLW
BSI
CYQ
NFS
GJL
TND
OCJ
RLV
#5: Record results (How many did your subject get correct?)

Control condition: ___________________

Experimental condition: ___________________

As a team, answer the following questions.

1. Does your data support the hypothesis? Explain.

2. In general, how does an interference activity impede recall?

3. How could the research be improved, if replicated?
4. To what extent is this information ecologically valid? Explain.

**Section 4: Trigrams for Control Condition**

KRP  
ZTH  
DLW  
BSI  
CYQ  
NFS  
GJL  
TND  
OCJ  
RLV

**Section 5: Trigrams for Experimental Condition**

KRP  
ZTH  
DLW  
BSI  
CYQ  
NFS
Lab Title: Does multitasking negatively impact the ability to recall?

Section 1: Performance Expectations

What will the student be asked to do?

- Plan and/or carry out a scientific investigation
- Analyze data
- Engage in argument or communicate information

Main Idea/Concept Demonstrated or Taught by Lab:

Through this lab, students will test if multitasking on social media and/or use of text messaging platforms impact the ability to recall information newly learned.

After concluding this lab, students should be able to:

- Examine sources of multitasking in their own lives
- Participate in the lab as either experimenter or subject
- Interpret collected data and communicate results

Key Terms and Psychologists Associated with Main Idea/Concept:

Hembrooke and Gay (2003), divided attention, working memory, multitasking, parallel processing, short term memory

Materials:

Copy instructions for the lab to distribute to the experimenter in each pair of students. The students assigned to be the subjects will need paper, a writing utensil, device with Internet connection and access to YouTube. The experimental condition subject will also need to have a browser window open to a copy of a Google Doc with questions to answer.

What students should know for the lab:
Students should already be familiar with the Baddeley and Hitch’s working memory model and the central executive.

Instructions:

- Prior to class, the teacher will want to procure devices for the students and load the Google Doc (https://docs.google.com/document/d/188lnhPlUp3ksEBJOYLD8ohCKeAZEs2Bi7HTXwm_QHb4/edit) into an Internet browser.
- Divide students into groups of three. Have students decide who will play the experimenter or subjects. Using a coin for heads-tails, randomly assign the subjects into the control condition and the experimental condition.
- Have the subjects sit back to back, so they cannot see each other. Each student will need an Internet enabled device.
- Pass out the instructions to the experimenters, who will read the instructions to the subjects. After the instructions are read, the experimenters will pass out the quizzes and place them upside down on the subjects’ desks.
- Subjects will watch a 2.5-minute video about sea slugs and their role in understanding human memory, which is located at https://www.youtube.com/watch?v=ZoNP1gwMsU8. The control subject will watch the video and take notes on a sheet of paper. The experimental subject will watch the video, take notes, but also answer questions through a Google Doc (https://docs.google.com/document/d/188lnhPlUp3ksEBJOYLD8ohCKeAZEs2Bi7HTXwm_QHb4/edit) in a second browser window.
- When video is done, subjects will flip over their paper and take the quiz on the information from the video. After the quiz is complete, the experimenter will grade the quiz.
- The team then compares the subjects’ performance, discusses the results, and comments on the impact of multitasking. Students will also brainstorm the ecological validity of the experiment and its potential connection to an academic setting.
- At the conclusion of the testing, the teacher (or students) collects the data for the classroom. The class then discusses the results of the experiment and its ecological validity. The teacher (or students) can also analyze the data with descriptive statistics to determine the mean, mode, or median answers recalled correctly and graph the data. Also, suggest potential confounding variable to the data.

Follow-up and Discussion

- When the experiment is done, and the quizzes collected, calculate the results for each condition and compare. As a class discuss the following questions:
  1. Does our data support our hypothesis? Explain.
  2. In general, what is the impact of multitasking on short term memory?
  5. How could the research be improved, if replicated?

Section 2: Crosscutting Concepts

Students will examine the cause and effect relationship between multitasking and recall.
Section 3: Lab Report

Introduction to Psychological Science: Memory

Lab: Does multitasking negatively impact the ability to recall?

In your trio, decide who will play the role of experimenter or subjects. Flip a coin to assign subjects to the control or experimental condition.

Experimenter:

Control Subject:

Experimental Subject:

Instructions for the Experimenter:

#1: Load the Google Doc on the devices that the groups will use.

#2: Read the following to your subject:

“Many people believe that multitasking is a necessity for modern life. Today my hypothesis is that multitasking can negatively impact the ability to recall information in short term memory. We will randomly assign you to the control and experimental conditions with a coin toss. Each participant will watch a video about understanding human memory by working with an animal. Both of you may take notes on the blank side of this paper as you watch the video. After the video has finish, please put your pencils down and close the Internet browser window. I will then ask you to flip your papers over and answer a few questions about the video. Are you willing to participate in the experiment? [Flip coin to determine conditions. Then hand paper to participants upside down.] Ready? Please click play on the video.”

#3: Observe the participants while they are watching the video. If needed, remind the experimental condition subject to also answer the questions on the Google Doc while they are watching the video.

#4: When they are done with the video say, “Please turn your papers over and answer the following 5 questions. You will not be able to look at the notes that you have taken on the other side.”

#5: Read the following to your subjects, “Thank you for participating in this psychological experiment. Now we will check to see if you recalled information about the video correctly. Please place a check next to correctly recalled questions. Ready?”

Quiz answers:
#5: Record results (How many did your subject get correct?)
Control condition: ________________
Experimental condition: ________________

As a team, answer the following questions.

1. Does your data support the hypothesis? Explain.

2. What was the independent and dependent variables of the research?

3. In general, how does multitasking impact recall?

4. How could the research be improved, if replicated?
5. To what extent is this information ecologically valid? Explain.

Section 4: Video quiz

Video link: https://www.youtube.com/watch?v=ZoNP1gwMsU8

1.

Section 5: Pseudo text messages

Google doc link: https://docs.google.com/document/d/188lnhPIUp3ksEBJOYLD8ohCKeAZE52BI7HTXwm_QHb4/edit

1. How are you doing today?

2. I’m hungry. What would you like to have for lunch? I was thinking we should go to McDonalds.

3. When is after school practice over today?

4. I’d like to see a movie this weekend. Do you have a suggestion?
5. Boy that math test was hard! How did you do?

6. What is your favorite color?

7. Did you bring your rain jacket? Heard it’s gonna pour.

8. Sam asked me to go to prom. Wanna do dinner together? Where should we go?

9. Where did your mom’s parents grow up?

10. What did you get for #8 on the history homework?

11. How many likes did you get on that pic from SnapChat?

12. What is your favorite show?
Lab Title: How does the depth of processing impact memory recall?

Section 1: Performance Expectations

What will the student be asked to do?

- Plan and/or carry out a scientific investigation
- Analyze data
- Engage in argument or communicate information

Main Idea/Concept Demonstrated or Taught by Lab:

This lab allows students to investigate whether the deep processing is a more effective way of encoding information than shallow. The experience allows students to compare words encoded using shallow, moderate, or deep processing.

After concluding this lab, students should be able to:

- Explain the benefits of using deep rather than shallow encoding.
- Compare visual, acoustic, and semantic encoding.
- Apply the use of deep processing to everyday life.
- Participate in the lab as either experimenter or subject.
- Interpret collected data and communicate results.

Note: Lab adapted from an activity provided by Dr. Elliott Hammer, Xavier University of Louisiana.

Key Terms and Psychologists Associated with Main Idea/Concept:

Memory, visual encoding, shallow vs. deep processing, visual/structural, acoustic/phonemic, semantic encoding, Craik & Tulving

Materials:

Copy instructions for the lab to distribute to the experimenter in each pair of students. Print the student cards and cut into a set for each experimenter. The students assigned to be the subject will need paper and a writing utensil for the memory recall test.

Instructions:

- Divide students into pairs. Have students decide who will play the experimenter or subject.
- Pass out the instructions to the experimenters.
Experimenters conduct a memory test. They need to read 15 sentences to the subject, while showing the pre-printed cards with the target word. Subjects need to answer each question silently to themselves. After the 15 sentences, subjects need to write down as many of the terms as they can remember.

The team then discusses the subject’s performance and comments on the effectiveness of using deep processing in memory recall and its usefulness at school.

At the conclusion of the testing, the teacher reviews research on the levels of processing by the Craik & Tulving (1975) and the implications of these findings on how we learn and how students should study.

Optional activity: Dr. Stephen Chew (Samford University) has produced a number of videos explaining how students can improve their studying using psychological concepts. Episode 2 “What Students Should Understand about How People Learn” is especially relevant to this lab. If time allows, show the video available at: https://www.samford.edu/departments/academic-success-center/how-to-study

Follow-up and Discussion

At the conclusion of the lab, discuss group results with the class.

1. Did you find that deep processing made a difference? Does our data support the hypothesis that deep processing leads to better memory recall? Explain.
2. How could the research be improved, if replicated?
3. Why does semantic encoding tend to lead to the greatest recall?
4. What does this indicate about how we learn?
5. How can you apply this observation to your studying?

Section 2: Crosscutting Concepts

Students will examine the cause and effect relationship between the uses of deep processing on the recall of information.

Section 3: Lab Report

Experimenter Instructions:

Read the following sentences to your subject as you show them the numbered card. After you read the sentence, pause long enough for the subject to answer the question silently. Make sure your subject knows not to answer the question aloud. Your subject will also need a pencil and paper to write down what he/she can recall after you read the questions.

Read the following:

In your mind, answer the following questions about the target word that follows:

1. Is the word in capital letters? BOOK
2. Would the word fit in a sentence, “I saw a _______ in a pond?” duck
3. Does the word rhyme with blue?
   Safe

4. Would the word fit the sentence: “The girl walked down the _______”?
   House

5. Does the word rhyme with FREIGHT?
   Weight

6. Is the word in small letters?
   Snow

7. Would the word fit the sentence: “The _______ was reading a book”?
   Student

8. Does the word rhyme with TYPE?
   Color

9. Is the word in capital letters?
   Flower

10. Would the word fit the sentence: “Last spring we saw a _______”?
    Robin

11. Does the word rhyme with SMALL?
    Hall

12. Is the word in small letters?
    Tree

13. Would the word fit the sentence: “My _______ is six feet tall”?
    Textbook

14. Does the word rhyme with SAY?
    Day

15. Is the word in capital letters?
    Fox

Read the following:

Write down all the target words that you can remember.

Analyze results:
As a team, analyze the subject’s results. How many of each category did the subject remember? (Circle each)

<table>
<thead>
<tr>
<th>Category 1</th>
<th>Category 2</th>
<th>Category 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Book</td>
<td>Safe</td>
<td>Duck</td>
</tr>
<tr>
<td>Snow</td>
<td>Weight</td>
<td>House</td>
</tr>
<tr>
<td>Flower</td>
<td>Color</td>
<td>Student</td>
</tr>
<tr>
<td>Tree</td>
<td>Hall</td>
<td>Robin</td>
</tr>
<tr>
<td>Fox</td>
<td>Day</td>
<td>Textbook</td>
</tr>
</tbody>
</table>

Now, compare the subject’s performance with the level of processing used to encode the words:

Category 1: Shallow (Visual/Structural)
Category 2: Moderate (Acoustic/Phonemic)
Category 3: Deep (Semantic)
As a team, answer the following questions:

1. Does our data support the hypothesis that deep processing leads to better memory recall? Explain.

2. How could the research be improved, if replicated?

3. Why does semantic encoding tend to lead to the greatest recall?

4. What does this indicate about how we learn?

5. How can you apply this observation to your studying?
1. BOOK  2. duck  3. safe
4. house  5. weight  6. snow
7. student  8. color  9. flower
10. robin  11. hall  12. TREE
13. textbook  14. day  15. FOX
Lab Title: Does organizing information into groups improve memory recall?

Section 1: Performance Expectations

What will the student be asked to do?

- Plan and/or carry out a scientific investigation
- Analyze data
- Engage in argument or communicate information

Main Idea/Concept Demonstrated or Taught by Lab:

This lab allows students to investigate whether grouping words, rather than presenting words randomly, makes a difference in memory recall.

After concluding this lab, students should be able to:

- Explain the benefits of grouping information into categories to improve recall.
- Apply the benefits of organization to how students study.
- Participate in the lab as either experimenter or subject.
- Interpret collected data and communicate results.

Key Terms and Psychologists Associated with Main Idea/Concept:

Memory, hierarchies, recall, Gordon Bower

Reference:


Materials:

Copy instructions for the lab to distribute to the experimenter in each pair of students. The students assigned to be the subject will need paper and a writing utensil for the memory recall test.

Instructions:

- Divide the class into two groups. Group 1 will receive the list of words that are randomly placed on the page. Group 2 will receive the list of words organized by categories. While the student experimenters and the teacher will know which group has which list, the subjects need to remain blind.
1. Divide the students into pairs. Have students decide who will play the experimenter or subject.
2. Pass out the appropriate instructions to the experimenters in each group.
3. Experimenters conduct a memory test. The experimenter will hand a list of terms to the subject to memorize. The subject will have 60 seconds to memorize as many words as they can from the list. Subjects need to write down as many of the terms as they can remember. The experimenter corrects and records the number of terms the subject got correct.
4. At the conclusion of the testing, the teacher should collect the data from each team and separate the data into the two groups. Display the findings on the whiteboard or suitable alternative.
5. Compare the data from the two groups and have each team respond to the reflection questions in preparation for class discussion.
6. Review the research findings of Gordon Bower (1969) who found that when words were organized into groups, recall was two to three times better.
7. Discuss how these findings apply to student study habits, such as paying more attention to chapter outlines, headings, learning objectives, summaries, and chapter review questions. Notes taken in outline form, which provide hierarchical organization, might also improve student recall for chapter content.

Follow-up and Discussion

At the conclusion of the lab, discuss group results with the class.

6. Did organizing terms into groups make a difference in recall? Explain.
7. How could the research be improved, if replicated?
8. Why does organizing concepts into hierarchies lead to greater recall?
9. What does this indicate about how our memories are organized?
10. How can you apply this observation to your studying?

Section 2: Crosscutting Concepts

Students will examine the cause and effect relationship between the uses of organization on the recall of information.

Section 3: Lab Report

List 1

In sixty seconds, memorize as many words from the list below as you can.

<table>
<thead>
<tr>
<th>belt</th>
<th>love</th>
<th>Oak</th>
<th>France</th>
<th>dog</th>
<th>red</th>
</tr>
</thead>
<tbody>
<tr>
<td>dress</td>
<td>hate</td>
<td>Maple</td>
<td>Germany</td>
<td>duck</td>
<td>white</td>
</tr>
<tr>
<td>shoes</td>
<td>sex</td>
<td>Pine</td>
<td>South America</td>
<td>cow</td>
<td>blue</td>
</tr>
<tr>
<td>shorts</td>
<td>violence</td>
<td>Spruce</td>
<td>Israel</td>
<td>horse</td>
<td>green</td>
</tr>
<tr>
<td>shirt</td>
<td>death</td>
<td>Juniper</td>
<td>Africa</td>
<td>chicken</td>
<td>yellow</td>
</tr>
<tr>
<td>stocking</td>
<td>honor</td>
<td>Aspen</td>
<td>Japan</td>
<td>pig</td>
<td>orange</td>
</tr>
</tbody>
</table>
List 2

In sixty seconds, memorize as many words from the list below as you can.

<table>
<thead>
<tr>
<th>belt</th>
<th>shorts</th>
<th>dress</th>
<th>shoes</th>
<th>shirt</th>
<th>stocking</th>
</tr>
</thead>
<tbody>
<tr>
<td>dog</td>
<td>horse</td>
<td>duck</td>
<td>cow</td>
<td>chicken</td>
<td>pig</td>
</tr>
<tr>
<td>France</td>
<td>Israel</td>
<td>Germany</td>
<td>South America</td>
<td>Africa</td>
<td>Japan</td>
</tr>
<tr>
<td>oak</td>
<td>spruce</td>
<td>maple</td>
<td>pine</td>
<td>juniper</td>
<td>aspen</td>
</tr>
<tr>
<td>love</td>
<td>violence</td>
<td>hate</td>
<td>sex</td>
<td>death</td>
<td>honor</td>
</tr>
<tr>
<td>red</td>
<td>green</td>
<td>white</td>
<td>blue</td>
<td>yellow</td>
<td>orange</td>
</tr>
</tbody>
</table>

Reflection questions:

1. Did organizing terms into groups make a difference in recall? Explain.
2. How could the research be improved, if replicated?
3. Why does organizing concepts into hierarchies lead to greater recall?
4. What does this indicate about how our memories are organized?
5. How can you apply this observation to your studying?
Lab Title: Does use of the peg word mnemonic lead to memory improvement?

Section 1: Performance Expectations

What will the student be asked to do?

- Plan and/or carry out a scientific investigation
- Analyze data
- Engage in argument or communicate information

Main Idea/Concept Demonstrated or Taught by Lab:

This lab allows students to investigate whether the peg word mnemonic is an effective memory aid. The experience allows students to compare memory retrieval when using peg words or maintenance rehearsal to recall a list of concepts.

After concluding this lab, students should be able to:

- Explain the benefits of using a mnemonic device
- Describe the peg word technique
- Apply the use of mnemonic devices to everyday life
- Participate in the lab as either experimenter or subject
- Interpret collected data and communicate results

Key Terms and Psychologists Associated with Main Idea/Concept:

Memory, visual encoding, shallow vs. deep processing, imagery, mnemonic device, peg words

Materials:

Copy instructions for the lab to distribute to the experimenter in each pair of students. The students assigned to be the subject will need paper and a writing utensil.

Instructions:

- Divide students into pairs. Have students decide who will play the experimenter or subject.
- Pass out the instructions to the experimenters.
Experimenters conduct two memory tests. In the first test, subjects are required to use maintenance rehearsal, then asked to recall the first list of 10 words. Before the second test, subjects learn the peg word mnemonic and recall the second list of 10 words.

The experimenter records student performance on the two tasks. The team then compares the subject’s performance, discusses the results, and comments on the effectiveness of the peg word technique and its usefulness at school. Students generate examples of mnemonics they have used in the past.

At the conclusion of the testing, the teacher (or students) collects the data for the classroom. The class then discusses the findings of the tests and specifically addresses whether the peg word technique was effective.

Follow-up and Discussion

- When the testing is complete, and the assignments collected, calculate the results for each test and compare. As a class discuss the following questions:

  1. Does our data support our hypothesis? Explain.
  2. In general, why are mnemonic devices useful?
  3. How could the research be improved, if replicated?
  4. Outside of doing a memory test, where else could you use the peg word mnemonic? How could you use this technique at school?
  5. What types of mnemonics have you used? Describe two examples of mnemonics that you have used for studying or learning a new skill.

Section 2: Crosscutting Concepts

Students will examine the cause and effect relationship between the uses of mnemonics on the recall of information.

Section 3: Lab Report

Introduction to Psychological Science: Memory

Lab: Does use of the peg word mnemonic lead to memory improvement?

In your pair, decide who will play the role of experimenter or subject

Experimenter: _______________________________ Subject: _______________________________

Instructions for the Experimenter:

#1: Read the following to your subject:
“Mnemonic devices, like peg words, use visual imagery to improve our ability to recall information. Today my hypothesis is that when you use a peg word mnemonic it will help you retain more information. You will be taking two memory tests. In the first test, I will read you a list of ten terms. You are ONLY allowed to repeat the word silently to yourself. Please do not use any other device to help you remember, other than maintenance rehearsal during this test. As I read the list, I will say the “Item number” and the term. When I am done, write down as many terms as you can recall. They need to be in the same order in which I read them to you. Are you ready? Let’s begin.”

#2: List #1

Item #1: firetruck
Item #2: corncob
Item #3: desk
Item #4: coffee cup
Item #5: pencil
Item #6: apple
Item #7: magazine
Item #8: penguin
Item #9: handcuffs
Item #10: boot

#3: Record results (How many did your subject get correct?): ____________________

#4: Read the following to your subject:

“Now I am going to teach you the peg word mnemonic. When you use this mnemonic, you are creating a visual image that ties the peg word to the new word in the list. Let me show you how this works. Here are the peg words:

One is a bun
Two is a shoe
Three is a tree
Four is a door
Five is a five
Six is sticks
Seven is heaven
Eight is a gate
Nine is wine
Ten is a hen

When you use a peg word, like bun, you create a visual that ties this to the first word in the list. In our last list, it was firetruck. What visual could you create that ties a bun to a firetruck?

Let’s repeat the list a few times and make sure you are comfortable with the peg words.”

#5: “Let’s do our second test. This time use the peg words to help you recall the terms. I’ll read the list like I did before, but this time I will pause long enough so that you can create a visual that ties the peg word to the term. Ready?”

List #2:

Item #1: radish
Item #2: bed
Item #3: trumpet
Item #4: peach
Item #5: football
Item #6: turkey
Item #7: Lettuce
Item #8: father
Item #9: plumber
Item #10: piano

#6: Record results (How many did your subject get correct?): ____________________

As a team, answer the following questions.

1. Does your data support the hypothesis? Explain.
2. In general, why are mnemonic devices useful?

3. How could the research be improved, if replicated?

4. Outside of doing a memory test, where else could you use the peg word mnemonic? How could you use this technique at school?

5. What types of mnemonics have you used? Describe two examples of mnemonics that you have used for studying or learning a new skill.
Section IX

Intelligence

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1. Success and Theories of Intelligence
2. Sternberg’s Theory of Intelligence and Survival TV
3. Head Size and Intelligence in Animals and Humans
4. Heritability: Intelligence, Family, and Strangers
5. Culture and IQ Testing
Lab Title: Success and Theories of Intelligence

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Construct expectations and develop models as to how successful people describe intelligence.
  - Engage in argument or communicate information about their chosen person and the theory their analysis aligns most closely with.

Main Idea/Concept Demonstrated or Taught by Lab:
This lab allows for an exploration of the various theories of intelligence while providing an in-depth analysis of how one person they find successful/admirable defines their own intelligence/success.

After concluding this lab, students should be able to:

- Describe the various theories/concepts of intelligence including (as covered by the selected book): Spearman’s “g,” Sternberg’s Triarchic Model, Gardener’s Multiple Intelligences (and others covered).

Key Terms and Psychologists Associated with Main Idea/Concept:
intelligence, Sternberg, Gardener, Spearman, Thurstone

Materials:
- Students will also need access to the library and/or computers to find interviews, TED talks, and books on the person they select.
- No other materials are required, though it could be useful to compile the components of intelligence students identify into a spreadsheet for the class to allow them to see similarities/differences.

Instructions:
This activity can be completed in-class or as homework in preparation for a class on the theories of intelligence. It may be particularly useful as an initial introduction to the topic as it will, ideally, generate a personal interest in the theories of intelligence.

1. Have students select someone they consider “intelligent,” “successful,” or “admirable.” A variety of individuals from various fields will be useful for generating good discussion. You may want to preference the investigation by mentioning that one would assume highly successful individuals are also highly intelligence. A list of possible individuals is included, but it is best to have students select someone of personal interest to generate interest in the activity. Note: this could potentially be paired with existing course assignments in other topic areas (e.g., history, English)
2. Have students find interviews, TED talks, books, and other materials on the person in question. The ideal material contains the words of the selected figure him/herself describing why s/he is/was successful, however, interviewer or biographer accounts will suffice when the person’s original words are not available.

3. Once located, have the student create a list of traits/attributes the individual (or interviewer/biographer) identifies as reasons for their success and/or describing their intelligent.

4. Have students review the portion of the textbook on theories/types of intelligence and select the theory that most closely aligns with the traits/attributes of the person they selected.

5. Come together as a class and have students list the attributes they found and intelligence theory they selected. A person by attribute spreadsheet in excel may be helpful for organizing this information.

6. Write a lab report about the frequency of traits and alignment with the theories – perhaps identifying patterns in the background of the individuals selected.

6. Discuss common traits and if they do/don’t align with intelligence. Discuss if success is intelligence or something more.

Follow-up and Discussion:

- Think about the following questions to guide discussion and check for understanding:
  - Ask students to discuss which traits most commonly aligned with which theory – attempt to identify relevant patterns in the data. If enough people are selected from each group (e.g., athletes, artists, scientists, business people), patterns related to each group may identified as well.
  - Ask students to identify traits that seem to be consistent across all individuals and discuss if they align with concepts of intelligence or if they might suggest other reasons for success beyond intelligence alone.
  - Ask students to consider if modern forms of intelligence (as defined by Gardener) really “intelligence” or just skills and abilities.
  - As students to consider if a person is strong in just a single area of intelligence, if it limits the extent to which they can be successful.

What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?

- Troublesome:
  - Successful people are always intelligent and intelligent people are always successful.
  - Intelligence is only one “thing” based on academic assessments.
- Helpful
  - Intelligence is more than what is measured by a test.
  - Difference between “book smart” and “street smart.”

What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?

- A general understanding of the concept of intelligence
What representations or media help students make sense of core ideas?
  o TED Talks (only available for some individuals): www.ted.com
  o Harvard Business Review interviews successful individuals: https://hbr.org/

What practices could students engage in to explore phenomena and/or representations of this concept?
  o Identify forms of intelligence they personally feel strong in or believe others in the class are strong in.

Section 2: Crosscutting Concepts

Select at Least One
  ● Select one or more of the following cross-cutting concepts central to the phenomena that students will investigate:
    o Patterns
    o Systems and System Models
  ● Describe how the cross-cutting concept(s) will factor into the lab.
  o Students will identify patterns of traits for success across different people they consider successful and relate these two systems and system models of intelligence.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:
  ● Background information
    o Related to the successful individual selected, including area of success
    o Or, if capturing class results, related to how success and intelligence are typically defined.
  ● Objectives
  ● Questions and hypothesis
    o If completed as a summative activity for theories, ask student to predict the theory that will apply.
    o If merging data as a class, ask the class to predict what theories might apply to different traits and/or groups of people (e.g., athletes, artists, scientists, business people).
  ● Graphs/tables of collected data
    o Summary table outlining the different traits and alignment with theory
    o If applicable, summary table outlining the different groups, traits, and theory
      ● Findings
        o Was hypothesis supported or not supported? Explain.
          • Ask if data does/does not support the hypothesis.
        o What do the findings mean? (use appropriate terminology related to concept)
          • How could the research be improved, if replicated?
List of Possible Individuals

Athletes
Lebron James
Michael Jordan
Payton Manning
Tom Brady

Religious Figures
Pope
Mother Teresa
Gandhi

Business People
Mark Zuckerberg
Jeff Bezos
Mark Cuban
Bill Gates
Oprah Winfrey
Jay Z
Larry Page
Warren Buffet
Elon Musk
Walt Disney

Authors and Artists
J.K. Rowling
Stephen King
Nora Roberts
Dan Brown
Bruno Mars
Taylor Swift
Lin-Manuel Miranda
George Orwell
Ernest Hemingway

Historical Figures
George Washington
Alexander Hamilton
Alexander Graham Bell
Nelson Mandela
Albert Einstein
Thomas Edison
Lab Title: It’s A Jungle Out There: Sternberg’s Theory of Intelligence and Survival TV

Section 1: Performance Expectations

What will the student be asked to do?
- Select one or more performance standard from the options.
  - Students will be able to recall the three types of intelligence from Robert Sternberg’s Triarchic Theory of Intelligence.
  - Students will apply and identify the three types of intelligence: Analytic, Creative, and Practical from Sternberg’s Triarchic Theory.
  - Students will compare and contrast Sternberg’s Triarchic Theory of Intelligence with other theories of intelligence that could include Gardner, Spearman, and Thurstone.
  - Students will discuss the merits of multiple intelligences versus the idea that intelligence is a singularity.
- Describe what students should know once the lab is complete using terminology from the expectations.
- Expectations are based on NSTA core ideas for students to investigate.

Main Idea/Concept Demonstrated or Taught by Lab:
- Define intelligence and list characteristics of how psychologists measure intelligence: abstract versus verbal measures
- Compare and contrast historic and contemporary theories of intelligence (e.g. Charles Spearman, Howard Gardner, Robert Sternberg).
- Identify key contributors in intelligence research and testing (e.g., Alfred Binet, Francis Galton, Howard Gardner, Charles Spearman, Robert Sternberg, Louis Terman, David Wechsler).
- Discuss intelligence as a general factor.
- Discuss alternative conceptualizations of intelligence.

Key Terms and Psychologists Associated with Main Idea/Concept:
- Robert Sternberg
- Sternberg’s Triarchic Theory of Intelligence: Analytic, Creative, and Practical
- Charles Spearman
- Spearman’s g factor in intelligence
- Howard Gardner
- Gardner’s Theory of Multiple intelligences: musical-rhythmic, visual-spatial, verbal-linguistic, logical-mathematical, bodily-kinesthetic, interpersonal, intrapersonal, and naturalistic.
Materials:

1. **Survival Television Shows** (These may be shown in class or assigned for homework. If they are shown in class, please preview for appropriate classroom content). Below are a list of possible shows to choose from and the networks that produce and play them. Many of these can also be accessed on streaming services such as Netflix, Hulu and YouTube.

   - *Naked and Afraid*—Discovery Channel Network
   - *Man vs. Wild*—Discovery Channel Network
   - *Alone*—History Channel Network
   - *The Great Human Race*—National Geographic Channel Network
   - *Kicking and Screaming*—Fox Network
   - *Men, Women, Wild*—Discovery Channel Network

*This is an incomplete list as there are many survival type shows on television that may be appropriate for this lesson.*

2. **Triarchic Theory Tabulation Sheet**

   Handout 1: It’s A Jungle Out There: Sternberg’s Triarchic Theory of Intelligence

**Instructions:**

Students should have a working knowledge about Sternberg’s Triarchic Theory, either from reading from the textbook, a teacher lecture, or possibly accessing a website like the ones below to get an elementary understanding of his theory:

http://wilderdom.com/personality/L2-2SternbergTriarchicTheory.html

1. Students should hypothesis which intelligence would most likely benefit in a survival type scenario: Sternberg’s Analytic, Creative or Practical intelligence. On a sheet of paper have students write an “If...Then” statement that encapsulates their hypothesis.

2. Students will be given Handout 1: It’s A Jungle Out There: Sternberg’s Triarchic Theory of Intelligence form.

3. Using the case study method, Students will be shown, in class or for homework, a survival television show (see above list) and as they watch they will make tally marks on the form indicating which intelligence they see the subjects using for each decision made.

4. After the show has ended, they will describe 2 specific examples of each type of intelligence at the bottom of the form; Students will also tabulate the number of instances of each type of intelligence recorded.
Follow-up and Discussion:

- Select one or more of the questions to guide discussion and check for understanding.
  - Which intelligence seemed most useful and used for survival? Was there a class consensus? If not, then why not?
  - Did students struggle in defining what they saw into a category? Discuss specific examples that they wrote down and how the class categorized the example. If there was a difference, how could the categories be better defined?
  - Did students think that the idea of 3 types of intelligence was represented well in the show or did their finding support an overarching intelligence (Spearman’s g)?
  - Was their hypothesis correct? Why or why not? Have students discuss their findings and whether they would change their hypothesis.
  - Since the subjects were obviously being filmed and had observers, do you think that may have affected their behaviors?
  - Why is this a case study and not a naturalistic observation?

Section 2: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Background information (Sternberg, Triarchic Theory, Spearman, g factor)
- Objectives: What was the point of this activity?
- Questions and hypothesis: Were your predictions correct? Why? Why not? If you were to redo the case study observation with another show would you adjust your hypothesis?
- Graphs/tables of collected data: Include Handout 1 as evidence of your data collection.
- Findings
  - Was hypothesis supported or not supported? Explain.
    - Which type of intelligence seems most useful in a survival situation? Do you see evidence of the three types of intelligence or do you see an overarching intelligence in the subjects? Which theory seems to make more sense? Sternberg’s Triarchic Theory, Spearman’s g factor? Do you feel the multiple intelligences were broken down enough? Would Gardner’s theory of 8 Multiple Intelligences been a better model or not?
  - What do the findings mean? (Use appropriate terminology related to concept)
  - How could the research be improved, if replicated?

Section 3: Crosscutting Concepts

Select at Least One

- Select one or more crosscutting concepts central to the phenomena that students will investigate.
- Patterns
- Cause and Effect
- Stability and Change

- Describe how the crosscutting concept(s) will factor in to the lab.
  - Students will identify patterns in types of intelligence as it applies to survival in the wild.
  - Students will examine the cause and effects of the types of intelligence used to solve problems and the outcomes of those choices.
  - Students will examine whether participants in the shows show stability or change in their choices and if those choices demonstrate that they favor a specific type of intelligence.

- For detailed explanations about each one, visit http://ngss.nsta.org/CrosscuttingConceptsFull.aspx

References:
**Analytic**
think abstractly and evaluate information logically; book smarts

**Creative**
the ability to invent novel solutions or ideas; new ways of solving problems

**Practical**
enable one to cope with concrete situations; street smarts

Number of instances: _______

Best examples:
1. 
2.

Number of instances: _______

Best examples:
1. 
2.

Number of instances: _______

Best examples
1. 
2.
Lab Title: Head Size and Intelligence in Animals and Humans

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Carry out a scientific investigation testing a historical heuristic (i.e., head size) of intelligence
  - Discussion the ideas of reliability and validity as they relate to intelligence testing
  - Analyze data collected as part of the investigation

Main Idea/Concept Demonstrated or Taught by Lab:

This lab allows all students to test a classic heuristic on intelligence (i.e., that a larger head size is related to greater intelligence) while also exploring the validity and reliability of measurement using physical measurement, ratings, and scales.

After concluding this lab, students should be able to:

- Understand how head size and intelligence vary across, but not within, species
- Define the concepts of validity and reliability to different forms of measurement
- Apply the concepts of validity and reliability to different forms of measurement
- Interpret graphical representations of data as used in both quantitative and methods (optional)

Key Terms and Psychologists Associated with Main Idea/Concept:

intelligence, brain, validity, reliability,

Materials:

You will need the following items:

- Cloth rulers (one per student/group)
- Copies of the accompanying Handouts for each student
  - Handout 1: The American/Australian Test of Intelligence
  - Handout 1.1: The American/Australian Test of Intelligence Scoring Sheet
  - Handout 2: Animal Skulls Sizes and Rankings
  - Handout 3: Classmate skull size and test scores
- Access to Google to identify the typical head size of different animals; list of animals (with varying head sizes) – alternatively used included list with sizes for a shorter activity

Instructions:

Depending on the length of time you want to devote to the activity, students can be assigned to groups to complete a different element listed below and report back to the class and/or all students can be involved with each element. Note: the elements are relatively independent and therefore could all be used or only one could be used.
Element 1 – Head size across animals
1. Provide students with the list of animals without cranial capacities (alternatively, brain weight may be used; see Handout 2) and have them rank the order of intelligence for each animal (at this point students shouldn’t know about the idea that head size may be correlated with intelligence). Optional: compile students’ ranks of each animal and discuss inter-rater reliability (i.e., agreement between students) which is likely to be high based on animals selected.
2. Compile students’ ranks of each animal into a single list in excel and/or whiteboard so everyone can see it. Optional: discuss inter-rater reliability (i.e., agreement between students) which is likely to be high based on animals selected.
3. Discuss why students ranked the animals in the way that they have and possible reasons they expect these differences in intelligence. Try to generate some consensus on the appropriate ranking. Typically, skull/brain size will come up as a point – at which point (or circling back if early in the conversation) you suggest that be explored further. If short on time, the instructor could suggest this as a possible explanation.
4. Have students use Google to find the skull size/cranial capacities for the various animals listed (see note on Handout 2). If short on time, simply provide the sizes on the included handout.
5. Plot the rankings and skull size/cranial capacities in a scatter plot in excel or drawn on the whiteboard for a visual. Optional: Calculate the correlation between ranking and skull size/cranial capacities.
6. Have students complete reports.

Element 2 – Head size and intelligence scores
1. Have students complete the included intelligence measure (see Handout 1) or a “flawed” intelligence test (or exam scores) may be used to generate greater discussion on validity/reliability; alternatively, recent exam scores can be used (esp. if short on time). Alternatively, if the class is large, different groups may be assigned different measures to generate discussion.
2. Score the intelligence test using the included scoring guide (skip this step if using exam scores)
3. Provide students with cloth rulers (if in groups, 1 per group) and have them measure each other’s head size and record the measurements on a sheet with the names of each student in the class (see Handout 3). For larger classes, only having them measure a portion of the class may be appropriate; ideally, you’ll have at least 5 measures per person. This may be done by having each member of a 5-person group measure the head size of each member of another 5-person group.
4. As a class (or in groups) compile a list of the measurements for each person’s skull size. Average these measures to get a single score for each person. These measures should be relatively similar and discuss the idea of reliability as it relates to physical measurements.
5. Add to the list each person’s intelligence/exam scores. If using exam scores, you may want to collect the skull size measurements at the end of one class and then anonymize the data prior to completing the activity the following class.
6. Plot the skill size measure and intelligence/exam scores on a scatterplot in Excel or on a whiteboard for a visual. Optional: Calculate the correlation between skill size measure and intelligence/exam scores. In both cases the relationship should be near 0.

7. If using the actual intelligence test example, discuss how skill size is a reliable measure, but not a valid measure of intelligence. Emphasize that reliability is necessary for validity but doesn’t guarantee that a measure is valid for the specific concept.

8. If using a flawed intelligence test or exam scores, discuss why the test/exam was or was not a good measure of intelligence. Possible concepts include:
   a. it was an achievement test (for exams) and not a measure of intelligence based on any of the definitions provided in the text (i.e., it wasn’t a valid measure of intelligence)
   b. some of the items on the flawed test are unclear or contain words/people that lack relevance to the student (i.e., not valid items; even if it once was a valid intelligence test)
   c. some of the items measure different concepts (math v. verbal ability) and therefore it isn’t appropriate to score them together as a single concept of intelligence (i.e., lacks validity).

9. Have students complete their reports.

Discussion of combined elements

1. Discuss the results of animal and human skull size investigations. Ask students to consider why a relationship might be found across, but not within, species (note: this can easily be connected to development of the frontal cortex if the physiology of the brain has been discussed).

2. Discuss the different forms of measurement used and how subjective/objective they are:
   a. Rank orders for animal intelligence predictions
   b. Measure of skull size for both animals and people (i.e., classmates)
   c. Intelligence test/exam scores

3. Note that objectivity doesn’t guarantee a measure is a valid measure of a specific concept.

Follow-up and Discussion:

- Think about the following questions to guide discussion and check for understanding:
  o Ask students to discuss other ideas they have related to intelligence and if/how they might be flawed (can be connected to domains/theories of intelligence).
  o Ask students to identify other measures that they know of (these can be both physical and psychological) and discuss if these are reliable and valid (one “fun” discussion may center on online quizzes for Hogwarts Houses (i.e., Harry Potter) or whatever is popular at the time.
  o As they discuss, have students define reliability and validity in their own words.

What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?

  o Troublesome:
* That validity and reliability are the same concept; esp. that reliable measures are automatically valid
* That differences across species in intelligence translate into within-species differences in intelligence
* Also, worth noting that this intersects with the biology chapter regarding increased size of cerebral cortex and frontal lobe

What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?
- They will need to have a fundamental understanding of processes and procedures of scientific inquiry.
- They will need to be familiar with the concept of a correlation/scatterplot and how to identify relationships between variables
- A general understanding of the concept of intelligence (esp. vs. achievement)

What representations or media help students make sense of core ideas?
- Reliability and validity in cornhole: [https://youtu.be/_Upk8M67loc](https://youtu.be/_Upk8M67loc)
- Reliability and validity in targets: [https://youtu.be/yoP2dN9eEtg](https://youtu.be/yoP2dN9eEtg)

What practices could students engage in to explore phenomena and/or representations of this concept?
- Identify various forms of measurement throughout their day. Identify how/why something is valid or reliable.

**Section 2: Crosscutting Concepts**

Select at Least One
- Select one or more of the following cross-cutting concepts central to the phenomena that students will investigate:
  - Patterns
  - Scale, portions, and quantity
  - Structure and Function
- Describe how the cross-cutting concept(s) will factor into the lab.
- Students will investigate how different scales of intelligence, including physical and psychological measures, relate to intelligence. As such, they will identify patterns and discuss how structure and function of the skull/brain are related across species but are not related within species.
Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Background information (related to the element assigned; skull size and intelligence)
  - Objectives
  - Questions and hypothesis
    - Have students make a prediction related to the element assigned
      - How might skull size/intelligence be related in animals?
      - How might skull size and intelligence/exam performance be related?
  - Materials used
    - Cloth rulers
    - Intelligence test/exam scores
      - List of animals
    - Excel spreadsheet to collect measures
  - Graphs/tables of collected data
  - Findings
    - Was hypothesis supported or not supported? Explain.
    - If lab does not involve inferential statistics, perhaps ask if data does/does not support the hypothesis.
    - What do the findings mean? (use appropriate terminology related to concept)
      - How could the research be improved, if replicated?
Handout 1

The American/Australian Test of Intelligence

[Source unknown]

These questions have been taken from a selection of American and Australian intelligence tests.

1. What number comes next in the following sequence:

   1 2 5 6 9 10 __________

2. How many weeks are in a year? __________

3. Filthy is to disease as clean is to __________

4. Three of the following may be classified with pool. What are they?

   lagoon  swamp  lake  marsh  pond (circle your answers)

5. Which items may be classified with clock?

   ruler  thermometer  rainguage  tachometer (circle your answers)

6. If BAD is written 214, how would you write DIG in the same secret writing? ______

7. If Mary’s aunt is my mother, what relation is Mary’s father to my sister? ______

8. Why does the state require people to get a license in order to get married?

   ___________________________________________________________________

9. What is the thing to do if you find an envelope in the street that is sealed, addressed
   and has a new stamp?

   ___________________________________________________________________

10. Why should you keep away from bad company?

   ___________________________________________________________________

Taken from:
Handout 1.1

The American/Australian Test of Intelligence Scoring Sheet

[Source unknown]
Scoring Sheet: Australian/American Test of Intelligence

1. Answer is 13. Add 1 to the first number, then add 3, then 1, then 3, etc.
2. Fifty-two
3. Health - If you believe that germs cause illness and if you believe that absences of "filth" signifies the absence of germs.
4. Lagoon, lake, pond
5. All of these. They are all measuring devices.
6. 497. Solution of this problem requires ability to count and sort some of concept of codes.
7. Uncle. Assumes conceptualization of European/Western familial relationships.
8. For social control? To see that people do not commit bigamy? To see that closely related kinsfolk do not marry? For statistical purposes? To ensure that people who are under age do not marry?
9. Post it. However, a more practical line of action would be: open it to see if it contains anything of value, carefully remove the stamp for your own use and at least be 18c richer. But in a highly acquisitive society principles of "honesty" (i.e. respect for unprotected property) have to be supported or society could easily break down (to the disadvantage of property owners). Note the question asks, "What is the thing to do...." not "What would you do...." Again, the "correct" answer has a moral basis.
10. Because they may influence your own behavior and get you into trouble. However, this only correct if you believe that bad people influence good people and not vice versa, that people who behave badly should be isolated in the community. Again, the "correct" answer has a moral basis.

Taken from:
http://wilderdom.com/personality/intelligenceOriginalAustralianAnswers.html
Handout 2

Brain size across species

<table>
<thead>
<tr>
<th>Animal</th>
<th>Cranial Capacity*</th>
<th>Intelligence Ranking</th>
</tr>
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<tbody>
<tr>
<td>Human</td>
<td>1300 cm³</td>
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<tr>
<td>Chimpanzee</td>
<td>390 cm³</td>
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<tr>
<td>Gorillas</td>
<td>550 cm³</td>
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<tr>
<td>Sperm Whale</td>
<td>8000 cm³</td>
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<tr>
<td>Red Deer</td>
<td>375 cm³</td>
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<td>Great-tailed Grackles</td>
<td>2.5 cm³</td>
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<tr>
<td>Lion</td>
<td>250 cm³</td>
<td></td>
</tr>
<tr>
<td>Jaguar</td>
<td>180 cm³</td>
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</tr>
</tbody>
</table>

*Note: Information on cranial capacity is difficult to find online – easier is length or weight, but it isn’t as directly related to a measurement that could be completed in class with students.

Brain weight for multiple species can be found here: [https://faculty.washington.edu/chudler/facts.html](https://faculty.washington.edu/chudler/facts.html)

Brain length and weight for multiple species can be found here: [http://serendip.brynmawr.edu/exchange/brains/compare/size1](http://serendip.brynmawr.edu/exchange/brains/compare/size1)
### Handout 3.

Classmate skull size and test scores

<table>
<thead>
<tr>
<th>Person</th>
<th>Skull Size</th>
<th>Score</th>
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<tr>
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</tbody>
</table>
Lab Title: Intelligence, Family, and Strangers

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Formulate a scientific question
  - Plan and/or carry out a scientific investigation
  - Analyze data
  - Engage in argument or communicate information
- Describe what students should know once the lab is complete using terminology from the expectations.
- Expectations are based on NSTA core ideas for students to investigate.

Main Idea/Concept Demonstrated or Taught by Lab:
The main idea capture in this lab is that the potential/capacity for intelligence is inherited and has a genetic component (nature), but that the environment (nurture) matters too in determining the extent an individual reaches their full potential/capacity is influenced by the environment.

Key Terms and Psychologists Associated with Main Idea/Concept:
Nurture, nature, intelligence, heritability

Materials:
- Online MENSA Workout: https://www.mensa.org/workout
- Sheet to record scores (see Handout)

Instructions:

Class prior to activity homework:
Have student complete the MENSA workout (approx. 30 minutes) and record their score. Also have them ask at least two family members to complete the workout and record family member scores.

In-class activity:
1. Have students randomly select 3-5 scores from other classmates (but no more than 1 score per classmate) and record those on their sheet with their family members’ scores.

2. Have students identify which scores are more similar – the scores of their family members or the scores of the randomly selected individuals. In general, family scores should be more similar than those of randomly paired others – though this may not hold in all cases.
3. Teachers may also find it useful to aggregate the scores for both family members and strangers for everyone in the class. This may result in differences that are easier to see. A simple way to do this would be to have each student calculate the differences between each pair of scores (e.g., own v. mother, own v. brother, mother v. brother; generic version: person 1 – person 2; person 1 – person 3; person 2 – person 3) and take the average of the three differences. The teacher would then record the average difference for each person in the class for both families and strangers and then calculate the overall class averages for each.

Follow-up and Discussion:

● Think about the following questions to guide discussion and check for understanding:
  ○ What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?
    ▪ Some students may believe that intelligence is exclusively based on nature. To address this, a discussion could focus on what environmental influences might contribute to intelligence. Discuss Flynn effect.
  ○ What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?
    ▪ A basic understanding of intelligence
    ▪ A basic understanding of inherited traits (perhaps discussed in biology with eye color; height, etc.).
  ○ What representations or media help students make sense of core ideas?
    ▪ Most AP/Intro Psychology textbooks will include a chart outlining heritability estimates either in the intelligence or biology sections. If not, they can be found online searching “heritability of intelligence” (these are not included here as the sources are unknown and may infringe on copyright protections).
    ▪ Twins Study Video (discusses intelligence, the role of nature and nurture):
      https://youtu.be/bRKbZtpBcgI
  ○ What practices could students engage in to explore phenomena and/or representations of this concept?
    ▪ Consider other traits that they share with their family members (e.g., personality). Note that heritability varies considerably across traits.
Section 2: Crosscutting Concepts

Select at Least One
- Select one or more of the following cross-cutting concepts central to the phenomena that students will investigate:
  - Patterns
  - Cause and effect
- Describe how the cross-cutting concept(s) will factor into the lab. Students will examine patterns within their family scores and those of randomly paired strangers. This will enable them to see that nature influences intelligence, but it should be noted that this is not a cause and effect relationship. That is, nurture also plays a role and the twin study video included in the additional materials section may assist with this understanding.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:
- Background information
  - Should address what is meant by both nature and nurture.
  - Describe what heritability means and how psychologists test for it.
  - At the college level (or AP Psychology) this may include reviewing a journal article on twin studies to provide a deeper understanding of heritability.
    - Objectives of the study.
    - Questions and hypothesis
      - A prediction regarding which scores will be more similar.
- Materials used (include measurements, where necessary)
  - Procedure described in detail (for replication)
  - Tables of collected data
    - This could be a table of scores for both family members and strangers.
- Findings
  - Was hypothesis supported or not supported? Explain.
  - If class data is aggregated, a t-test could be used to determine if a significant difference exists.
  - What do the findings mean? (use appropriate terminology related to concept)
    - How could the research be improved, if replicated?
Handout.

Record the MENSA workout score for each person you have complete it. Be sure to note the relationship between you and your family members.

<table>
<thead>
<tr>
<th>Family member scores</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship</td>
<td>Score</td>
</tr>
<tr>
<td>Self</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stranger scores</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
<td>Score</td>
</tr>
<tr>
<td>Stranger 1</td>
<td></td>
</tr>
<tr>
<td>Stranger 2</td>
<td></td>
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<td>Stranger 3</td>
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<tr>
<td>Stranger 4</td>
<td></td>
</tr>
<tr>
<td>Stranger 5</td>
<td></td>
</tr>
</tbody>
</table>
Lab Title: Culture and IQ Testing: Is a Culture-Free IQ Test Possible?

Section 1: Performance Expectations

What will the student be asked to do?
- Select one or more performance standard from the options.
  - Discuss the history of intelligence testing, including historical use and misuse in the context of fairness.
  - Identify current methods of assessing human abilities.
  - Identify measures of and data on reliability and validity for intelligence test scores.
  - Recognize bias in intelligence tests.
  - Describe what students should know once the lab is complete using terminology from the expectations.
  - Expectations are based on NSTA core ideas for students to investigate.

Main Idea/Concept Demonstrated or Taught by Lab:
1. Students will understand appropriate testing practices, particularly in relation to culture-fair test uses.
2. Students will understand cultural influences on the definition of intelligence.
3. Students will be able to analyze bias in intelligence tests.

Key Terms and Psychologists Associated with Main Idea/Concept:
- Intelligence Quotient (IQ)
- Stanford-Binet (Terman) IQ Test
- Lewis Terman
- David Wechsler
- WAIS (Wechsler)
- Test of Mental Abilities (Thurstone)
- Stereotype Threat

Materials:
Copies of the accompanying Handouts (1 and 2) for each student and one copy of handouts (1.1 and 2.2) for teacher for debriefing:

Handout 1: The American/Australian Test of Intelligence

Handout 1.1: The American/Australian Test of Intelligence Scoring Sheet

Handout 2: The Original Australian Test of Intelligence
Handout 2.2: The Original Australian Test of Intelligence Scoring Sheet

Student created, Culture-Free Quiz done for homework (sets of 5)

Instructions:

Day before activity: HOMEWORK (20-30 minutes) Students will be assigned or will choose groups of 4 or 5 (5 works better as the workload is shared evenly) For homework ask the groups to write 10 (two per student) questions that they think would be good questions to include on an IQ test: a test that measures a person’s intelligence. (I see no problem with them finding questions online that they deem appropriate for the assignment, but teachers can decide this for themselves) Students can work together to create the 5-question IQ test on Google DOCS or compile the questions through other means. The questions should be typed, and 5 copies should be brought to class the next day along with one copy of the answer key.

1. Have students move into their groups of 4 or 5.
2. Hypothesize: Have students hypothesize whether they think cultural bias can affect the outcomes of IQ tests. Have them write an “If...then” statement summing up their hypothesis.
3. Administer the American/Australian Test of Intelligence
4. Administer the Original Australian Test of Intelligence
5. Grade the tests with the students (each can grade their own) Have them write their scores on their tests—number of answers correct out of 10.
6. Gather data: Have students find the combined mean score for each test and convert the mean to a percentage score of the correct answers. Have students compare the data and discuss why there was a discrepancy in the scores.
7. Results: Students should then record the data on the hypothesis paper and write out and summarize the results in a few short sentences. Discuss: Was their hypothesis correct? Why? Why not? Why do they think the scores turned out the way they did?
8. Hypothesis: Students will now hypothesize whether the Culture-Free test they created for homework will measure intelligence with less bias than the two previous tests they took. They will make a prediction as to which test their peer groups will do best on and will write that prediction down on their data sheet.
9. Gather data: Now have students administer the Culture-Free test they created for homework to a nearby group. Once the tests are done the originating group will share the answer key and have the test group find the raw score out of 5, and then the mean score, and then the percentage correct. Each group will record the group’s mean scores and the percentage correct scores for each test on a piece of paper and pass that paper to the group that administered the test to them.
10. Results: The tests, answer key, data from the Culture-Free tests and data the other two test will be given to the originating group to discuss and compare. Was their new hypothesis correct? Why? Why not?
Follow-up and Discussion:
Additional Considerations: Questions to Ask

- Which test did the groups do the best on? Why do you think this is true? Did the outcome meet your group’s expectations?
- Did you find bias in the tests? Even the Culture-Free test?
- How do these ideas about bias apply to SAT, ACT, college entrance exam tests? Can those tests also be biased?
- What are some things test creators can do to make tests less bias? What about a language-free test?

Section 2: Lab Report (written, verbal, or recorded)

Complete a writing assessment that addresses the question: “Is it possible to create a Culture-Free, non-biased test of intelligence?”

Student should demonstrate an understanding of the difficulty in removing bias from any test.

Suggested Content to be Included in Student Report:
- Background information on development of IQ tests—could include discussion of Lewis Terman (Stanford-Binet), David Wechsler (WISC, WAIS)
- Objectives: What was the objective of this lesson?
- Questions and hypothesis
- Materials used to collect data in this lesson.
- Graphs/tables of collected data
- Findings
  - Was your hypothesis supported or not supported? Explain.
    - The data does/does not support the hypothesis.
  - What do the findings mean? (use appropriate terminology related to concept)

Section 3: Crosscutting Concepts

Select at Least One
- Select one or more cross-cutting concept central to the phenomena that students will investigate.
  - Structure and Function
  - Stability and Change
  - Cause and Effect
  - Patterns

- Describe how the cross-cutting concept(s) will factor in to the lab.
• For detailed explanations about each one, visit

References:
3. Cultural Bias in Intelligence Testing, wilderdom.com/personality/intelligenceCulturalBias.html#CulturalBias.
4. Lab model adapted from:
5. Template adapted from:
7. Lab model adapted from:
HANDOUT 1

The American/Australian Test of Intelligence

[Source unknown]

These questions have been taken from a selection of American and Australian intelligence tests.

1. What number comes next in the following sequence:
   
   1 2 5 6 9 10

2. How many weeks are in a year?

3. Filthy is to disease as clean is to __________

4. Three of the following may classified with pool. What are they?
   
   lagoon  swamp  lake  marsh  pond (circle your answers)

5. Which items may be classified with clock?
   
   ruler  thermometer  rain gauge  tachometer (circle your answers)

6. If BAD is written 214, how would you write DIG in the same secret writing?

7. If Mary's aunt is my mother, what relation is Mary's father to my sister?

8. Why does the state require people to get a license in order to get married?

9. What is the thing to do if you find an envelope in the street that is sealed, addressed and has a new stamp?

10. Why should you keep away from bad company?

Taken from:

HANDOUT 1.1

The American/Australian Test of Intelligence Scoring Sheet

[Source unknown]

Scoring Sheet: Australian/American Test of Intelligence

1. Answer is 13. Add 1 to the first number, then add 3, then 1, then 3, etc.
2. Fifty-two
3. Health - If you believe that germs cause illness and if you believe that absences of "filth" signifies the absence of germs.
4. Lagoon, lake, pond
5. All of these. They are all measuring devices.
6. 497. Solution of this problem requires ability to count and sort some of concept of codes.
7. Uncle. Assumes conceptualization of European/Western familial relationships.
8. For social control? To see that people do not commit bigamy? To see that closely related kinsfolk do not marry? For statistical purposes? To ensure that people who are under age do not marry?
9. Post it. However, a more practical line of action would be: open it to see if it contains anything of value, carefully remove the stamp for your own use and at least be 18c richer. But in a highly acquisitive society principles of "honesty" (i.e. respect for unprotected property) have to be supported or society could easily break down (to the disadvantage of property owners). Note the question asks, "What is the thing to do...." not "What would you do...." Again, the "correct" answer has a moral basis.
10. Because they may influence your own behavior and get you into trouble. However, this only correct if you believe that bad people influence good people and not vice versa, that people who behave badly should be isolated in the community. Again, the "correct" answer has a moral basis.

Taken from:
http://wilderdom.com/personality/intelligenceOriginalAustralianAnswers.html
These items relate to the culture of the Edward River Community in Far North Queensland

1. What number comes next in the sequence, one, two, three, __________?
2. How many lunar months are in a year?
3. As wallaby is to animal so cigarette is to __________
4. Three of the following items may be classified with salt-water crocodile. Which are they?
   - marine turtle
   - brolga
   - frilled lizard
   - black snake
   (circle your answers)
5. Which items may be classified with sugar?
   - honey
   - witchetty grub
   - flour
   - water-lilies
   (circle your answers)
6. We eat food and we __________ water.
7. Sam, Ben and Harry are sitting together. Sam faces Ben and Ben gives him a cigarette. Harry sits quietly with his back to both Ben and Sam and contributes nothing to the animated conversation going on between Sam and Ben. One of the men is Ben’s brother, the other is Ben’s sister’s child. Who is the nephew?
   - a. Sam
   - b. Harry
   - c. Ben
   (circle your answer)
8. Suppose your brother in his mid-forties dies unexpectedly. Would you attribute his death to (circle your answer):
   - a. God
   - b. Fate
   - c. Germs
   - D. No-one
   - e. Someone
   - f. Your brother himself
9. You are out in the bush with your wife and young children and you are all hungry. You have a rifle and bullets. You see three animals all within range - a young emu, a large kangaroo and a small female wallaby. Which should you shoot for food?
   - a. Young emu
   - b. Large kangaroo
   - c. Small female wallaby
   (circle your answer)
10. Why should you be careful of your cousins?

Taken from: http://wilderdom.com/personality/intelligenceOriginalAustralian.html
HANDOUT 2.2

The Original Australian Test of Intelligence Scoring Sheet

[Source unknown]

Scoring Sheet: Original Australian Test of Intelligence

1. One, two, three, many....the kuuk thaayorre system of counting only goes to three...thana, kuthir, pinalam, mong, mong, mong, etc. The word mong is best translated as "many" since it can mean any number between 4 and 9 or 10 after which yurr mong (many figures) would be more appropriate.

2. Those who say thirteen are right in European terms but irrelevant in Edward River terms. The speakers of kuuk thaayorre clearly recognize lunar menstruation and possess a notion of the lunar month as calculated as the time between one phase of the moon and the next appearance of that particular phase. However, apart from having no specific word to designate thirteen and thirteen only - yurr mong or "very many", is the right answer - the annual cycle is crouched in terms of environmental rhythms rather than in terms of fixed, invariant divisions of time. The "year" then is the time between the onset of one wet season and the onset of the next wet season - and wet seasons may be early or late, so who can be precise?

3. The right answer is "tree". This stems from the kuuk thaayorre speakers early experience with tobacco which was "stick" tobacco, hence it is classified with tree.

4. Crocodiles, turtles, birds and frill necked lizards are all classified as minh (which broadly might be translated as animals). Snakes along with eels are classified as yak which may be broadly translated as snake-like creatures.

5. All the items are classified with sugar as belong to the class of objects known as may. Broadly translated, may means vegetable food. Even witchetty grubs that are found in the roots of trees fall under this rubric - so does honey which is also associated with trees and hence fruit. The kuuk thaayorre language had no problem fitting flour into the may category since it obviously resembled some of their own processed vegetable foods (e.g., yams like Dioscoria sativa elongata). The word may can also mean sweet and hence sugar, which of course does not resemble anything in their traditional culinary.

6. "Eat" is the right word - well sort of, anyway. Where we make a distinction between "eating" and "drinking", kuuk thaayorre does not and they use the same verb to describe both functions and why not?

7. The clues are easy for kuuk thaayorre. An avoidance taboo operates between mother's brother and sister's son and politeness requires that sister's son should never directly face mother's brother nor talk to him directly in company. Sam and Ben are obviously brothers because of their unrestrained interaction while Harry, with his back turned to both his uncles is obviously the respectful nephew.
8. Among the kuuk thaayorre God has been equated with a mythological character and he is definitely non-malevolent. Both fate and germs are concepts foreign to the kuuk thaayorre belief system. No-one dies without reason and suicide is unknown to them, so the right answer is SOMEONE - which is the case in this sorcery riddled society.

9. The small female wallaby is the right answer. Emu is a food that may be consumed only by very old people. Kangaroos (especially large ones) may not be eaten by parents or their children. The children will get sick otherwise. Everyone knows that....don't they?

10. Because some of them have to be avoided like the plague. For example, a male must avoid his father's sister's daughter, or anyone classified with her. Such relations are called poison cousins in Aboriginal English.

Taken from:
http://wilderdom.com/personality/intelligenceOriginalAustralianAnswers.html
1. Identify Facial Expressions
2. Pop-out effect and motivation
3. Facial Feedback
4. Music & Emotion
5. Masculinity/Femininity scale (Personal Attribute Questionnaire)
6. Need for Achievement
7. SuperTracker Nutritional Lesson Places for High School Students
Lab Title: Identify Facial Expressions

Section 1: Performance Expectations

What will the student be asked to do?
Plan and/or carry out an investigation

This lab is an investigation and discussion starter.

Can we identify the emotion behind the expression? Why?

If given 20 faces (19 frowns and 1 smile) how quickly can we pick out the smile? With practice can we improve our time? Can we train ourselves to look for the positive?

Expectations are based on NSTA core ideas for students to investigate.

Main Idea/Concept Demonstrated or Taught by Lab:

- Emotion
- Nonverbal Communication

Key Terms and Psychologists Associated with Main Idea/Concept:

- Emotion
- Motivation
- Depression
- Facial Expressions
- Nonverbal Communication
- 6 Universal/Basic Emotions
- Positive Psychology

Materials:

- Students
- Instructor
- 10 slides with 20 faces on each (19 frowns and 1 smile)
**Instructions:**

Students should be broken into pairs. In these pairs: Student A will track time and Student B will try to point out the smiling face. Each time the smile is found, Student A will restart the timer. There should be a time noted for each slide.

Students should note any change in time taken to find the smile over time.

**Follow-up and Discussion:**

What practices could students engage in to explore phenomena and/or representations of this concept?

Can we identify the emotion behind the expression? Why?

With practice can we improve our time? Can we train ourselves to look for the positive?

**Section 2: Lab Report (written, verbal, and recorded)**

Content to be Included in Student Report:

- Background information
- Objectives
- Questions and hypothesis
- Materials used (include measurements, where necessary)
- Procedure described (for replication)
- Graphs/tables of collected data
- Findings
  - Was hypothesis supported or not supported? Explain.
    - If lab does not involve inferential stats, perhaps ask if data does/does not support the hypothesis.
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the research be improved, if replicated?

**Section 3: Crosscutting Concepts**

**Cause and effect**

Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

Students may observe a change in how quickly they can identify the positive facial expression because of the repetition.
References:

1. Template adapted from:

2. Lab model adapted from:
Lab Title: Pop-out effect and motivation

Section 1: Performance Expectations

What will the student be asked to do?
Engage in argument or communicate information

Students would be given pictures (ex. a group of slanted lines with one line slanted in the opposite direction. a snake camouflaged in leaves). Are they able to pick out the difference? Why? Why would this be a beneficial skill to have.

Expectations are based on NSTA core ideas for students to investigate.

Main Idea/Concept Demonstrated or Taught by Lab:
- Pop-out effect
- Motivation

Key Terms and Psychologists Associated with Main Idea/Concept:
- Pop-out effect/pop-out phenomenon
- Motivation
- Evolutionary Psychology
- Visual Stimuli

Materials:
- Student
- Instructor
- Image of repeated shape with one shape different.
- Photo of hidden danger (ex. Snake)

Instructions:
This lab can be done in groups or as a class.
Show students a pictures (ex. a group of slanted lines with one line slanted in the opposite direction. a snake camouflaged in leaves etc.).
As if they can see what is different/hidden? Are they able to pick out the difference? How? Why would this be a beneficial skill to have.
Follow-up and Discussion:

What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?

What motivation is there to noticing difference?

Section 2: Lab Report (verbal and recorded)

Content to be Included in Student Report:

- Background information
- Objectives
- Questions and hypothesis
- Materials used (include measurements, where necessary)
- Procedure described (for replication)
- Graphs/tables of collected data
- Findings
  - Was hypothesis supported or not supported? Explain.
    - If lab does not involve inferential stats, perhaps ask if data does/does not support the hypothesis.
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the research be improved, if replicated?

Section 3: Crosscutting Concepts

Scale, portions, and quantity

In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

Students will be trying to identify difference in images.

References:

1. Template adapted from:

2. Lab model adapted from:
Lab Title: Facial Feedback

Section 1: Performance Expectations

What will the student be asked to do?

Plan and/or carry out an investigation

Students will note their current emotional state. They will then be asked to smile/laugh. Will there be any change in their emotional state? This lab will try to utilize facial feedback theory.

Expectations are based on NSTA core ideas for students to investigate.

Main Idea/Concept Demonstrated or Taught by Lab:

- Facial Feedback Theory

Key Terms and Psychologists Associated with Main Idea/Concept:

- Emotion
- Facial Feedback Theory
- Laughter

Materials:

- Students
- Instructor
- Piece of paper
- Pen/Pencil

Instructions:

Ask students to write down how they are currently feeling (a lot of times students may be tired, hungry or feel a general lack of energy). Ask them to rate that emotion on a scale (ex. 1-5). Instructor will then ask students to laugh. It helps if the instructor laughs too. It may seem forced at first but just keep laughing. Do this for at least a minute. Try to judge when the students laughter becomes real and unforced. It often time will because of the silliness of the situation. After the laughter has died out, ask students to go back over their list and rate their emotions once more. Hopefully there is a change. If so, what kind of change was it and why? Discuss facial feedback theory. What comes 1st the emotion or physical response.
Follow-up and Discussion:
What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?

Section 2: Lab Report (written, verbal and recorded)

Content to be Included in Student Report:

- Background information
- Objectives
- Questions and hypothesis
- Materials used (include measurements, where necessary)
- Procedure described (for replication)
- Graphs/tables of collected data
- Findings
  - Was hypothesis supported or not supported? Explain.
    - If lab does not involve inferential stats, perhaps ask if data does/does not support the hypothesis.
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the research be improved, if replicated?

Section 3: Crosscutting Concepts

Cause and effect

Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

Students will learn about facial feedback theory. What effect does a physical response have on emotion.

References:

1. Template adapted from:

2. Lab model adapted from:
Lab Title: Music & Emotion

Section 1: Performance Expectations

What will the student be asked to do?
Engage in argument or communicate information

Does the music we listen do affect our mood/emotions or do we listen to music that complement our current emotional state.

Expectations are based on NSTA core ideas for students to investigate.

Main Idea/Concept Demonstrated or Taught by Lab:
Students will learn about correlations and confounding variables. They will also learn about Catharsis theory and discuss reason why music and emotions seem to be closely intertwined. Much like the Bobo doll experiment, if we hear lyrics that are filled with a certain emotion/vocab/tone will we/do we mirror the lyrics in our everyday lives?

Key Terms and Psychologists Associated with Main Idea/Concept:
- Music
- Emotion
- Research correlations
- confounding variable
- Catharsis
- Sigmund Freud
- Bobo doll experiment
- Albert Bandura

Materials:
- Students
- Instructor
- Music [Optional]

Instructions:
Provide students with background information regarding correlational studies of music and emotional states. Facilitate discussion “What kind of music do you listen to when you are sad?” “Does a sad song make you feel
any type of way?”. It is optional but recommended to bring in different songs/types of music and ask students to label if it brings out any type of emotional response. Is this response due to:

- Memory (ex. Song makes student feel sad because it reminds them of a breakup)
- Current state of emotion (ex. Student reports a strong bond with song at current time because they are calm, and the song makes seems calm)
- Due to preference of music (ex. Song makes student feel happy because they like rap)

Report date collected.

Follow-up and Discussion:

What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?

Section 2: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Background information
- Objectives
- Questions and hypothesis
- Materials used (include measurements, where necessary)
- Procedure described (for replication)
- Graphs/tables of collected data
- Findings
  - Was hypothesis supported or not supported? Explain.
    - If lab does not involve inferential stats, perhaps ask if data does/does not support the hypothesis.
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the research be improved, if replicated?

Section 3: Crosscutting Concepts

Select at Least One

- Select one or more cross-cutting concept central to the phenomena that students will investigate.
  - Cause and effect

Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.
Students will discuss music’s effect on emotion. They will learn theories regarding why possible connections between music and emotion are observable.

References:

1. Template adapted from:

2. Lab model adapted from:
Lab Title: Masculinity/Femininity scale (Personal Attribute Questionnaire)

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standard from the options.
  - Choose an item.
- Describe what students should know once the lab is complete using terminology from the expectations.
- Expectations are based on NSTA core ideas for students to investigate.

Main Idea/Concept Demonstrated or Taught by Lab:

**WHAT THE SCALE MEASURES**

Devised by Janet Spence and Robert Helmreich (1978), the PAQ assesses masculinity and femininity in terms of respondents’ self-perceived possession of various traits that are stereotypically believed to differentiate the sexes. The authors emphasize that the PAQ taps on limited aspects of sex roles: certain self-assertive or instrumental traits traditionally associated with masculinity and certain interpersonal or expressive traits traditionally associated with femininity. Although the PAQ should not be viewed as a global measure of masculinity and femininity, it has been widely used in research to provide a rough classification of participants in terms of their gender-role identity.

Key Terms and Psychologists Associated with Main Idea/Concept:

Gender

Materials:

PAQ sheet and scoring

Instructions:

The items below inquire about what kind of person you think you are. Each item consists of a pair of characteristics, with the letters A-E in between. For example:

Not at all Artistic  A....B....C....D....E  Very Artistic

Each pair describes contradictory characteristics—that is, you cannot be both at the same time, such as very artistic and not at all artistic.
The letters form a scale between the two extremes. You are to choose a letter which describes where you fall on the scale. For example, if you think you have no artistic ability, you would choose A. If you think you are pretty good, you might choose D. If you are only medium, you might choose C, and so forth.

Follow-up and Discussion:

- Select one or more of the questions to guide discussion and check for understanding.
  - Choose an item.

Section 2: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Background information
- Objectives
- Questions and hypothesis
- Materials used (include measurements, where necessary)
- Procedure described (for replication)
- Graphs/tables of collected data
- Findings
  - Was hypothesis supported or not supported? Explain.
    - If lab does not involve inferential stats, perhaps ask if data does/does not support the hypothesis.
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the research be improved, if replicated?

Section 3: Crosscutting Concepts

Select at Least One

- Select one or more cross-cutting concept central to the phenomena that students will investigate.
  - Choose an item.
- Describe how the cross-cutting concept(s) will factor in to the lab.
- For detailed explanations about each one, visit [http://ngss.nsta.org/CrosscuttingConceptsFull.aspx](http://ngss.nsta.org/CrosscuttingConceptsFull.aspx)

References:

1. Template adapted from:
2. Lab model adapted from:


# Personal Attributes Questionnaire

The items below inquire about what kind of person you think you are. Each item consists of a pair of characteristics, with the letters A-E in between. For example:

```
Not at all Artistic A....B....C....D....E Very Artistic
```

Each pair describes contradictory characteristics—that is, you cannot be both at the same time, such as very artistic and not at all artistic.

The letters form a scale between the two extremes. You are to choose a letter which describes where you fall on the scale. For example, if you think you have no artistic ability, you would choose A. If you think you are pretty good, you might choose D. If you are only medium, you might choose C, and so forth.

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Not at all aggressive</td>
<td>A....B....C....D....E</td>
<td>Very aggressive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Not at all independent</td>
<td>A....B....C....D....E</td>
<td>Very independent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Not at all emotional</td>
<td>A....B....C....D....E</td>
<td>Very emotional</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Very submissive</td>
<td>A....B....C....D....E</td>
<td>Very dominant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Not at all excitable in a major crisis</td>
<td>A....B....C....D....E</td>
<td>Very excitable in a major crisis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Very passive</td>
<td>A....B....C....D....E</td>
<td>Very active</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Not at all able to devote self completely to others</td>
<td>A....B....C....D....E</td>
<td>Able to devote self completely to others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Very rough</td>
<td>A....B....C....D....E</td>
<td>Very gentle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Not at all helpful to others</td>
<td>A....B....C....D....E</td>
<td>Very helpful to others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Not at all competitive</td>
<td>A....B....C....D....E</td>
<td>Very competitive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Very home oriented</td>
<td>A....B....C....D....E</td>
<td>Very worldly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Not at all kind</td>
<td>A....B....C....D....E</td>
<td>Very kind</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Indifferent to others’ approval</td>
<td>A....B....C....D....E</td>
<td>Highly needful of others’ approval</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Feelings not easily hurt</td>
<td>A....B....C....D....E</td>
<td>Feelings easily hurt</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Question</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>15</td>
<td>Not at all aware of feelings of others</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Can make decisions easily</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Gives up very easily</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Never cries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Not at all self-confident</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Feels very inferior</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Not at all understanding</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Very cold in relations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Very little time for security</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Goes to pieces under pressure</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SCORING THE PAQ

Put an X in the spaces to the left of the items for the following: 1, 4, 5, 11, 13, 14, 18, and 23. These items can be ignored. The rest of the items are scored in the following manner: A = 0, B = 1, C = 2, D = 3, E = 4. Based on the responses you circled, enter the appropriate numbers for the remaining items in the spaces to the left of the items.

The next step is to compute your scores on the femininity and masculinity subscales of the PAQ. To compute your score on the femininity subscale of the PAQ, add up the numbers next to items 3, 7, 8, 9, 12, 15, 21, and 22, and enter your score in the space below. To compute your scores on the masculinity subscale of the PAQ, you first need to reverse score item 16 and then add up the numbers next to items 2, 6, 10, 16, 17, 19, 20, and 24, and enter your score in the space below. Item 16 must be reverse scored so that a "4" is scored as a "0"; "3" as a "1"; "2" as a "2"; "1" as a "3"; and "0" as a "4".

MY SCORE ON THE FEMININITY SUBSCALE ____________
MY SCORE ON THE MASCULINITY SUBSCALE ____________

INTERPRETING YOUR SCORE

You can use the chart shown below to classify yourself in terms of gender-role identity. These norms are based on a sample of 715 college students studied by Spence and Helmreich (1978). The cutoffs for “high” scores on the masculinity and femininity subscales are the medians for each scale. Obviously, these are very arbitrary cutoffs, and results may be misleading for people who score very close to the median on either scale, as a difference of a point or two could change their classification. Hence, if either of your scores are within a couple of points of the median, you should view your gender-role classification as very tentative.

<table>
<thead>
<tr>
<th>Group</th>
<th>Masculinity Males</th>
<th>Masculinity Females</th>
<th>Femininity Males</th>
<th>Femininity Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School</td>
<td>21.7</td>
<td>19.4</td>
<td>20.9</td>
<td>24.1</td>
</tr>
<tr>
<td>College</td>
<td>22.4</td>
<td>20.1</td>
<td>21.4</td>
<td>24.0</td>
</tr>
<tr>
<td>School Parents</td>
<td>24.2</td>
<td>20.1</td>
<td>20.4</td>
<td>24.0</td>
</tr>
<tr>
<td>College Parents</td>
<td>23.2</td>
<td>19.7</td>
<td>21.1</td>
<td>24.0</td>
</tr>
</tbody>
</table>
Lab Title: Need for Achievement

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standard from the options.
  - Choose an item.
- Describe what students should know once the lab is complete using terminology from the expectations.
- Expectations are based on NSTA core ideas for students to investigate.

Main Idea/Concept Demonstrated or Taught by Lab:

Demonstrate the concept of need for Achievement, by exploring students’ own motivation during an activity.

Key Terms and Psychologists Associated with Main Idea/Concept:

Need for achievement

Materials:

Ring toss

Instructions:

THE NEED FOR ACHIEVEMENT: STRIVING FOR SUCCESS

The need for achievement is a stable, learned characteristic in which a person obtains satisfaction by striving for and achieving challenging goals. People with a high need for achievement seek out situations in which they can compete against some objective standard—such as grades, money, or winning a game—and prove themselves successful. People high in achievement motivation generally choose tasks that are of intermediate difficulty. In contrast, people with low achievement motivation tend to be motivated primarily by a desire to avoid failure.

Atkinson & Litwin, 1960 had individuals try to toss a ring onto a peg. There were 3 pegs, placed them at different points away (5, 10, or 15 feet). The farther the peg the participants would ring, the more points they would receive (1 point for 5, 2 for 10, 3 for 15). If you do not have 3 pegs, you can just ask people to stand at different distances. Students can just do this for points or you can award prizes. Each person is given 10 chances to shot for points. People high in need for Achievement tend to throw toward the center point. People lower in nAch tended to select the nearest peg, it being the easiest to hit and getting the greatest chance of success or the farthest peg where a miss was expected but the payoff was greatest.

Follow-up and Discussion:

Variations on this could be asking students who they would prefer working with on a project – a close friend or a stranger who was an expert in the field/problem they would be solving. People who are higher nAch tended to pick the expert who was a stranger. People with higher need for Affiliation tended to pick their
friends. McClelland (19) states that this shows different types of motivations – is the desire to be with some you like greater than the desire to succeed or excel at the task?

- Select one or more of the questions to guide discussion and check for understanding.
  - What practices could students engage in to explore phenomena and/or representations of this concept?

Section 2: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Background information
- Objectives
- Questions and hypothesis
- Materials used (include measurements, where necessary)
- Procedure described (for replication)
- Graphs/tables of collected data
- Findings
  - Was hypothesis supported or not supported? Explain.
    - If lab does not involve inferential stats, perhaps ask if data does/does not support the hypothesis.
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the research be improved, if replicated?
  - Could also include a discussion on how this could be applied to other areas (besides ring toss).

Section 3: Crosscutting Concepts

Select at Least One

- Select one or more cross-cutting concept central to the phenomena that students will investigate.
  - Cause and effect
- Describe how the cross-cutting concept(s) will factor in to the lab.
- For detailed explanations about each one, visit http://ngss.nsta.org/CrosscuttingConceptsFull.aspx

References:

1. Template adapted from:

2. Lab model adapted from:
Lab Title: SuperTracker Nutritional Lesson Places for High School Students
Adapted from USDA Center for Nutritional Policy and Promotion

Section 1: Performance Expectations

What will the student be asked to do?
- Select one or more performance standard from the options.
  - Performance Expectations (Plan and/or carry out an investigation)
- When instruction is completed, students will have investigated their own eating behaviors, including factors that motivate the consumption of certain foods and barriers that prevent them from consuming other (usually healthier) foods

Main Idea/Concept Demonstrated or Taught by Lab:
High school students have considerable control over food choices that can impact their health. These eating behaviors (and consequences of those eating behaviors) can carry on into adulthood. This activity looks at the factors that influence adolescent eating behaviors.

Motivators
- support from family and friends
- wider availability of healthy foods
- improving or maintaining appearance

Barriers
- lack of time
- limited availability of healthy foods
- lack of concern regarding healthy eating
- taste preferences

Key Terms and Psychologists Associated with Main Idea/Concept:
Hunger and eating, psychological factors on eating, promoting healthy eating, obesity and overweight

Materials:
SuperTracker lesson plans.

Instructions:
Cups (C) Daily recommendations

<table>
<thead>
<tr>
<th>Food Group</th>
<th>Girls (14-18)</th>
<th>Boys (14-18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits</td>
<td>1.5 C</td>
<td>2 C</td>
</tr>
<tr>
<td>Vegetables</td>
<td>2.5 C</td>
<td>3 C</td>
</tr>
<tr>
<td>Grains</td>
<td>6 oz (3 oz whole)</td>
<td>8 oz (4 oz)</td>
</tr>
<tr>
<td>Protein</td>
<td>5 oz</td>
<td>6.5 oz</td>
</tr>
<tr>
<td>Dairy</td>
<td>3 C</td>
<td>3 C</td>
</tr>
</tbody>
</table>

5 food groups

Ask students which food groups they feel they meet the daily guidelines and which they do not.

Which food groups did you eat the right amount of (Status = OK)? Check all that apply:

- Grains
- Vegetables
- Fruits
- Dairy
- Protein

Why do you eat the way you do? Rate each on how important they are for your food choices from 1 not important to 5 very important (list of common reasons why adolescents eat the way they do – note this is not the same across all age groups). This topic can link up with Health Psychology or the Learning chapter on changing behaviors.

<table>
<thead>
<tr>
<th>Motivators and/or barriers</th>
<th>Hunger or food cravings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parental influences</td>
<td>Friends influences</td>
</tr>
<tr>
<td>Availability or convenience of foods</td>
<td>Improving or maintaining appearance</td>
</tr>
<tr>
<td>Perceived benefits for health, energy, sports</td>
<td>Personal Mood</td>
</tr>
<tr>
<td>Cost</td>
<td>Media influence</td>
</tr>
<tr>
<td>Lifestyle choice (e.g. vegetarianism)</td>
<td>Time (speed of getting or eating)</td>
</tr>
<tr>
<td>Concern regarding healthy eating</td>
<td>Taste preferences (appeal of food)</td>
</tr>
</tbody>
</table>
Follow-up and Discussion:

- Select one or more of the questions to guide discussion and check for understanding.
  - What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?
- What are some strategies for including all five food groups in your daily diet?
- What motivates you to make healthy food choices?
- What are some strategies for building a healthy meal?
- What steps will you take to eat healthier meals?
- Do you have any barriers preventing you from eating healthier meals? If so, how might you overcome them?

Section 2: Crosscutting Concepts

Select at Least One

- Select one or more cross-cutting concept central to the phenomena that students will investigate.
  - Choose an item.
- Describe how the cross-cutting concept(s) will factor in to the lab.
- For detailed explanations about each one, visit http://ngss.nsta.org/CrosscuttingConceptsFull.aspx

To add to this lesson plan, see the following website:

https://choosemyplate-prod.azureedge.net/sites/default/files/printablematerials/SuperTrackerHighSchoolLessonPlans2016Updates-FINAL.pdf

https://www.supertracker.usda.gov/

- Objectives
  - Measurement of current eating habits
- Questions and hypothesis
  - What are my eating habits? How do they compare to My Food Plate recommendations?
- Materials used (include measurements, where necessary)
  - Choose my plate file, Food tracker website
- Procedure described (for replication)
You could ask students to evaluate just a snack or you could ask them to evaluate what they have eaten in the day.

Build healthy meals – What did you plan for to eat in your menu? How many total calories are in your daily menu? On a typical day, do you eat foods from all five food groups? How much of each food group does your menu include? Look up the nutrition content using Food-A-Pedia on (1) the number of food groups, (2) the number of calories, (3) the amount of added sugars, (4) the amount of saturated fat, and (5) the amount of sodium.

A shorter version of this could be evaluating lunch choices.

Calculate your Basal metabolic rate – the amount of energy expenditure (assuming you are at rest). This accounts for about 60-75% of calorie use per day. I am using the Mifflin-St Jeor calculation.

Men
10 x weight (kg) + 6.25 x height (cm) – 5 x age (y) + 5

Women
10 x weight (kg) + 6.25 x height (cm) – 5 x age (y) – 161.

When using these formulas, your weight is in kilograms and your height is in centimeters. Y is years.

1-pound equals .45 kg
1-inch equals 2.5 cm

Once you have this calculated, factor in your exercise level. Take the number after the amount of activity and multiply it by the number in your BMR

Sedentary. Little to no regular exercise. (factor 1.2)

Mild activity level: Intensive exercise for at least 20 minutes 1 to 3 times per week. This may include such things as bicycling, jogging, basketball, swimming, skating, etc. If you do not exercise regularly, but you maintain a busy life style that requires you to walk frequently for long periods, you meet the requirements of this level. (factor 1.375)

Moderate activity level: Intensive exercise for at least 30 to 60 minutes 3 to 4 times per week. Any of the activities listed above will qualify. (factor 1.55)

Heavy or (Labor-intensive) activity level: Intensive exercise for 60 minutes or greater 5 to 7 days per week (see sample activities above). Labor-intensive occupations also qualify for this level. Labor-intensive occupations include construction work (brick laying, carpentry, general labor, etc.). Also farming, landscape worker or similar occupations. (factor 1.7)

Extreme level: Exceedingly active and/or very demanding activities: Examples include: (1) athlete with an almost unstoppable training schedule with multiple training sessions throughout the day (2) very demanding job, such as shoveling coal or working long hours on an assembly line. Generally, this level of activity is very difficult to achieve. (factor 1.9)

For example, if male was 6 feet tall and weighed 200 pounds and was 30 years old and mildly active:

72 inches – 182 cm  200 lbs – 90.7 kg

\[(10\times90.7)+(6.25\times182)-(5\times30)+5\times1.375 = (907+1137.5-150)\times1.375 = 2607\]
Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Background information
  - Recommended daily allowances of each of the 5 food groups
- Graphs/tables of collected data
- Findings
  - Ask students about barriers that prevent them from eating healthy

References:

1. Template adapted from:

2. Lab model adapted from:
1. Performance Expectations
2. Social/Cultural
3. Biological Differences
4. Adjustment
5. Identity Crisis and Identity Commitment
6. What Do Others Know About You, and Are They Right? Self-Other Agreement in Personality
Lab Title: Traits

Section 1: Performance Expectations

What will the student be asked to do?

- Formulate a scientific question about personality assessment
- Take 2 different personality assessments that address traits and typology and think about the validity and reliability of these measures.
- Communicate information in a written report

Main Idea/Concept Demonstrated or Taught by Lab:

This lab allows all students to think about the conceptual difference between traits and typology. The Five-Factor personality assessment (Big-Five) has underlying factors that are consistent with the lexical hypothesis: personality characteristics that are most important in peoples' lives will eventually become a part of their language. The factors of extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience are theoretically based personality questionnaires which supports the comprehensiveness of the model and its applicability across observers and cultures. These factors have been found cross-culturally, however openness to experience is the least defined across cultures (McCrae & Costa, 1987).

The Myers-Briggs type indicator is based on Jung’s (1923) theory of type (Briggs & Myers, 1976). This assessment measures dichotomous preferences or qualitatively distinct types. Individuals are characterized as either as extraverted (E) or introverted (I), sensing (S) or intuitive (N), thinking (T) or feeling (F), and judging (J) or perceiving (P). Combinations of the four preferences determine personality types. Everyone is classified in terms of one of 16 possible four-letter codes (such as ESFJ, ENFP, INTP, and ISFJ). This assessment is used in education, business and for career counseling, however, the instrument’s popularity is not consistent with research evidence. Reliance on dichotomous scores, rather than continuous scores, restricts the level of statistical analysis and limits the assessment psychometrically (Boyle, 1995).

After concluding this lab, students should be able to:

- Describe the difference between traits and types
- Describe how personality assessments measure dispositional aspects of the individual
- Understand validity and reliability in terms of personality assessment
- Understand the need to differentiate between scientific and pseudoscientific assessments of personality
Key Terms and Psychologists Associated with Main Idea/Concept:

Traits, types, dispositions, individual differences, Big-Five personality assessment, extraversion, agreeableness, conscientiousness, neuroticism, openness to experience, validity, reliability

Instructions:

Have students take the following assessments.

1. IPIP-NEO

   1. Go to http://www.personal.psu.edu/faculty/j/j5/j5j/IPIP/
   2. Click "Follow this link if you wish to complete the original IPIP-NEO"
   3. Go to the 4th "bulleted" line on the page and click "take the shorter version"
   4. Click "yes" to both queries on the page that comes up, go to the bottom of the page and click SEND. That will activate the first 60 items of the test.
   5. Have students look over their results and think about how accurately the results describe their personality.

II. Jung Typology Test

   1. Go to http://www.humanmetrics.com/cgi-win/jtypes2.asp
   2. Have students complete the 64 items.
   3. Have students look over their results and think about how accurately the results describe their personality

Follow-up and Discussion:

- Ask students to identify the differences between the two assessments and think about the accuracy of the assessments
- As they discuss their personality results, help students identify issues with the validity and reliability of typology. Whereas the Big-Five assessment places individuals on a continuum for each trait, typology places them into a discrete category.
- Discuss issues of reliability and validity. For example, if an individual scores toward the middle on introversion, they are placed in the same group as an individual who scores high on introversion. If they take the assessment again and the score varies slightly, they may end up in a different dichotomous type.
What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?

- Many personality assessments may give a general response which can apply to anyone. This is called the Barnum effect and usually the basis for horoscopes.
- Personality assessments do not predict behavior in every situation. For instance, an individual who scores toward the introversion end may be sociable and gregarious at times. Traits predict the aggregation of behaviors.

What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?

- They will need to understand the difference between dimensional and categorical assessments
- Students would benefit from understanding the difference between reliability and validity

What representations or media help students make sense of core ideas?

- https://www.youtube.com/watch?v=qPCsCiOqmXA illustration of the Barnum effect

What practices could students engage in to explore phenomena and/or representations of this concept?

- Students could ask others, to whom they are close, about the accuracy of the results. Other people who know the individual well should have a good concept of their personality, possibly even better than the individual themselves.
- Students can think about how accurate the results are by keeping note of their choices over the next week to determine predictive validity (introverts may to choose more time alone, etc.)

Section 2: Crosscutting Concepts

Select at Least One

- Students will identify the predictive validity of traits. Are they a good predictor of aggregate behavior?
- Students should think about the dispositional nature of traits. If these traits can be found cross-culturally, does this mean they have a biological basis?

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Students will summarize their findings in either a written report or a verbal presentation that includes the following
- Background information on traits and types
Objectives of this study
Questions that were answered
Hypothesis on the accuracy of traits and types
Procedures
Findings – Did the results describe them accurately?
Discussion tied to reliability and validity
Discussion of surprises or new understanding concerning personality assessment

References

Jung, C. G. (1923). Psychological types: or the psychology of individuation.


Lab Title: Social/Cultural

Section 1: Performance Expectations

What will the student be asked to do?

- Plan and/or carry out a scientific investigation
- Analyze data
- Construct expectations or develop models

Main Idea/Concept Demonstrated or Taught by Lab:

The goal of this lab is to guide students to conduct a case study of people outside their social/cultural groups in the form of an interview. Specifically, through the interview, students will understand what cultural identity is and how people from another cultural group may have a distinct cultural identity and perceptions. Cultural identity can be defined as one’s collective self (Hall, 1990). In other words, it is how one perceives themselves as it relates to a group with which they identify. Cultural identity was found to contribute to one’s attitudes and values (Atkinson & GIm, 1989). Therefore, it is an important issue to be studied.

Key Terms and Psychologists Associated with Main Idea/Concept:

- Groups
- Cultures
- Cultural identity

Materials:

Interview questions:

- Students may use the following questions adapted from the Cultural Circles Exercise developed by Radhakrishnan (n.d.). Students may also write more interview questions
  - 1. Describe your cultural background. You can define this as narrowly or as broadly as you like but try to focus on what distinguishes you culturally from others. Describe some of the customs, rituals and/or ceremonies associated with your cultural group
  - 2. Of what aspects of your cultural background are you most proud?
  - 3. Excluding members of your family, describe a member of your cultural group who is a good role model for others in that cultural group
  - 4. Describe a situation in which you felt out of place as a result of being different from others.

Instructions:

Data collection

1. Students should first identify one individual outside their cultural group (broadly defined). For example, students may invite an individual who share a different race/ethnicity, country of origin, gender, sexual orientation, age, etc.
2. Students then invite the individual and schedule an interview with the individual. Students may conduct the interview through phone or in-person.
3. Students should record and transcribe the interview and make sure that no personal identifiable information is discussed in the recording.

Data analysis

Once the interview is transcribed, students then analyze the data and answer the following questions:

1. What was the cultural group that you have chosen? What was the cultural group that your interview participant identified?
2. Did your participant feel positive or negative of the cultural identity? Or, did your participant feel a mix of the two?
3. If your participant belongs to members of the minority, did your participant express feeling conflict between their own cultures versus the majority culture?
4. In what way were your participant’s cultures different from yours?

Follow-up and Discussion:

- Think about the following questions to guide discussion and check for understanding:
  - In interview study, how can the interviewer prevent your expectations or subjectivity from affecting the interpretation of your findings? Do you think your expectations or mere presence affected what the participants told you?
  - Were your participant open to talk about their experiences? How can you design your interview questions so that your participant would be more open to share?
  - Did your findings indicate any intergroup conflicts or misunderstandings? How could you, as an individual, help eliminate this kind of conflicts or misunderstandings around you?
  - There are people with many diverse cultures in this country, how do you think one can increase cultural awareness/understanding?

Section 2: Crosscutting Concepts

Select at Least One

- Students will describe the patterns of cultural identity and cultural differences.
- Students will identify the cause of intercultural conflicts. Specifically, what contributed to the cause of intercultural conflicts and how can one help to reduce such conflicts or misunderstandings.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Background information of cultural identity and inter-cultural understanding
- Objectives of the interview study
- Materials used (i.e. the interview questions)
- Procedure described in detail (for replication)
- Graphs/tables of collected data, as well as quotes from the interview transcripts, wherever relevant.
- Findings
  - Use the questions in the “data analysis” section under “instructions” to write your findings.
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the research be improved, if replicated?

References:

Lab Title: Biological Differences

Section 1: Performance Expectations

What will the student be asked to do?

In this lab, students will be asked to obtain, evaluate, and communicate information that analyzes biological differences between introverts and extraverts.

- Complete a test that assesses biological differences among extraverts and introverts
- Complete a questionnaire that assesses subtrait differences among extraverts and introverts
- Explore the reliability of these measures.
- Complete a lab report which will allow them to communicate information about their research findings

Main Idea/Concept Demonstrated or Taught by Lab:

*Introversion-Extraversion* is a normally distributed personality dimension, as opposed to two dichotomous types. Another way to think about it is this. *Introversion-Extraversion* is a continuum anchored on one end by introversion and the other end by extraversion. Very few people score at the extreme ends and most of us score somewhere in the middle. People who score low on this dimension are labeled as introverts and they typically prefer less stimulation, are less talkative, prefer staying in rather than going out, and are more comfortable with routine tasks and monotony. People who score high on this dimension are labeled as extraverts and they typically prefer more stimulation, are more talkative, prefer going out rather than staying in, and dislike routine and monotony. In this lab, students will be asked to obtain, evaluate, and communicate information that analyzes biological differences between introverts and extraverts.

Part One of this activity facilitates students’ exploration of a biological difference between people who are introverted and people who are extraverted. Because introverts are more comfortable with less stimulation, the prediction is that introverts will experience a larger reaction to the lemon juice. By comparison, because extraverts are more comfortable with more stimulation, the prediction is that extraverts will experience a smaller reaction to the juice. Part Two of this activity allows students to explore the reliability of the lemon juice test. In Part Two, they will complete a widely-used questionnaire that assesses level of extraversion. Finally, they will compare their lemon juice test results to those questionnaire scores. If both measures indicate the same level of the trait, then that suggests these two measures are reliable.

After concluding this lab, students should be able to:

- Describe the introversion—extraversion trait dimension
- Describe two common techniques for assessing people’s level of this trait dimension
- Explore two types of differences in people who score low vs. high on this trait dimension
- Examine the reliability of two tests that assess this trait
- Interpret and Communicate research results in a lab report format
Key Terms and Psychologists Associated with Main Idea/Concept:

Key Terms: Introversion, Extraversion, Dimension, Continuum, Stimulation

Key Psychologists: Hans Eysenck and D.W.J. Corcoran

Materials

1. Fresh lemon juice (You will need one tbsp. of lemon juice for each student completing the lab.)
2. 2-3 bags of cotton balls
3. one tablespoon-sized measuring spoon
4. napkins
5. small cups (e.g., disposable paper .75 oz. soufflé cups) (You will need three cups for each student completing the lab.)
6. Digital electronic kitchen scale
7. Alcohol wipes to clean the scale between uses

Instructions

1. Before you begin:
   a. Place one tablespoon of pure lemon juice in a cup for each student.
   b. Give each student 2 empty cups.
   c. Place 8-10 cotton balls on a napkin for each student’s use.
   d. Place copies of the questionnaire aside for students to complete in Part Two of this lab

Part One:

2. Each student should perform a pre-test:
   a. place a cotton ball in your mouth to absorb all of the saliva
   b. place that cotton ball in one of the small cups before placing the cup on the digital electronic kitchen scale
   c. note how heavy the cup is
   d. record the weight in your lab report
3. Each student should place the lemon juice in their mouths and swirl it around for 5 seconds before swallowing it. Then, move to step ‘4’.
4. Each student should perform a post-test:
   a. place enough cotton balls in your mouth to absorb all of the saliva
   b. place those cotton balls in the other small cup before placing that cup on the digital electronic kitchen scale
   c. note how heavy the cup is
   d. record the weight in your lab report
Please note that it may be necessary to clean the scale between uses so that one person’s data will not contaminate another person’s data.

5. Each student should calculate a difference score:

Subtract the pre-test weight from the post-test weight and record the difference (i.e., difference score = post-test – pre-test)

6. Each student should analyze their scores and answer the question, “What does your difference score say about your level of extraversion?” Although there are many reasons why a person might experience fluctuations in their salivation (e.g., dehydration, thirst, time of day, temperature, etc.), larger difference scores indicate a larger reaction to the lemon juice while smaller difference scores indicate a smaller reaction to the lemon juice. Consistent with the published literature, more introverted students should experience a larger reaction to the lemon juice and have larger difference scores. Similarly, more extraverted students should experience a smaller reaction to the juice and have smaller difference scores.

7. Create a numerically-ordered list of students’ difference scores and notice whose scores are larger vs. smaller. Discuss.

**Part Two:**

**Steps 8 through 10 if you do NOT have access to Excel and already are familiar with correlation coefficients:**

1. Each student should complete the questionnaire, compute his or her score on it, and record it.

2. Create a numerically-ordered list of students’ questionnaire scores and notice whose scores are larger vs. smaller.

3. Compare both lists and examine similarities. Did the students with larger difference scores have lower scores on the questionnaire? If so, then your findings are consistent with the theory and published literature and indicates the following:
   a. the students with larger difference scores (i.e., students who showed a larger reaction to the lemon juice) have lower scores on the questionnaire (i.e., are more introverted), and
   b. the students with smaller difference scores (i.e., students who showed a smaller reaction to the lemon juice) have higher scores on the questionnaire (i.e., are more extraverted).

**Steps 8 through 13 if you do have access to Excel and already are familiar with correlation coefficients:**

1. Each student should complete the questionnaire, compute his or her score on it, and record it.

2. In a blank Excel spreadsheet file, create the following type of file that will contain 3 columns titled the following: students’ names; difference scores; and extraversion scores,

   \[ =\text{CORREL(B2:B4,C2:C4)} \]
3. Enter each student's information in the appropriate column on the same row. Each student should have his or her own row of data.

4. After you have finished entering all of the students’ information, enter the following ‘correlation command’ text in one of the blank boxes: =CORREL(B2:B4,C2:C4).

The ‘2’ and the ‘4’ will differ depending upon how many students you have in your group. In the example above there are only 3 students. The first number is the row number of the first students’ data, and the second number is the row number of the last students’ data.

5. When you finish entering the correlation command text and press return, you will have a correlation coefficient for your data. This correlation coefficient is a decimal number that gives you a numerical indication of how closely associated people’s difference scores and extraversion scores are. Use the table below for reference.

<table>
<thead>
<tr>
<th>Correlation coefficient</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exactly –1.</td>
<td>A perfect negative (inverse) relationship</td>
</tr>
<tr>
<td>–0.70.</td>
<td>A strong negative (inverse) relationship</td>
</tr>
<tr>
<td>–0.50.</td>
<td>A moderate negative (inverse) relationship</td>
</tr>
<tr>
<td>–0.30.</td>
<td>A weak negative (inverse) relationship</td>
</tr>
<tr>
<td>0.</td>
<td>No linear relationship</td>
</tr>
<tr>
<td>+0.30.</td>
<td>A weak positive relationship</td>
</tr>
<tr>
<td>+0.50.</td>
<td>A moderate positive relationship</td>
</tr>
<tr>
<td>+0.70.</td>
<td>A strong positive relationship</td>
</tr>
<tr>
<td>Exactly +1.</td>
<td>A perfect positive relationship</td>
</tr>
</tbody>
</table>
6. Think about the correlation coefficient and interpret its meaning. Did the students with larger difference scores have lower scores on extraversion? If so, then your findings are consistent with the published literature and indicate the following:

   a. the students with larger difference scores (i.e., students who showed a larger reaction to the lemon juice) have lower scores on the questionnaire (i.e., are more introverted), and

   b. the students with smaller difference scores (i.e., students who showed a smaller reaction to the lemon juice) have higher scores on the questionnaire (i.e., are more extraverted).

**Personality Questionnaire**

**Instructions:** These are some items from the Eysenck Personality Questionnaire Extraversion Scale. For every question, circle just one response. After you have finished, please proceed to the scoring instructions below.

1. yes  no  Are you a talkative person?
2. yes  no  Are you rather lively?
3. yes  no  Can you usually let yourself go and enjoy yourself at a lively party?
4. yes  no  Do you enjoy meeting new people?
5. yes  no  Do you tend to keep in the background on social occasions? (reversed)
6. yes  no  Do you like going out a lot?
7. yes  no  Do you prefer reading rather than meeting people? (reversed)
8. yes  no  Do you have many friends?
9. yes  no  Would you call yourself happy-go-lucky?

Scoring instructions: reverse your answers to the items marked ‘reversed’; then count how many questions you endorsed with a ‘yes’. 1-3 yes’s indicate a more introverted personality; 4-6 yes’s indicate moderate levels of both; 7-9 yes’s indicate a more extraverted personality. The average college student scores about 6 on this questionnaire.


*This questionnaire was adapted from Larsen and Buss (2010, p. 198).

Written Lab Report Worksheet

1. Describe some of the major differences between people who are considered extraverted vs. people who are considered introverted?

2. Describe the 2 techniques you used in this lab to assess whether you are more introverted or extraverted.

3. What is the weight of your pretest cup?

4. What is the weight of your posttest cup?

5. What is your difference score (posttest – pretest)?

6. Based upon your difference score, are you considered introverted, extraverted, or ‘in the middle’?

7. Based upon your questionnaire score, are you considered introverted, extraverted, or somewhere ‘in the middle’?

8. Did both ‘tests’ give you similar results? Explain. If both measures indicate the same level of the trait, then that suggests these two measures are reliable.
Section 2: Crosscutting Concepts

Select at Least One

- Students may examine the validity of the two forms of measurement. Which of the two tests is better at assessing the trait dimension?
- In the event scores on one measure are not similar to scores on the other measure, what are some possible explanations for this?

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Students will summarize their findings in either a written report or a verbal presentation that includes their answers to the questions on the lab report worksheet (above)
- Answers to those questions will help the student explore the following:
  - Background information on the trait dimension Introversion-Extraversion
  - Objectives of this study
  - Questions that were answered
  - Procedures
  - Findings
  - Discussion tied to reliability and validity
  - Discussion of surprises or new understanding concerning personality assessment

References


Lab Title: Adjustment

Section 1: Performance Expectations

What will the student be asked to do?

- Plan and/or carry out a scientific investigation
- Analyze data
- Engage in argument or communicate information

Main Idea/Concept Demonstrated or Taught by Lab:

Students will conduct a self-assessment of life challenges and stresses that they are currently experiencing. The goal of this lab is to help students identify sources of stress due to adjustment and discuss ways to cope with the stress. Adjustment occurs throughout life span, such as transition to a new school (Roberson, Fish, Olmstead & Fincham, 2015), or death of a loved one (Worden & Silverman, 1996). To help students understand what circumstances may involve adjustment, students will first complete the Holmes & Rahe Social Readjustment Rating Scale (SRRS) for Students (Holmes & Rahe, 1967; Insel & Roth, 1985). The SRRS for students has been commonly used to measure stressful life events in students/non-adult sample. The SRRS for Students also provide students with some examples of possible life events that cause adjustment issues.

A common complain about SRRS is that SRRS measures only life events but not the perceived stress experienced by individuals. Therefore, to complement the SRRS, an assessment based on one’s perception and experiences was also chosen. The Depression, Anxiety, and Stress Scale (DASS, Lovibond & Lovibod, 1995) is a commonly used measurement to assess individuals level of depression, anxiety and stress. Students could compare the two scores and have a better picture of the two sides of adjustment, that is, situational/contextual factors (measured by SRSS-students) and individuals’ perception/experiences (measured by DASS).

Key Terms and Psychologists Associated with Main Idea/Concept:

- Adjustment
- Stress
- Coping
- Anxiety
- Depression

Materials:

Holmes & Rahe Social Readjustment Rating Scale (SRRS) for Students

2. Include also the following scoring guide:
   a. 300 points or more: an elevated risk of illness in the future.
b. 150-299: moderate risk of illness

c. 150 or below: slight risk of illness.

**Depression Anxiety Stress Scales (DASS)**

1. Go to [http://www2.psy.unsw.edu.au/dass/down.htm](http://www2.psy.unsw.edu.au/dass/down.htm) and download the DASS. Instructors may choose the full version (DASS) or the shortened version DASS-21.

2. DASS manual can be ordered here: [http://www2.psy.unsw.edu.au/dass/order.htm](http://www2.psy.unsw.edu.au/dass/order.htm), but the free download listed in (1) already includes response form and scoring that instructors may need.

3. Scoring instruction may also be found here: [https://serene.me.uk/tests/dass-score-guide.pdf](https://serene.me.uk/tests/dass-score-guide.pdf)

Instructors are also free to choose from the following commonly used scales for stress measurement.


**Instructions:**

Pair students up and have them complete the SRRS-students and the DASS for Students. However, students should complete the forms separately. The purpose of pairing students up is to give students an opportunity to discuss and build rapport.

**Follow-up and Discussion:**

- One student completed the SRRS-students and DASS, students then share their scores with one another and discuss. For example, they may discuss
  - In the SRRS-students, which life event contributes to the largest proportion of your total scores? What life events do you think people at your age encounter? Do you think these life events cause difficult adjustment issues?
  - In the DASS, what is your score of depression, anxiety and stress? (Students should obtain a score of the three dimensions separately using the scoring guide in the material section.)
  - Compare the SRRS-students and DASS, are you high on both or low on both? Or, do you have high score on one but low on the other?
  - Consider a situation where a student score high on SRRS-students but low on DASS, what may have contributed to the students’ resilience? Do you have any experiences like this when you can handle a stressful circumstance without stressing yourself out?
  - Read this news excerpt from the New York Post:

    At least three people have killed themselves during livestreams since last month, most recently an aspiring actor who had been arrested on suspicion of sexual assault. Police reportedly arrived just moments after Frederick Jay Bowdy, 33, shot himself while broadcasting a Facebook Live video inside a car in North Hollywood, Calif., on Jan. 23.
Bowdy’s suicide came less than one day after Naika Venant, 14, killed herself during a Facebook Live video in an apartment she shared with her foster parents in Miami Gardens, Fla. Just hours earlier, the teen — whose mother blames the sexual abuse she endured while in Florida’s foster care system for her death — had posted on Facebook: “I Don’t Wanna Live No More.”

Weeks earlier, Katelyn Nicole Davis, 12, livestreamed her suicide from her front lawn in Cedartown, Ga., on a site called Live.me, telling viewers she decided to take her own life on Dec. 30 during a 40-minute video because she had been physically and sexually abused by a relative. (Excerpt from the New York Post, Joshua Rhett Miller, January 31, 2017)

- People who feel stressed use different means to cope. Some people choose to end their lives. What do you think about the news excerpt? How do you prevent yourself and your peers from using negative approaches to cope like above?
  - Do you think that it’s better not to have stress at all?
  - See this Ted Talk on “How to make stress your friend” by Dr. Kelly McGonigal: https://www.youtube.com/watch?v=RcGyVTaOxeU

Section 2: Crosscutting Concepts
Students will identify the probable causes and effects of stress. What are some sources stress and what are some consequences of having slight to an elevated level of stress?

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:
- Background information on adjustment, stress and coping.
- Objectives of this lab
- Questions that were answered
- Materials used (include measurements, where necessary)
- Procedure described in detail (for replication)
- Graphs/tables of collected data (scores of self and the partner)
- Findings: What do the findings mean? (use appropriate terminology related to concept)

References:


Lab Title:  Identity Crisis and Identity Commitment

Section 1: Performance Expectations

What will the student be asked to do?

- Plan and/or carry out a scientific investigation
- Analyze data
- Present findings via a written report or class discussion

Main Idea/Concept Demonstrated or Taught by Lab:

The goal of this lab is for students to explore personal accounts of the process of identity crisis and commitment via an interview. In Post-Freudian Theory, Erik Erikson (1950) described a stage model of personality development that includes the psychosocial crisis of identity versus role confusion in adolescence. The adolescent’s primary task is to develop a coherent sense of self. Identity exploration begins with an identity crisis, or a period of questioning who one is and what one believes. While multiple identity crises occur all along the lifespan, the first and largest generally occurs during adolescence. Building on Erikson’s work, James Marcia proposed four distinct identity statuses—diffusion, foreclosure, moratorium, and achievement—that describe identity along two dimensions, whether an individual has had an identity crisis and whether they have committed to an identity (Kroger & Marcia, 2011). In this lab, students will interview a person of their choice in person or via telephone to ask questions about the person’s experience going through an identity crisis. Students will learn about common time frames, topics, emotions, and resolutions involved in identity crises. In addition, they will have an opportunity to think about social and cultural factors that may play a role in identity development.

Key Terms and Psychologists Associated with Main Idea/Concept:

- Identity
- Identity crisis
- Personality development
- Erik Erikson
- James Marcia

Materials:

Interview questions:

- Suggested interview questions are listed below. Students may also ask follow-up questions to participants’ responses if they wish.
  - 1. Have you ever experienced a time when you weren’t sure who you were, what you believed, or what you wanted out of life? If so, how old were you when you became unsure?
    - If yes, proceed with the questions below. If no, proceed to the second set of interview questions below.
  - 2. Tell me about that experience. What were you unsure about? What kinds of questions did you ask yourself or others? Was there a particular event that made you start questioning yourself?
  - 3. How did you feel when you were uncertain about this aspect of your life?
4. Did you experiment with different personalities, behaviors, philosophies, etc. when you were trying to answer this question? If so, what did you do differently?

5. Have you figured out the answer to these questions yet, or are you still searching?

6. How long did this period of time last (or how long has it been so far, if they have not yet resolved their identity crisis)?

7. What people, events, or ideas were most helpful to you in your search?

8. If you resolved your questions, what conclusion did you come to? Do you currently think the same way you did before you started questioning, or have you changed your position through this process?

Set 2: Use these questions if the person indicates they have not experienced uncertainty about some aspect of their identity.

1. Tell me a little bit about the ideas and beliefs that are most important to you. Why do you think you have never questioned them?

2. How do you think it would feel to question your identity or beliefs?

3. Do you think there is any value in questioning your identity or beliefs?

4. What people, events, or ideas have been most influential in shaping your current identity?

Instructions:

Data collection

1. Interviews may occur in class or outside of class. If interviews are conducted in class with fellow students, it is possible that some students may not have yet experienced an identity crisis, and this may result in fewer examples of identity crises for students to examine. If interviews are conducted outside of class, they may take place in person or over the phone.

2. Before beginning the interview, students should obtain verbal consent to record the interview and tell participants that their names will not be associated with their stories. Students should plan for interviews should last approximately 30 minutes.

3. Students should record and transcribe the interview and make sure that no personally identifiable information is discussed in the recording or added to the transcription.

Data analysis

Once the interview is completed and transcribed, students should answer the following questions:

1. Has your participant experienced an identity crisis?
   - If so, would you consider it a major (involving most or the entire identity) or minor (concerning a small part of the self) crisis?
   - When did the crisis begin? How long did they question their identity before settling on an identity?
   - Did your participant approach the process of working through the identity crisis positively or negatively? Was it a smooth process, or did they experience great difficulty?

2. If your participant had never questioned some aspect of his or her identity,
3. How old are they currently? What reasons did they give for why they have not done this? Did they seem to think questioning one’s identity is a good thing or a bad thing?

Follow-up and Discussion:

The following questions may be used to help students analyze their results:

- What was the average age that a person’s identity crisis began? What was the average and range for duration (time between identity crisis and identity commitment)?
- How many individuals would be classified as being in identity diffusion? Moratorium? Foreclosure? Achievement?
- For participants who reported experiencing an identity crisis, what were some common themes they discussed? Did you notice similar questions, emotions, or experiences? If so, why do you think so many people would experience an identity crisis in similar ways?
- For participants who reported never having experienced an identity crisis, did you notice any themes in their responses?
- Did your participants seem hesitant to discuss their experiences? If so, what do you think would make them afraid to discuss their identity explorations?
- Why do you think people often experience their first identity crisis in adolescence? Why not earlier or later? What is going on in an adolescent’s life or body that might contribute to an identity crisis?
- Do you think different cultures or family environments might affect how the identity process works? Why or why not?
- Thinking about Erikson’s stages of personality development, why would it be important to resolve the identity crisis and establish an identity before seeking romantic partnership?

Section 2: Crosscutting Concepts

- Students will describe the thoughts, feelings, and behaviors associated with experiencing an identity crisis and search for patterns in timing and events associated with the beginning or resolution of a crisis.
- Students should think about what biological and societal factors contribute to identity crises. Would crises look different in other cultures or families?

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Background information on Erikson’s concept of identity versus role confusion
- Background information on Marcia’s four identity statuses
- Objectives of the interview
- Interview questions used
● Description of procedure
● Tables of data where applicable
● Findings
  o Summary of interview responses
  o Responses to questions under “data analysis”
  o Comparison of student’s data to the larger dataset (after group discussion of the responses as a whole)

References:

Lab Title: What Do Others Know About You, and Are They Right? Self-Other Agreement in Personality

Section 1: Performance Expectations

What will the student be asked to do?

- Complete a brief personality questionnaire about themselves, someone they know well, and someone they do not know well
- Calculate composite scores for the Big Five, including reverse-scored items
- Examine and discuss the differences between their ratings of themselves and others’ ratings of them
- Communicate findings and analysis in a written report

Main Idea/Concept Demonstrated or Taught by Lab:

Many people wonder how others see them. Research in personality has shown us that a good portion of the time, other people see us similarly to how we see ourselves. It’s not only those who know us best that agree with us about what we are like; people we barely know or who we have never met before can size us up pretty accurately. Recent research has shown that strangers can judge our personality correctly from photos of us that depict our facial expressions, posture, and clothing (Naumann, Vazire, Rentfrow, & Gosling, 2009), our Facebook pages (Vazire & Gosling, 2004), our bedrooms and offices (Gosling, Ko, Mannarelli, & Morris, 2002), and even from our music preferences (Rentfrow & Gosling, 2006)!

This lab will ask students to explore self-other agreement in personality traits. Specifically, they will examine self- and other-ratings on the Big Five: extraversion, or the tendency to be gregarious, socially dominant, and energetic; agreeableness, or being warm, trusting, cooperative, and sympathetic; conscientiousness, the tendency to be organized, self-controlled, hard-working, and responsible; emotional stability, or the extent to which someone is calm and unflappable; and openness to experience, or the tendency to prefer intellectual and aesthetic experiences, be curious, and enjoy new things (John, Naumann, & Soto, 2010). Students will first rate themselves on the Big Five and then have two other people rate their personality: one person who they know fairly well, and one person they barely know or do not know at all. They will examine how different their ratings are from others’, whether some traits seem to have more agreement while others have less, and think about why they might sometimes see differences between their own ratings and others’. Students will also gain an understanding of how personality scales are scored, including reverse scoring items.

Key Terms and Psychologists Associated with Main Idea/Concept:

- Personality traits
- Big Five
- Measurement
- Personality perception

Materials:

Ten-Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003) and scoring key, included below.
Several non-English versions of the TIPI can be found at:

https://gosling.psy.utexas.edu/scales-weve-developed/ten-item-personality-measure-tipi/.

Instructions:
1. Each student should first write down a prediction about his or her scores on each of the Big Five (high, medium, or low).
2. Then each student should answer the TIPI questions about him- or herself.
3. Next, ask each student to find someone in class who knows them well. This friend should complete the TIPI questions about the student. If a student does not know anyone in the class very well, ask them to find a person they have spoken with before.
4. Each student should then find someone they do not know. Ideally, they will have never had a conversation with this person. This stranger should complete the TIPI questions about the student. If a student knows everyone in the class, ask them to find the person they know the least well.
5. Every student should provide at least two sets of TIPI ratings—one for themselves and at least one for another person.
6. Students should follow the scoring instructions to generate three sets of scores on each of the Big Five traits (extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience) ranging from 1-7 for their ratings of themselves, their friend’s ratings of them, and a stranger’s ratings of them.
7. Finally, students should complete the questions on the attached lab worksheet.

Section 2: Crosscutting Concepts

Students will examine what sources of information we use to evaluate others’ personalities. How do we intentionally or unintentionally communicate our personality to others? Students should also think about whether there is a discrepancy between their behavior and their internal states (emotions and thoughts) that contribute to others’ ability to read them accurately.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Students will complete a written report and/or an oral presentation that includes their answers to the questions on the lab worksheet below, which will explore:
  o Background information on the Big Five personality traits
  o Predictions about one’s own personality
  o Scores on a personality inventory
  o Comparison of self- and other-ratings
  o Findings and analysis

References:


Ten-Item Personality Inventory -(TIPI)—FOR STUDENTS

Here are a number of personality traits that may or may not apply to you. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.

1 = Disagree strongly
2 = Disagree moderately
3 = Disagree a little
4 = Neither agree nor disagree
5 = Agree a little
6 = Agree moderately
7 = Agree strongly

I see myself as:

1. _____ Extraverted, enthusiastic.
2. _____ Critical, quarrelsome.
3. _____ Dependable, self-disciplined.
4. _____ Anxious, easily upset.
5. _____ Open to new experiences, complex.
6. _____ Reserved, quiet.
7. _____ Sympathetic, warm.
8. _____ Disorganized, careless.
9. _____ Calm, emotionally stable.
10. _____ Conventional, uncreative.
Ten-Item Personality Inventory-(TIPI) – FOR A FRIEND

**Instructions for student:** Have someone you know fairly well answer the following questions about YOU. If you don’t know any classmates well, ask someone you have had a conversation with before. Please do not look at the paper while your friend is completing the survey. We want them to be honest! Before giving this scale to your friend, please write your name in the blanks below.

**Instructions for friend:** Here are a number of personality traits that may or may not apply to ____________. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to ____________, even if one characteristic applies more strongly than the other.

1 = Disagree strongly
2 = Disagree moderately
3 = Disagree a little
4 = Neither agree nor disagree
5 = Agree a little
6 = Agree moderately
7 = Agree strongly

I see ____________ as:

1. _____ Extraverted, enthusiastic.
2. _____ Critical, quarrelsome.
3. _____ Dependable, self-disciplined.
4. _____ Anxious, easily upset.
5. _____ Open to new experiences, complex.
6. _____ Reserved, quiet.
7. _____ Sympathetic, warm.
8. _____ Disorganized, careless.
9. _____ Calm, emotionally stable.
10. _____ Conventional, uncreative.
Ten-Item Personality Inventory-(TIPI) – FOR A STRANGER

Instructions for student: Have someone you have never talked to or who you don’t know very well answer the following questions about YOU. Please do not look at the paper while your partner is completing the survey. We want them to be honest! Before giving this scale to your partner, please write your name in the blanks below.

Instructions for friend: Here are a number of personality traits that may or may not apply to ______________. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to ______________, even if one characteristic applies more strongly than the other.

1 = Disagree strongly
2 = Disagree moderately
3 = Disagree a little
4 = Neither agree nor disagree
5 = Agree a little
6 = Agree moderately
7 = Agree strongly

I see ______________ as:

1. _____ Extraverted, enthusiastic.
2. _____ Critical, quarrelsome.
3. _____ Dependable, self-disciplined.
4. _____ Anxious, easily upset.
5. _____ Open to new experiences, complex.
6. _____ Reserved, quiet.
7. _____ Sympathetic, warm.
8. _____ Disorganized, careless.
9. _____ Calm, emotionally stable.
10. _____ Conventional, uncreative.
How to score the TIPI

Many questionnaires like the TIPI include multiple questions that measure the same variable. In order to understand whether someone is introverted, extraverted, or somewhere in the middle, we must calculate what is known as a composite score, or an average score on all the questions that measure the same variable. Since the TIPI is scored on a scale from 1-7, your composite score can range from 1 (very low on that trait) to 7 (very high on that trait).

Sometimes researchers ask what are known as reverse-keyed questions, which measure the opposite of the variable you are measuring. For example, if a researcher wants to measure extraversion, she might ask “Are you extraverted?” but she might also ask a reverse-keyed question such as “Are you introverted?” If someone says 7 (strongly agree) to the question “Are you extraverted?” and 1 (strongly disagree) to the question “Are you introverted?”, it sounds like that person is very extraverted! However, if we were to average these scores together, we would end up with a 3.5, which would tell us that that person is neither very extraverted nor very introverted.

Before we can calculate our composite score, we must first reverse score the reverse-keyed questions. To do this, we simply change the number the respondent chose to its opposite on the response scale. For example, on a 7-point scale, a 1 becomes a 7, a 2 becomes a 6, a 3 becomes a 5, a 4 stays the same, and so on. Once we have reverse scored these questions, we can calculate the composite score.

In our example above, our participant said 1 (strongly disagree) to “Are you introverted?”. If we reverse score this question, the 1 becomes a 7. When we take the average of 7 and 7, we get... 7! This indicates that the person is indeed highly extraverted.

**Instructions:** For each set of questionnaires, you will reverse score one question per personality trait, then calculate the composite score by taking the average of the two questions for each personality trait. For example, on the TIPI, extraversion is represented by Question 1 and Question 6 (reverse-keyed). To calculate the composite score for extraversion, I will add the original score for Question 1 and the reverse score for Question 6, and then divide by 2. If I chose “3” for Question 1 and “7” for Question 6, I should first reverse score Question 6. The new score for Question 6 becomes “1.” Then, I should take the average of Question 1 and the new score for Question 6. The average of 3 and 1 is 2, so my overall score for extraversion would be 2, indicating low extraversion.

Below is a list of the questions that correspond to each personality trait:

**Extraversion:**
1, 6 reversed

**Agreeableness:**
2 reversed, 7

**Conscientiousness:**
3, 8 reversed

**Emotional Stability:**
4 reversed, 9

**Openness to Experience:**
5, 10 reversed
Results

What were your ratings of yourself on the TIPI?
Extraversion: _____
Agreeableness: _____
Conscientiousness: _____
Emotional Stability: _____
Openness to Experience: _____

What were your friend's ratings of you on the TIPI?
Extraversion: _____
Agreeableness: _____
Conscientiousness: _____
Emotional Stability: _____
Openness to Experience: _____

What were a stranger's ratings of you on the TIPI?
Extraversion: _____
Agreeableness: _____
Conscientiousness: _____
Emotional Stability: _____
Openness to Experience: _____
Lab Report Worksheet

1. In your own words, describe what it means to be extraverted, agreeable, conscientious, emotionally stable, and open to experience.

2. Before you rated your personality, did you think your scores would be high, medium, or low on each of these traits? Were you surprised by any of your results?

3. Compare your ratings to your friend’s ratings of you. On which traits were your ratings most similar?

4. Which trait(s) showed the biggest differences between how you see yourself and your friend saw you? Why do you think the scores were different? Were you surprised at what they thought of you?

5. Now, compare your ratings to a stranger’s ratings of you. On which traits were your ratings most similar? If they were similar, were you surprised that a stranger was able to accurately judge you?

6. Which trait(s) showed the biggest differences between how you see yourself and a stranger saw you? Why do you think the scores were different?

7. Examine the differences between your friend’s ratings and the stranger’s ratings. In what ways did these two people see you similarly? In what ways did they perceive you differently?

8. Were there any traits for which the stranger and friend agreed with each other, but not with you? If so, why do you think this happened? Were they wrong, or do they see something in you that you do not see in yourself?

9. Now, think about when you rated someone else’s personality. What information did you use to make your ratings? Was this a difficult task?

10. Which traits do you think are the easiest and most difficult to judge in others? Why?
Section XII
Abnormal Psychology

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1. Beliefs about Substance Use Disorders
2. The Impact of Diagnostic Labels
3. YouTube & Psychopathology
Lab Title: Beliefs about Substance Use Disorders

Virginia Welle - Chippewa Falls Senior HS

Section 1: Performance Expectation

What will the student be asked to do?

When instruction is complete, students will have gathered and analyzed data regarding beliefs about substance use disorders and will have communicated this via oral lab report.

Main Idea/Concept Demonstrated or Taught by Lab:

After concluding this lab, students will understand:

- controversies within the area of addiction treatment

After concluding this lab, students are able to (performance standards):

- Describe the benefits and drawbacks of viewing addiction as a “brain disease”
- Create scatterplots to represent relationships between variables
- Interpret graphical representations of quantitative data

This lab allows students to collect, organize, and interpret correlational data regarding attitudes toward substance use disorders and their treatment.

Key Terms and Psychologists Associated with Main Idea/Concept:

substance use disorder

Materials:

You will need:

- A copy of the Put Yourself on the Line handout for each student.
- Paper or tagboard on which students will create scatterplots
- Optional: Access to Google Forms & Sheets or Excel spreadsheets for students

Instructions:
1. Begin by asking students to complete the Put Yourself on the Line form. If you wish to use their responses as part of class discussion, it may be helpful to let them know ahead of time that they may be asked to share their responses to particular statements and accompanying rationales.

2. Lead students in a “Put Yourself on the Line” style of discussion by selecting a particular item (for example, #4, “Addictions are brain diseases.”) and asking students to line up according to the number they selected (1’s on the left end and 7’s on the right). Ask students at varying positions (low, middle, or high numbers) to explain their reasoning. This is a helpful way to help students understand the viewpoints of others and to understand the complexity of these controversial issues.

3. After discussion has taken place (it is not necessary to complete all the items, so allow student preference to guide duration), have students return to their seats. Ask students to generate hypotheses about which items might correlate positively with other items on the handout. Likewise, would students predict any negative correlations between items? Record the hypotheses on the board.

4. Based on student responses, select items that you will examine for correlations. Organize students to analyze the data. How you do this may depend upon your access to electronic spreadsheets and the size of your class. If using Google Sheets, you might share a spreadsheet with students and ask them to input their own responses. Or, if using paper forms only, you might divide students into pairs or small groups to examine specific questions. For example, imagine that you wish to explore the relationship between students’ answers to Item #4 (Addiction as brain disease) and Items #10, #12, and #13. You might divide the class into three groups to accomplish this.

5. Have students (or groups) calculate the correlation coefficient for each relationship of interest (there are free online calculators that can be used for this purpose), and create an accompanying scatterplot showing the results.

6. Have each group share their findings with the class, presenting the correlation coefficient that was found, sharing the scatterplot, and explaining what conclusions could be drawn from the finding.

Follow-up and Discussion:
You might extend students’ understanding of the issue of addiction as a “brain disease” by having them read an article on the controversy. Here is one example, but you might also opt for a more scholarly article, depending on time and students’ reading abilities.

Students might be asked to consider:

● How might we improve upon this informal study?
● What limitations of correlational studies emerged during this activity?
● If you wanted to determine whether a cause and effect relationship exists between the variables we considered, how could you do that?
● What implications to these relationships have for clinicians? For public policy?

Additional Considerations:
• You might extend this activity by having students gather responses to these questions via survey (online or paper format). If gathering data from other students or the general public, engage students in discussions about appropriate ethical considerations and sampling bias prior to design and implementation of the survey.

**Oral Report:**
Students will summarize their findings when presenting outcomes to the class. A complete oral report will include:

- The hypothesis guiding the investigation
- The variables under consideration
- The correlation coefficient and scatterplot

An interpretation of the findings

**Section 2: Crosscutting Concepts**

**Concepts:**
Students will evaluate the *patterns* that appear in student attitudes and beliefs regarding substance use disorders and related issues.

**References:**

1. Template adapted from:

2. Lab model adapted from:
Put Yourself on the Line:
Substance Use and Addictive Disorders

Use the scale above to rate your agreement or disagreement with each of the following statements.

1. _______ Adults are overconcerned about drug use among teens.

2. _______ Criminal charges are an appropriate consequence for possession and use of illegal drugs.

3. _______ Incarceration is an appropriate consequence for selling or distributing illegal drugs.

4. _______ Addictions are brain diseases.

5. _______ Medicinal use of marijuana should be legally permitted.

6. _______ People can be “addicted” to behaviors (e.g., gambling, internet use) much like they can be addicted to substances.

7. _______ Eighteen-year-olds should be legally permitted to use alcohol.

8. _______ “Drug maintenance therapies” (e.g., methadone clinics, use of nicotine patches) are appropriate ways to manage the risks associated with addiction.

9. _______ Recreational use of marijuana should be legally permitted.

10. _______ Those who test positive for drugs should not receive the benefits of social welfare programs (e.g., food stamps, welfare payments, Medicaid).
11. ________ Alcoholics should be placed “last” in waiting lists for organ transplants when their organ failures result from chronic drinking.

12. ________ Drug addictions are mostly the result of the physical effects of the drug on the body (and brain).

13. ________ College students with criminal convictions related to drug use should not be allowed to receive federal financial aid for tuition.
Lab Title: The Impact of Diagnostic Labels

Virginia Welle - Chippewa Falls Senior HS

Section 1: Performance Expectation

What will the student be asked to do?

When instruction is complete, students will have *gathered* and *analyzed* data regarding the effects of diagnostic labeling and will have *communicated* this information in a written summary.

Main Idea/Concept Demonstrated or Taught by Lab:

After concluding this lab, students will understand:

- the biasing power of diagnostic labels
- the continued controversy over use of diagnostic labels

After concluding this lab, students are able to (performance standards):

- Describe the benefits and drawbacks of diagnostic labeling
- Apply principles of experimental design
- Interpret graphical representations of quantitative data

This lab allows students to participate in an experiment on the biasing effects of diagnostic labels. It will also serve as an introduction to the research and controversies surrounding use of such labels, including the work of David Rosenhan.

Key Terms and Psychologists Associated with Main Idea/Concept:

David Rosenhan, independent variable, dependent variable, operational definitions, random assignment, deception, reliability, validity, DSM-5

Materials:

You will need:

- Access to a brief video clip of a person introducing themselves and projection equipment.
- Student handouts that provide varied descriptions of the “subject.” Shuffle them ahead of time so that the three forms will be randomly assigned as you hand one to each student.
- Student access to this electronic form for data collection OR a print version.
Instructions:

1. Begin by informing the students that they will be participating in an activity that will involve use of analogue observations to assess an individual’s behavior. Some deception may be used to ensure that students do not collaborate or discover the various conditions: “Because we will be examining the extent to which our observations of this individual show strong inter-rater reliability—or are consistent with each other—it is important that you keep your observations to yourself until it is time for us to compare.”

2. Hand out the forms and instruct students to read the background information about the “subject.” They may use the forms to jot down observations during and after the video. However, unknown to students at this point, the forms contain different background information about the subject: Form 1 describes him as a student in a communications course, Form 2 describes him as a student in an alcohol dependence support group, and Form 3 describes him as having recently been diagnosed with bipolar disorder.

3. Show subjects the video clip. Following its end, given them a minute or two to finish jotting down impressions of the subject.

4. Then, direct students to the electronic form to complete ratings of the subject (or, alternatively, use a paper form). Students will be asked to rate the subject on a variety of factors, including his friendliness, potential for academic success, potential for violence, his optimism, and anxiety levels.

5. Begin the process of analyzing the results with students, which will vary based on the method of data collection you used. If you used the electronic form, results can be easily shared with students via spreadsheet or graph. If you used paper forms, you may need to organize students to compile the results on a chalkboard/whiteboard.

Follow-up and Discussion:

It will be necessary to remove the deception introduced at the start of the activity to discuss the results. Students must be informed that, although inter-rater reliability could be explored through this activity, its primary purpose was actually to measure the impact of diagnostic labels on observers’ impressions of a person’s behavior. Describe the three conditions that students were assigned to without their knowledge.

Before discussing trends in the data, describe previous research that suggests the biasing power of labels, including David Rosenhan’s Being Sane in Insane Places. Students might read a description of this work, or view a brief video clip.

Ask students to generate hypotheses about what trends they might expect within their responses. Then, view results to see if those hypotheses were confirmed.

Example (these data were collected from a small section of 16 students in an Abnormal Psychology course):
Students might be asked to consider:

- On which attributes did participants differ substantially across the three conditions?
- Which attributes (if any) were unaffected by the diagnostic labels provided?
- Can we be confident that the labels caused the differences in the ratings? (Here, students may address experimental design strengths and weaknesses. For example, although conditions were randomly assigned and all of them saw the same video, in a typical classroom the size of each “group” will be quite small, making it unlikely that differences between groups will meet statistical significance.)

Additional Considerations: Questions to Ask

- Is there such a thing as a “positive” bias? For example, in the small sample above, students who believed the video subject had been diagnosed with bipolar disorder also found him to be friendlier. Is this bias harmful even if it seems to exaggerate his positive qualities?

- Considering the work of Rosenhan and others, what impact might diagnostic labels have in clinical settings? What about in non-clinical settings, such as schools, workplaces, and the community?

- If diagnostic labels have significant biasing effects, why are diagnostic manuals like the DSM-5 used by clinicians? What benefits does that system have? Might there be alternatives to it?
Section 2: Crosscutting Concepts

Concepts:
Students will evaluate the cause and effect of diagnostic labels on clinical impressions.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

Students will summarize their findings in either a written report or a verbal presentation that includes the following:

- Background information (about the Rosenhan study and the use of diagnostic manuals such as the DSM-5)
- Objectives of this study
- Procedures, including specific identification and descriptions of
  - the independent and dependent variables
  - operational definitions
  - use of deception
  - random assignment
- Appropriate graphs/tables depicting results (can be created collaboratively)
- Conclusions that offer an interpretation of results
- Strengths and limitations of the experiment

References:

1. Template adapted from:

2. Lab model adapted from:
Lab Title: YouTube & Psychopathology

Section 1: Performance Expectations

What will the student be asked to do?

- Students will *carry out a scientific investigation* examining experiences of and reactions to psychopathology on YouTube.
- Students will *formulate* and *communicate* their *expectations* and *hypotheses*.
- Students will *analyze data* and *communicate* their results in a report (written, oral, etc.).

- After the lab, students should be able to:
  - Discuss the role of social media in psychopathology
  - Code data using a basic coding scheme
  - Discuss interrater reliability
  - Present results so that others can understand

Main Idea/Concept Demonstrated or Taught by Lab:

This lab will teach students about the role of social media in psychopathology, while giving them experience with coding and calculating interrater reliability.

Key Terms and Psychologists Associated with Main Idea/Concept:

social media, psychopathology, coding, interrater reliability

Materials:

Students will need to have access to YouTube for this project. Students can watch videos in class or outside of class. If you want, you can hand out the assignment explanation sheet to your students. Alternatively, you can just explain to them what they will be doing. Also give students as many data collection sheets as needed. Also decide in advance how many videos you want each pair to watch. The recommended number is 3-5 videos. If they are watching them in class, you may want to limit the length of the video – for example, you may ask them to watch only the first five minutes of each video.

Instructions:

1. Students will form pairs and select a disorder (or you can select a disorder for them – it may be more interesting if different pairs have different disorders.)
2. Generate hypotheses
   a. Before doing the background reading (see below), students should write down their hypotheses about whether comments will be mostly supportive, mostly critical, or mostly neutral/other.
   b. After reading the background material, students should write down whether their hypothesis changed.
3. Together, they should search for videos by people with the disorder they selected. That is, students should not look for instructional videos about depression, for example. They should look for videos by people discussing their own depression.

4. Students should watch the video and take notes. After watching all the videos, they should be able to discuss patterns. These patterns could be the demographic characteristics of people who post (mostly one gender/race? a mixture? age?), the goal of the videos (education? release? personal expression? others?), the tone of the videos (positive? negative?), or other patterns.

5. After watching each video, the students should look at the first 10 comments (if there are that many) and independently categorize each comment as mostly supportive, mostly critical, or mostly neutral/other.

6. After watching all the videos and discussing patterns in the videos themselves, students should calculate interrater reliability. You can have them calculate a simple percent agreement. Students simply count up the number of comments they agreed on, divided by the number of comments they categorized.

7. Finally, the pair should calculate the percentage of total comments that were: mostly supportive, mostly critical, or mostly neutral/other. When this assignment has been completed in a college course, most of the comments are positive, against the expectations of the students.

Follow-up and Discussion:

- Students should discuss interrater reliability. Were they surprised by the level of agreement or disagreement? What would make interrater reliability more challenging? What could make it easier?
- How could a lack of agreement (i.e., unreliable measure) affect the results and our understanding of what we are studying?
- Would students have changed the coding scheme? Added categories? If so, why and which categories? What themes did students see emerging in the comments that were not captured by the coding scheme?
- What patterns did students see in the videos themselves? What kind of coding scheme might they develop to quantify those patterns?
- Were comments mostly supportive, mostly critical, or something else? Did their results match their expectations/hypotheses? If it did not match their hypotheses, discuss why.
- What are the advantages and disadvantages of social media for people dealing with psychological disorders?
- If student pairs were assigned/selected different disorders, discuss differences in patterns across various disorders. If there are differences, why might that be?

What prior concepts do students need to learn to understand the core ideas?

- They need to understand interrater reliability, although this can be taught during the data analysis.
- They should know the difference between quantitative and qualitative data.

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1 For the purposes of this assignment, percent agreement is probably fine. It does not, however, take into account chance agreement and may overestimate interrater reliability. For instructors wishing to use kappa, which is more advanced, they can show students how to use an online calculator: https://www.graphpad.com/quickcalc/kappa1/?K=3
Background reading:

- “Naturally occurring peer support through social media: The experiences of individuals with severe mental illness using YouTube”: [http://journals.plos.org/plosone/article/metrics?id=10.1371/journal.pone.0110171](http://journals.plos.org/plosone/article/metrics?id=10.1371/journal.pone.0110171)

What media can help students make sense of the core ideas?

- Interrater reliability [https://explorable.com/interrater-reliability](https://explorable.com/interrater-reliability)

### Section 2: Crosscutting Concepts

Select at Least One

- *Scale, portions, & quantity*: Students will characterize the average comment by reporting what percentage were mostly supportive, mostly critical, or mostly neutral/other.

- *Patterns*: Students will identify patterns in the videos they watch, including the type of people who post, the tone of their post, and whether patterns differ between different disorders.

### Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- Background information about social media and psychopathology
- Objectives
- Hypotheses
  - Students should report their naïve hypothesis (before doing the background reading)
  - Their informed hypothesis
  - Whether they differed
- Procedure described in detail (for replication)
  - Search terms used to find videos
  - Criteria for including videos (e.g., by someone with the disorder, not an educational video by someone else)
  - Coding scheme
  - Process for calculating interrater reliability
- Table of collected data
- Results
  - Was hypothesis supported or not supported? Explain.
  - What do the results mean? (use appropriate terminology related to concept)
  - What were weaknesses with the study?
• What other coding schemes could be used in the future?

References:

1. Template adapted from:

2. Lab model adapted from:
Assignment Explanation Sheet

Many people with psychological disorders use YouTube to talk about their lives, their identities, and their disorders. They may use YouTube to connect to a community or to educate. Many will allow people to comment on their videos. These comments may be supportive, critical, grateful, confused, or any number of other possibilities.

For this assignment, you and a partner will look for videos about one psychological disorder. You should look for individuals with the disorder. That is, don’t look for an instructional video about depression, for example. Rather, look for videos from people talking about their own depression.

After reading the instructions below, but before doing the assignment, you should write your hypotheses about what you expect to find.

Your instructor will tell you how many videos you need to find and watch. You should select videos uploaded by different people. Don’t pick five videos from the same person.

Notice any patterns. How do people present themselves and their disorders? What does the goal of the video seem to be? Education? Release? Social support? Personal expression? Other things? What kinds of people seem to post? Do many different types of people post? Do most videos seem to be from one gender, race, age range, etc.?

After each video, you will independently categorize each of the first 10 comments (or fewer if there are not 10 comments). Independently means that you should decide which category they fit, without discussing it with your partner or looking at their answers.

You could use any number of coding schemes, but for this assignment, you will be categorizing each comment as “mostly supportive,” “mostly critical,” or “mostly neutral/other”. You will have a data sheet for each video where you should record your categorization.

After you have categorized the comments for all of the videos, compare them with your partner. If you agreed, then put an “X” in the agree column for that comment. You will be calculating the percentage of comments that you agreed on. Individually, you should calculate the percentage of comments that were mostly supportive, mostly critical, and mostly neutral/other.
Hypotheses before background reading:

Hypotheses after background reading:
Data Collection Sheet
YouTube & Psychopathology

Video Title: ________________________________

Video Link: http://www.youtube.com/watch?v=______________________

Notes about the video
(Remember that you will be describing patterns across the videos)

Comment categorization:
Write an X to categorize each comment.

After making your independent rating, compare with your partner. Put an X in the column marked “Agree” if you categorized the comment the same way.

<table>
<thead>
<tr>
<th>Comment Number</th>
<th>Mostly Supportive</th>
<th>Mostly Critical</th>
<th>Mostly Neutral/Other</th>
<th>Agree?</th>
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Total number with agreement: ______

Total number of comments rated (up to 10): ______

*You will add each of these up across all videos, then divide Total Agreement by Total Comments to get the proportion of agreement. Multiple by 100 to get the percentage.
Section XIII
Social Psychology

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1. Helping Behavior
2. Confirmation Bias
3. Group Dynamics: Naturalistic Observation
Lab Title: Helping Behavior

Adapted from/References:

- Original activity “A Field Experiment in Helping” by David L. Watson, University of Hawaii at Manoa

Section 1: Performance Expectation

What will the student be asked to do?

When the lab is complete, students will be able to formulate scientific questions about social psychology and helping behavior. Students will be asked to carry out an investigation and analyze data gathered from the observations. Finally, students will be asked to communicate information in a lab report.

Main Idea/Concept Demonstrated or Taught by Lab:

After concluding this lab, students understand:

- Social relations
- Research methods and measurements used to study behavior and mental processes
- Basic concepts of data analysis

After concluding this lab, students are able to (performance standards):

- Describe determinants of prosocial behavior
- Interpret graphical representations of data as used in both quantitative and qualitative methods

This lab allows students to experience designing and carrying out an experiment on social behavior. Students will formulate a hypothesis, practice observation, gather data and submit a report of findings. Students will learn about helping behavior and the variables related to whether or not people will help each other. Students will observe the effects of manipulating social variables on human behavior.

Key Terms and Psychologists Associated with Main Idea/Concept:

Hypothesis, variables, operational definition, participant, experiment, data, altruism

Materials:

Notebook or phone to record observations, a large stack of books to drop
Instructions:

Students will be asked to complete the following steps.

1. Decide what you will be studying about helping behavior when a stack of books are dropped by a confederate. Write a testable hypothesis comparing your two conditions: (age, sex, race, dress, location) AND helping behavior. For example, “I believe males will be more likely to help females pick up their books than females will help females.”

2. Operationally define your variables.
   - What counts as helping? (picking up one book, picking up all books, bending down to assist, etc.)
   - Is there an operational component to your second variable? If so, please note.

3. Pick your location (for example, the library, school, or mall). Choose a spot where there is a constant flow of walkers, so you can target a person and where you can record your observations without drawing attention to the fact that you are gathering data.

4. Book dropping! Drop your armload of books before 20 selected participants one at a time.
   - Try not to drop books directly in their path. Instead, drop books approximately five feet in front of the participants.
   - Try to act the same for each person. Practice your technique to make things look natural.
   - Wait until your participant is out of sight before choosing another.
   - Select an equal number of participants from each of your groups defined by your hypothesis (gender, race, age, etc.)
   - Thank them if they help you, but do not explain what you are doing.
     - Because we are not causing them any physical/psychological stress you do not need to disclose your purpose.

5. Record your data. In your notebook or on your phone, record whether the person helped you and the information about the individual relevant to your hypothesis (age, race, sex, gender, etc.).

Follow-up and Discussion:

Additional Considerations: Questions to Ask

- What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?
  - How do each of the research terms apply to this lab?
  - How does this lab relate to research that has already been conducted?

- What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?
  - Students might need examples or definitions for key terms
  - Students may have ideas regarding how the variables will relate and can incorporate these ideas into their hypotheses
  - Core ideas would be applied from the standards

- What representations or media help students make sense of core ideas?
  - The original version of this study: [https://www.researchgate.net/publication/226385420_Helping_Hands_A_Study_of_Alttruistic_Behavior](https://www.researchgate.net/publication/226385420_Helping_Hands_A_Study_of_Alttruistic_Behavior)
As an introduction to the concepts and the lab, teachers could show a short clip from The Human Zoo. What factors influence helping behavior? Go to: https://www.youtube.com/watch?v=cgE5q5rDlaA

- What practices could students engage in to explore phenomena and/or representations of this concept?
  - Students are engaging in an experiment
  - The above media representations could help to engage in the content either before or after the results
  - Ethical practices might need to be addressed as part of the discussion
- What connections to the Common Core State Standards (CCSS) could be emphasized as students engage in the instructional sequence?

Section 2: Crosscutting Concepts

Concepts:

Students will identify patterns of helping behaviors. Students will attempt to discover the cause and effect relationship between variables. Students will consult past research to determine the stability of these findings and human behavior in helping situations over time.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

Students will summarize their findings in either a written report or a verbal presentation that includes the following

- What were the objectives of this lab?
- Discuss the hypothesis and operational definitions for each of the variables.
- Materials used
- Describe the specific procedure followed in detail.
  - How did you conduct your experiment? Where did you go? Did you have any helpers? If so, describe what they did. How did you pick your participants? Did you have a special book-dropping technique? Identify some potential confounding variables. How did you control or these? If you didn’t control for them, how could you fix it for future experiments?
- Graphs/tables of collected data
- Findings
  - Was hypothesis supported or disproven?
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the experiment be improved?
References:
1. Template adapted from:
2. Lab model adapted from:
Lab Title: Confirmation Bias

2-4-6 Game: How do we test our perspectives?

Adapted from: Original classroom activity by Kevin Grobman, adapted from original experiment by Peter Wason.


Section 1: Performance Expectations

What will the student be asked to do?

- *Plan and carry out a scientific investigation* using Wason’s 2-4-6 task.
- *Formulate a scientific question* such as testing if individual differences predict differences in performance on the task, or if variations of the task impact performance. Alternatively, the instructor may simply have students replicate the original result.
- *Analyze data* to determine if participants show the confirmation bias. Instructors can set expectations for data analysis. The results of a replication are typically strong enough where a graph (e.g., pie chart) and descriptive statistics (e.g., percentages) clearly show the confirmation bias. Alternatively, instructors may have students conduct inferential statistics (details below).

Main Idea/Concept Demonstrated or Taught by Lab:

By demonstrating the confirmation bias, students discover that even those capable of sophisticated reasoning are nevertheless prone to reasoning errors. Students hopefully recognize how the confirmation bias plays a role in the world around them, such as how people share information on social media, and why people like to watch news sources with particular political leanings. Ideally, students start to appreciate how understanding the complexities of everyday life can be informed by carefully designed experimental tasks, even when those tasks do not look like everyday life experiences.

Key Terms and Psychologists Associated with Main Idea/Concept:

Confirmation Bias, Peter Cathcart Wason

Materials:

2-4-6 task, a PDF of the handout is available at: [http://DevPsy.org/teaching/method/confirmation_bias.pdf](http://DevPsy.org/teaching/method/confirmation_bias.pdf)

Pencil or pen for participant; pencil or pen for experimenter.

Additional materials may be necessary if students generated a hypothesis beyond replication.
**Instructions:**

It is helpful if the teacher demonstrates the 2-4-6 game in class with all their students acting as participants before the students design their labs. Complete instructions for the class activity, PowerPoint slides, and the 2-4-6 handout are available at [http://www.DevPsy.org/teaching/method/confirmation_bias.html](http://www.DevPsy.org/teaching/method/confirmation_bias.html). For the classroom activity to work well, the teacher needs to be especially clear when giving instructions. By demonstrating to the class, the teacher is helping students recognize the need for precision when collecting their data. Most importantly, once students know the answer, it seems obvious. They are unlikely to believe they would have been prone to this reasoning error (i.e., confirmation bias). But they would have: about 80% show the bias, even very capable students who enroll in classes like AP Psychology. Ironically, this lack of realization is due to an additional common reasoning error called the “hindsight bias.” Because we are all subject to these biases, I recommend that teachers view the webpage and provide their first sequence in response, before continuing to read these instructions.

Students in class act as the experimenter in a one-on-one session with each participant. Allot about 5 minutes to administer the 2-4-6 task to each participant. The experimenter should be deliberate when explaining the task to participants and, to avoid extraneous variables, the directions should be written in advance and spoken consistently to each participant. Here are recommended standard instructions:

A sequence of numbers has an order to it. For example, 1-2-3 is a different sequence from 3-2-1. Some sequences of 3 numbers make me incredibly happy; other sequences of 3 numbers make me very sad. Your goal is to figure out the rule for what sequences make me happy. But you can't simply ask me my rule. Instead you can conduct experiments on me. You can make up a 3-number sequence and I'll tell you if it makes me happy. Then you can make up another sequence, I'll tell you again, and we'll keep going until you're mostly confident you know the rule inside my head. Let's do the first sequence together. 2-4-6 (gesture to the pre-written cell on the handout). After you write a sequence I'll write a happy or sad face for you in the “fits my rule” column (gesture to the pre-written cell on the handout). It turns out this sequence makes me very happy! Now that you have feedback from me, you should make your best guess for the rule that makes me happy. For example, you might guess, “counting up by 2’s.” If that's your guess write it in this blank (gesture to cell), or you can feel free to write another hypothesis (wait for participant to write hypothesis). To finish the row, you should make a rough estimate for how certain you are that the rule you guessed really is the rule for sequences that make me happy (gesture to cell). If you have absolutely no confidence and your guess is basically random, write 0%. On the other hand, if you are totally sure you have it, write 100%. You can also write anything in between, such as 50% (wait for participant to write percent). Now let's continue. Write a sequence of 3 numbers to test. Once I give you feedback with a happy or sad face, write your hypothesis. If it's the same as before, feel free to put ditto marks. Say how sure you are with a percent. Then make another sequence to test what rule makes me happy, and so forth. Once you're nearly 100% confident we'll stop.

Generally, participants are 100% confident in about 5 trials. Nevertheless, experimenters should have a clear rule for when to stop. You might also say that once a participant is more than 90% confident, the experimenter asks at each trial if the participant would like to continue or stop there. If a participant writes 100%, you stop without asking.

For each trial, the experimenter needs to determine if the sequence fits the rule. The rule is, “any increasing sequence,” so this normally requires little thought. Sequences that fit the rule include: \{1,2,3\}, \{2,4,6\}, \{-20, \pi, 3000\}, and \{\frac{1}{6}, \frac{1}{4}, \frac{1}{2}\}. Sequences that do not fit the rule include: \{3,2,1\}, \{7,4,7\}, and \{42,42,42\}.
Experimenters should retain the handouts as their raw data, as well as keep any additional information that will be analyzed (e.g., demographics like school grade, other tasks for comparison).

If students go beyond a replication, there will either be additional information recorded (e.g., for individual differences) or additional tasks. The opportunity to generate hypotheses for oneself are important experiences for budding scientists, so I recommend not sharing examples with students at first. But the teacher may benefit from having some examples in mind to help nudge students toward their own. Here are some examples:

There may be group or individual differences. For example, perhaps one gender is hypothesized to perform better on the 2-4-6 task than another. Perhaps seniors perform better than sophomores, or teachers perform better than students, or students who take AP classes perform better than other students, or students whose favorite subject is science perform better. Generally, these hypotheses will not be supported by the data. This is okay because being wrong, and being okay with being wrong, is an important part of science. Moreover, since the confirmation bias is a basic part of human cognition, we should not expect much variation.

There may be correlates with naturally occurring variations. For example, maybe those who complete the task right before a class or catching the bus (i.e., rushed) perform worse than those who participate during study hall. Perhaps those who take longer to complete the task perform better. To test these hypotheses, students will need to collect additional information with each handout (e.g., timing for each participant, time of day, location).

Performance on other tasks might predict performance on the 2-4-6 task. For example, those who are better at solving logical syllogisms might perform better. To test these hypotheses, students will need to find or create an additional task.

Finally, the 2-4-6 task itself might be changed. For example, rather than trying to find the rule for sequences that make me happy, you might find a rule for sequences that make me bop my head to the left or right. What if the directions caution participants that most people do not get the right answer? What if participants are first taught about the confirmation bias before playing the game? To test these hypotheses, students will need to rewrite the handout, alter the directions, or write something to tell participants beforehand (e.g., teach about the confirmation bias versus a control). Be especially sure to remind students that they need to record the condition with each participant’s handout. After all, condition is a variable.

Follow-up and Discussion:

- I recommend most class discussion precede the design of the lab (see first paragraph of Instructions).
- To understand and appreciate this lab, students benefit from prior knowledge of the scientific method (especially hypothesis testing) from their science classes, as well as knowledge of current events and historical group polarization from their social studies classes. Students’ knowledge of media (e.g., ‘bubbles’ on Facebook and Twitter, Fox News vs. MSNBC) may help them appreciate the importance of the topic.
Students might be hindered by lay-person beliefs about intelligence and the expectation that being smart means you won’t fall prey to cognitive biases. However, having “common sense” lay theories challenged by data is an especially powerful lesson.

Especially thoughtful students might consider how it could be adaptive that we make reasoning errors like the confirmation bias (Next Generation Science Standard LS2D). Teachers might highlight that the world in which our reasoning evolved is quite different from modern-day schooling. What helps students do well in school and in science today (e.g., careful, methodical thinking) is not necessarily the same as what helped our species survive in the distant past (e.g., quick decisions for survival).

Section 2: Crosscutting Concepts

- **Stability & Change**: Just like an ecosystem, a person is a complex dynamic system. The confirmation bias is one mechanism by which we maintain stability.
- **Structure & Function**: By observing how people function when completing the 2-4-6 task we can infer something about the overall structure of cognition.
- **Cause & Effect**: Different lab groups may choose to test different hypotheses. Those who experimentally manipulate the 2-4-6 task can infer a cause & effect relationship whereas those who correlate performance with something else may not.

Section 3: Lab Report (written, verbal, or recorded)

Students’ lab reports might follow the standard science lab report format. The Introduction begins by defining the confirmation bias and it closes with the hypothesis. The Method describes the participants, materials, and procedure. The Results summarize the pattern of results found in the study. It is not the same thing as the raw data (i.e., handouts); however, the handouts might be included in an appendix. More details about the results section follow. The Discussion restates the conclusion from the results, discusses the implications of the confirmation bias, and notes any limitations (e.g., correlation does not imply causality, how the sample of participants may differ from persons broadly, and therefore may not generalize).

Students’ prior knowledge of statistics might vary widely, as might teachers’ expectations for the results section. Generally, only about 20% of participants figure out the rule on the 2-4-6 task. This descriptive finding is dramatic enough to illustrate the confirmation bias, so teachers might expect students to summarize the results with descriptive statistics like this. Students might provide more detail by summarizing the proportion of participants with each final hypothesis (i.e., count up by 2’s, count up by multiples, a formula combining the first two numbers for their third, or any increasing sequence).

This lab provides a nice learning opportunity for basic inferential statistics. To be likely to have statistically significant results, I recommend each lab group collect data from at least 15 participants. Each participant’s handout can be classified as “inclined toward confirmation” or “inclined toward falsification” based on what sequences participants generate after they make hypotheses. Two students can “code” each participant handout and resolve disagreements through discussion. If participants show no bias, they should be just as likely to confirm versus falsify. Students can set up a table like this:

<table>
<thead>
<tr>
<th>Response to 2-4-6 Task</th>
<th>Observed Outcome</th>
<th>Expected Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falsification Bias</td>
<td>3</td>
<td>50%</td>
</tr>
<tr>
<td>Confirmation Bias</td>
<td>12</td>
<td>50%</td>
</tr>
</tbody>
</table>
The numbers students put in their “observed outcome” column are from their actual data (i.e., observed) and they should sum to their total number of participants. To test if participants have a confirmation bias, you compare the results to the null hypothesis. That is, participants being just as likely to confirm as falsify (i.e., expected outcome column). The appropriate statistic to determine if the proportion found by students’ observations differs from the null hypothesis is a Goodness-of-Fit Chi Square. Many online calculators will complete that statistic for you, such as this one: https://www.graphpad.com/quickcalcs/chisquared1.cfm. If you enter the sample data above into this calculator, you would write the results like this: $\chi^2(1)= 5.400, p = .020$. From the p-value we can infer that there is only a 2% chance these results would differ from chance (i.e., the null hypothesis) by a fluke. Since this is less than 5%, by convention we say that we can reject the null hypothesis because our result is, “statistically significant.”

If lab groups formed hypotheses beyond a replication, the statistics may be more complicated. I recommend at least 15 participants per condition / kind of person. For example, maybe students hypothesized that different proportions of teachers and students show the confirmation bias. To compare the proportions you would conduct a Chi Square Test of Independence with an online calculator such as: https://www.graphpad.com/quickcalcs/contingency1/. Your students’ table might look like this:

<table>
<thead>
<tr>
<th>Response to 2-4-6 Task</th>
<th>Students</th>
<th>Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falsification Bias</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Confirmation Bias</td>
<td>9</td>
<td>12</td>
</tr>
</tbody>
</table>

Though it looks like teachers have a greater tendency to use the confirmation bias than students (80% vs. 60%) the statistic is $\chi^2(1)= 1.429, p = .232$. The p-value shows there is a 23.2% chance the result was just a fluke, so we cannot reject the null hypothesis. That is, teachers and students probably have similar cognitive biases. For a brief summary of basic inferential statistics with common ways of showing the results graphically, please see this one page summary: http://PerplexingQuestions.org/science_fair/science_fair_statistics.pdf

**Lab Title: Naturalistic Observation**

**Group Dynamics**

**Adapted from/References:** Taylor Newton IToP 2015

Section 1: Performance Expectation

What will the student be asked to do?

When the lab is complete, students will formulate scientific questions about behaviors associated with environmental sustainability and group dynamics. They will also plan and/or carry out an investigation on human behavior as it relates to naturalistic observation. Students will communicate a final lab.

Main Idea/Concept Demonstrated or Taught by Lab:

After concluding this lab, students understand:

- Research methods and measurements used to study behavior and mental processes
- Ethical issues in research with human and non-human animals
- Basic concepts of data analysis

After concluding this lab, students are able to (performance standards):

- Describe the scientific method and its role in psychology
- Define systematic procedures used to improve the validity of research findings, such as external validity
- Identify ethical standards psychologists must address regarding research with human participants
- Define descriptive statistics and explain how they are used by psychological scientists
- Define forms of qualitative data and explain how they are used by psychological scientists
- Define correlation coefficients and explain their appropriate interpretation
- Interpret graphical representations of data as used in both quantitative and qualitative methods
- Explain other statistical concepts, such as statistical significance and effect size
- Explain how validity and reliability of observations and measurements relate to data analysis

This lab gives students experience collecting and analyzing naturalistic observational data.

Key Terms and Psychologists Associated with Main Idea/Concept:

naturalistic observation, operational definition, variables, hypothesis, APA ethical guidelines

Materials:

None, other than supplies students will need for their projects.

Instructions:

1. Students should work in pairs or small groups and identify questions related to sustainability.
2. The task is to choose a publicly observable sustainability behavior; in other words, a behavior (or lack thereof) with environmental implications. Examples include recycling, using refillable mugs or water bottles, taking stairs instead of escalators, and pressing the automatic door buttons at handicap accessible entrances.

3. Students should identify at least one other variable that they think may be related to the sustainability variable. These variables can be behaviors (e.g., students are less likely to use recycling containers when they are texting) or characteristics (e.g., males are more likely to ride a bike to school than females). Students should develop a hypothesis about the relationship between their variables.

4. Students should operationally define the variables to be observed and plan exactly how they will be measured. They should consider the reliability of their measurements. How will they maintain consistency across time and observers?

5. Students should collect a minimum of 30 observations.

6. Students must abide by the following ethical ground rules as related to naturalistic observation and data collection:
   a. Only make observations in public places where privacy cannot be reasonably assumed.
   b. Do not record video or audio of your observations.
   c. Do not conduct observations on people who appear to be younger than high school students.
   d. Do not make observations of behaviors that might be considered embarrassing or illegal.
   e. Do not record identifying information about your participants, even if you know some of them personally. Use an anonymous coding system (e.g., participant numbers).
   f. Be professional and unobtrusive.
   g. Be prepared to submit raw data in class and destroy any other copies.

Follow-up and Discussion:
Students should analyze their results for their lab report.

1. What observable sustainability behavior did you study?
2. What other observable behavior(s) or characteristic(s) did you think would relate to your sustainability variable?
3. What was your hypothesis? State the predicted relationship in easy-to-understand language (e.g., “Individuals using ear buds are less likely to recycle in the cafeteria.”).
4. How did you operationally define your variables? Did you do anything to ensure reliability (e.g., comparing the results of independent observers).
5. Do you think your presence as observers influenced the behavior of the individuals you observed?
6. Do your data support your hypothesis? How did statistical analysis help you
7. If you could do your study again, what would you change?

Upon completion of the project, students should turn in their raw data and a copy of their presentation materials. You should also discuss with your students their understanding of the procedural limits of this study. For example, cause-and-effect conclusions cannot be drawn from correlational data.

Additional Considerations: **Questions to Ask**

- What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?
  - Naturalistic Observation is people watching
  - Naturalistic Observation and other form of research methodology are the same and follow the same procedures.
  - How individuals behavior is affected by the presences of others.
  - Naturalistic Observation does not need to follow Ethical Standard
- What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?
  - They will need to have a fundamental understanding of processes and procedures of scientific inquiry.
  - They will also need to discuss and identify their operational definitions.
- What representations or media help students make sense of core ideas?
  - [https://www.youtube.com/watch?v=hFV71QPvX2I&list=PL8dPuuaLjXtOPRkzVLY0jJY-uHOH9KVU6](https://www.youtube.com/watch?v=hFV71QPvX2I&list=PL8dPuuaLjXtOPRkzVLY0jJY-uHOH9KVU6) Crash Course: Psychological Research
  - [https://www.youtube.com/watch?v=Gljv31Sumsw](https://www.youtube.com/watch?v=Gljv31Sumsw) Naturalistic Observation in Psychology
- What practices could students engage in to explore phenomena and/or representations of this concept?
  - Students should be conscience of Ethical Standards in all forms of research.
- What connections to the **Common Core State Standards (CCSS)** could be emphasized as students engage in the instructional sequence?

**Section 2: Crosscutting Concepts**

**Concepts:**
Students will use the scientific method of naturalistic observation to identify **patterns** as well as variables of behavior as related to environmental sustainability.

**Section 3: Lab Report (written, verbal, or recorded)**

**Suggested Content to be Included in Student Report:**

Students will summarize their findings in either a written report or a verbal presentation that includes the following
● Background information (Psychological Methodology or Empirical Process)
● Objectives of this study
  ○ What observable sustainability behavior did you study?
● Questions that were answered
  ○ What other observable behavior(s) or characteristic(s) did you think would relate to your sustainability variable?
● What was your hypothesis? (include operational definition)
  ○ State the predicted relationship in easy-to-understand language (e.g., “Individuals using ear buds are less likely to recycle in the cafeteria.”).
  ○ How did you operationally define your variables? Did you do anything to ensure reliability (e.g., comparing the results of independent observers).
● Materials used (sample data collection sheet)
● Procedure
● Graphs/tables of collected data
● Findings
  ○ Was hypothesis supported or disproven?
  ○ What do the findings mean with regards to environmental sustainability?
  ○ Do you think your presence as observers influenced the behavior of the individuals you observed?
  ○ Do your data support your hypothesis? How did statistical analysis help you decide?
● How could the experiment be improved?
  ○ Were there procedural limits in their study
  ○ If you could do your study again, what would you change?

References:
1. Template adapted from:
2. Lab model adapted from:

Section XIV
Therapy
1. Behavioral Treatment for Anxiety

2. The Relationship Between Thoughts, Feelings, and Behaviors
Lab Title: Behavioral Treatment for Anxiety

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Section 1: Performance Expectations

What will the student be asked to do?
- Formulate a scientific question about the impact of a relaxation exercise on anxiety and tension.
- Plan/carry out a scientific investigation on how the use of a relaxation exercise reduces feelings of anxiety and tension.
- Communicate the effect of this exercise in a written or verbal report and provide suggestions on how to integrate this exercise into one’s life.

Main Idea/Concept Demonstrated or Taught by Lab:
This lab allows all students to identify their own body sensations and experience a relaxation exercise to reduce feeling of anxiety and tension.

After concluding this lab, students should be able to:
- Describe the effect of anxiety/stress and relaxation on the mind and body.
- Describe the relaxation treatment strategy for reducing anxiety and tension.

Key Terms and Psychologists Associated with Main Idea/Concept:
anxiety; stress response; relaxation; stress management

Materials:
Stress Meter handout; relaxation script

Instructions:
- Prior to starting the relaxation exercise, have students complete the Stress Meter below.

<table>
<thead>
<tr>
<th></th>
<th>0%</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COMPLETELY</td>
<td>RELAXED</td>
<td></td>
<td></td>
<td>COMPLETELY</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>TENSE</td>
</tr>
</tbody>
</table>

_________________________________________________________
• Next, have students settle into their chairs, sitting with their feet flat on the ground and their hands resting comfortably in their laps.
• Instruct students to close their eyes if they are comfortable doing so. If they are uncomfortable closing their eyes, students may pick a spot on the floor on which to focus their attention.
• Instruct students to listen to your voice as you guide them through the following exercise:

  Gently begin to focus your attention on your breathing. You are not trying to control your breath in any way but rather you are simply noticing the process of breathing. Experience the air moving in and out of your body. Notice the sensations as your breath comes into your body and your abdomen gently expands. Then notice your belly deflate as the breath comes out of your body. Notice the quality of the air as it comes in through your nose or mouth and then goes back out. Bring your full attention to the rhythmic movement of each breath and let your body sink a little bit deeper into relaxation. The mind will inevitably wander away from the breath and the body from time to time as you complete this activity. That is entirely normal. It is what minds do. When you notice this happening, gently acknowledge it, notice where your mind has gone, and then gently return your attention to my voice and the part of the body you are intending to focus on.

When you are ready, bring your awareness to the physical sensations present in your body at this moment, especially to the sensations of touch or pressure, where your body makes contact with the chair. On each outbreath, allow yourself to let go, to sink a little deeper into the chair. Remember that the intention of this exercise is not to change what is going on in your body but rather to bring awareness to any sensations that may be present in various parts of your body and to create space for those sensations. You may feel relaxed or tense, comfortable or uncomfortable – whatever your experience is, simply notice it. Bring a gentle curiosity and investigate the quality of the sensations.

Now bring your awareness to your feet, becoming aware of whatever sensations are there. If you are registering a blank as you tune in, then just experiencing nothing. As you breathe in, imagine your breath moving all the way down to your feet and then let your outbreath move all the way back up your body and out your nose. Become aware of the shins and calf muscles and the sensations in the lower legs, not just on the surface but right down into the bones, experiencing and accepting what you feel here and breathing into it, then breathing out from it. Move your attention into the thighs – notice any tension or any other sensations. Breathe into and out from the thighs. Shift your attention to your pelvis now. From one hip to the other. Notice the sensations of contact and of weight. As you breathe out, move the breath back up through your body and out your nose, softening and releasing all tension as you sink even deeper into a state of relaxed awareness and stillness - totally present in each moment, content to just be right here as you are right now. Direct your attention now to your lower back. Notice whatever sensations or lack of sensations you are experiencing. Let your breath penetrate and move into every part of your lower back on the in-breath and release any tension or tightness on the out-breath. Now move your attention up into your upper back. Notice any tightness, fatigue or discomfort and let them dissolve and move out with your breath as you sink deeper into stillness and relaxation.

Move your attention now to both of your hands together, becoming aware of the sensations in the tips of your fingers and thumbs. Now expand your awareness to include the palms of your hands and the backs of your hands and your wrists. Become aware of the forearms and the elbows. Notice any and all sensations regardless of what they are. Expand your awareness to the upper arms and shoulders. Breathe into your shoulders and arms, letting any tension dissolve as you breathe out. Let yourself sink even deeper into a state of relaxed awareness. Try to stay present in each moment, letting go of any thoughts that come up or any impulses to move. Just experience yourself in this moment.
And now focus your attention on your neck and throat and feel this part of your body. Become aware of your face now. Focus on the jaw and the chin, just experiencing them as they are. Become aware of your lips and mouth. Become aware of your cheeks and your nose, feeling the breath as it moves in and out. Become aware of your eyes and eyelids. Let any tension leave with your breath. Bring your attention to your forehead, letting it soften to let go of stored emotions. Notice your temples. Breathe in and let the face dissolve into relaxation and stillness. Become aware of your ears and the top of your head. Let your whole face and head relax. Let yourself be still, relaxed, and at peace.

Now let your breath move through your entire body in whatever way feels natural for you. Be aware of your body as a whole, noticing the breath flowing freely in and out of your body. Allow your muscles to relax and simply be aware of the flow of your breath. Allow yourself to sink deeper into a state of stillness and relaxation, noticing that this stillness is healing in itself. Allow the world to be as it is beyond your personal fears and concerns. Let go of the tendency for your mind to want everything to be a certain way. See yourself as complete right now just as you are. Take a few deeper breaths and then slowly begin to lift yourself out of this deep state of relaxation. When you are ready go ahead and open your eyes and re-orient yourself to the room and your current environment.

Follow-up and Discussion:

- At the conclusion of the relaxation exercise, have students complete the Stress Meter below.

<table>
<thead>
<tr>
<th>0%</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPLETELY RELAXED</td>
<td>COMPLETELY TENSE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Ask students to describe what they noticed in their bodies during the exercise.
- Ask students to comment on any changes in their overall tension ratings or anxiety symptoms before and after engaging in the mindful relaxation exercise.
- Ask students to reflect on their experience doing the exercise. What is easy or difficult to engage in the material?

What are some commonly held student ideas (both troublesome and helpful) about this topic? How could instruction build on them?

- Usefulness/purpose of relaxation
- Experience and effects of anxiety/stress on their life, well-being, school performance, relationships, etc.

What prior concepts do students need to learn to understand the core ideas? What level of abstraction is expected of them?

- Knowledge of the anxiety/tension and relaxation responses.
- How anxiety and tension influence the body and mind.
- How mindful relaxation influences the body and mind.
- Strategies used in mindfulness/relaxation exercises.

What representations or media help students make sense of core ideas?

- Free mindfulness apps:
  - Stop Breathe & Think: Meditate
  - Insight Timer
- Headspace: Guided Meditation & Mindfulness
- Websites with free mindfulness recordings:
  - http://marc.ucla.edu/mindful-meditations
  - http://mindfulwaythroughanxietybook.com/exercises/
- TED Talk: All it Takes is 10 Mindful Minutes https://www.ted.com/talks/andy_puddicombe_all_it_takes_is_10_mindful_minutes

What practices could students engage in to explore phenomena and concepts?

- Additional relaxation practice.
- Understand personal causes for anxiety and tension in the mind and body.

**Section 2: Crosscutting Concepts**

**Select at Least One**

- Discuss the *structure and function* of both the stress and relaxation responses in the body. Ask students to identify *causes* of stress and anxiety in their own lives as well as the *effects*.
- Ask students to identify the *effects* of relaxation on the body. How does engagement in relaxation exercises impact the experience of stress/anxiety?

**Section 3: Lab Report (written, verbal, or recorded)**

**Suggested Content to be Included in Student Report:**

Students will summarize their findings in either a written report or verbal presentation that includes the following suggested content:

- Background information about the stress and relaxation responses, and the experience and treatment of anxiety
- The objectives of this experiment/activity
- Questions that were answered
- Materials used
- Procedures
- Findings (note any changes in pre/post ratings of overall stress)
- Discussion of things learned during the activity/experiment
- Ideas for improving the activity in the future
Lab Title: The Relationship Between Thoughts, Feelings, and Behaviors

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Section 1: Performance Expectations

What will the student be asked to do?
- Formulate a scientific question about how thoughts, feelings, and behaviors are related.
- Plan and carry out a scientific investigation on how we can change thoughts, feelings, and behaviors.
- Communicate in a written report how thoughts, feelings, and behaviors are related and how we can change them.

Students will communicate the information they have learned through a final lab report.

After conducting this lab, students will understand:
- The relationship between thoughts, feelings, and behaviors.
- How thoughts, feelings, and behaviors are impacted by each other and how we can work to change how we think, feel, and act.

After concluding the lab report, students are able to (performance standards):
- Understand the relationship between thoughts, feelings, and behaviors and how each impacts the other.
- Formulate examples of specific situations that would illustrate how thoughts, feelings, and behaviors are related. Begin to understand how awareness of patterns in our thoughts, feelings, and behaviors in reaction to different environmental stimuli.

Main Idea/Concept Demonstrated or Taught by Lab:
This lab will aid students in understanding the relationship between thoughts, feelings, and behaviors. Students may be able to apply this knowledge to their own life and conceptualize patterns of thinking/behaviors for themselves.
Key Terms and Psychologists Associated with Main Idea/Concept:
Aaron Beck, Albert Ellis, automatic thoughts, depression, emotion, behavior, cognitive model, cognitive therapy, point of intervention, cognitive distortions

Materials:
Pen and paper (or whiteboard and markers).

Instructions:

Experiential Component

Lead students in a series of exercises that may result in changed behaviors or thoughts, and therefore changed feelings.
1. Have students think of a positive experience, such as playing with a favorite pet, eating a favorite food, or cheering for a favorite sports team.
2. Have students record the impact of these thoughts on their feelings and behaviors.
3. Have students engage in a positive behavior, such as smiling or laughing.
4. Have students record the impact of this behavior on their feelings and thoughts.
5. Have students think of a negative experience.
6. Have students record the impact of these thoughts on their feelings and behaviors.
7. Have students engage in a negative behavior, such as frowning.
8. Have students record the impact of this behavior on their feelings and thoughts.

Reflective Component

1. Have students think about how their thoughts, feelings, and behaviors changed in each of the scenarios. Why did these changes occur?
2. Have students write down personal ways they could change negative thoughts, feelings, and behaviors.

Follow-Up and Discussion:

Additional Considerations: Questions to Ask

1. Ask students to describe the relationship among thoughts, feelings, and behaviors that they noticed. How readily changeable are our emotions?
2. Ask students to comment on why these changes occur.
3. Ask students to consider how therapy can be used to impact negative thoughts, behaviors, and feelings. How easy is it to change thoughts, feelings, or behaviors? Which is the easiest component to change? Which is the most difficult?

Section 2: Cross-cutting concepts: Choose One

Students will identify the relationship between thoughts, feelings, and behaviors. Students will attempt to discover the cause and effect relationship between factors.

Section 3: Lab Report (written):

Students will demonstrate 1) how thoughts, feelings, and behaviors are related and 2) ways we can change thoughts, feelings, and behaviors. Consider the activity you engaged in and any resulting change in thoughts, feelings, or behaviors.

Please adhere to the following sections in your write up:

- Background information
  - Explain key terms (e.g., thoughts, feelings, behaviors)
  - Explain the theories that account for the relationship between thoughts, feelings, and behaviors.

- Objectives of research
  - What would we expect to find by thinking about a pleasant event or by engaging in a pleasant activity? What would we expect to find by thinking about a negative event or by engaging in a negative activity? What impacts our emotions? State this in the form of a hypothesis.

- Method
  - Describe the process of implementing the experimental component described above, including materials used.

- Results
  - What did the intervention do? What did it target or change?
  - How did thoughts, emotions, and behaviors change depending on the activity?

- Discussion
  - Summarize your findings.
  - What worked well and why do you think that happened?
  - What did not go according to plan?
  - How can these findings be used in psychotherapy?
What representations or media help students make sense of the material?

https://www.youtube.com/watch?v=IWPMKbFzsk

Thoughts, Feelings and Behaviors Explained

https://www.youtube.com/watch?v=PcFmrVZ0e-I

Thoughts, Feelings and Behaviors Explained as they Relate to Mental Health and Brain Function
Section XV

Health Psychology

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1. Mindfulness and Physiological Arousal
2. Posture and Well-Being
3. Exercise and Psychological Health
4. The Potential Effects of Stress
5. Nutrition and Health
6. Habits for Successful Students
Lab Title: Mindfulness and Physiological Arousal

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Formulate a scientific question about the impact of mindfulness strategies on physiological arousal and psychological well-being.
  - Plan and/or carry out a scientific investigation about the impact of a brief mindfulness intervention on psychological well-being, as measured by physiological arousal.
  - Prepare a written or oral report, sharing their findings about the impact of mindfulness on psychological well-being.

Main Idea/Concept Demonstrated or Taught by Lab:
This lab allows all students to learn the basic theories of mindfulness practice; to try a brief mindfulness intervention first-hand; and to discuss potential benefits of mindfulness practice in their lives.

After concluding this lab, students should be able to:

- Describe and define mindfulness, including examples of common mindfulness strategies.
- Describe empirically validated effects of mindfulness on psychological health and well-being.
- Use a simple mindfulness intervention as a form of stress management in daily life.
- Interpret graphical representations of data as used in both quantitative and qualitative methods.

Key Terms and Psychologists Associated with Main Idea/Concept:

- Mindfulness, meditation, yoga, tai chi, qi gong, martial arts, self-control, self-regulation, stress management, mindfulness-based stress reduction (Jon Kabat-Zinn), attention, relaxation, contemplative practices

Materials:

You will need a computer/tablet/iPad/Smart phone with timer and with internet access for research and accessing videos; paper and pen/pencil or computer for documenting results and writing report.

Instructions:

1. Have students use timer to determine their pulse (number of heartbeats per minutes) and breathing rate (number of breaths per minute).
2. Have students complete the 4-7-8 Breathing Exercise (or another mindfulness breathing exercise of your choice): [https://www.youtube.com/watch?v=Uxbdx-SeOOo](https://www.youtube.com/watch?v=Uxbdx-SeOOo)
3. Immediately after, have students take their pulse and breathing rate again.
4. Gather data: how many students experienced a lowering of pulse and breathing rate after completing the mindfulness breathing exercise?
5. Have students write up results in report format.

Follow-up and Discussion:

- Read this brief introduction to mindfulness, and then watch the included video clip, from University of California at Berkeley: [https://greatergood.berkeley.edu/mindfulness/definition](https://greatergood.berkeley.edu/mindfulness/definition)
- Watch this Ted Talk from Andy Puddicombe, All It Takes is 10 Minutes: [https://www.ted.com/talks/andy_puddicombe_all_it_takes_is_10_mindful_minutes](https://www.ted.com/talks/andy_puddicombe_all_it_takes_is_10_mindful_minutes)
- Read this article from the National Institute of Health, summarizing the benefits of meditation: [https://nccih.nih.gov/health/meditation/overview.htm](https://nccih.nih.gov/health/meditation/overview.htm)
- Think about the following questions to guide discussion and check for understanding:
  - How many people had some experience with mindfulness or meditation before we tried it? What were your preconceived ideas of meditation before we tried the exercise today?
  - Why did we use heart rate and breathing rate as measures in this lab? How do these physiological markers reflect emotional / psychological status?
  - How did you feel after just three minutes of deliberate breathing? How did your body feel? How did your mind feel? How did your stress level change?
  - How could you use this daily to help you manage the stressors in your life: parents, school, peers, romantic relationships? How do you think managing your breath might help you manage your life overall?
  - How do you think sustained practice – doing this every day over for 6 weeks or more – could impact how you feel? How you think? Your emotional experience?
  - What connections to the Common Core State Standards (CCSS) could be emphasized as students engage in the instructional sequence?

Section 2: Crosscutting Concepts

Select at Least One
- Students will identify the relationship between physiological stress (heart rate and breathing rate) and emotional well-being.
- Students will discuss how deliberate breathing (mindfulness strategies) can cause immediate changes in physiological measures of stress, such as pulse and breathing rate.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:
- General objective, e.g., to experience the effects of mindfulness on psychological health.
- Working definition of mindfulness.
- Materials used (include measurements, where necessary).
- Procedure described in detail (for replication).
• Graphs/tables of collected data.
• Findings:
  o Individual findings.
  o Summary of group data.
  o What do the findings mean? (use appropriate terminology related to concept).
  o How could the research be improved, if replicated?

References:
Lab Title: Posture and Well-Being

Section 1: Performance Expectations

What will the student be asked to do?

- Select one or more performance standards:
  - Formulate a scientific question about the impact of physical / bodily posture on psychological well-being.
  - Plan and/or carry out a scientific investigation about the impact of a brief posture intervention on both self-reported psychological well-being and external evaluation of performance.
  - Prepare a written or oral report, sharing their findings about the impact of posture on psychological well-being.

Main Idea/Concept Demonstrated or Taught by Lab:

This lab allows all students to learn the psychological effect of physical posture on psychological health; to try a brief posture intervention first-hand; and to discuss potential benefits of deliberately working on physical posture in their lives.

After concluding this lab, students should be able to:

- Describe how physical / bodily posture impacts psychological health.
- Describe implications of animal research on posture, dominance, and hierarchies.
- Use a simple posture intervention to improve confidence in performance tasks.
- Interpret graphical representations of data as used in both quantitative and qualitative methods.

Key Terms and Psychologists Associated with Main Idea/Concept:

Posture, bodily posture, confidence, self-esteem, dominance, social hierarchies

Materials:

You will need a computer/tablet/iPad/Smart phone with internet access for research and accessing videos; paper and pen/pencil or computer for documenting results and writing report.
Instructions:

1. First, have students come to a consensus about how Superman (or Wonder Woman) stands. Students should be able to describe and demonstrate superhero posture.

2. Small group discussion and/or debate among students: Does Superman / Wonder Woman stand this way because he/she feels brave? Or does he/she feel brave because of how he/she stands?

3. Experiment: find a group of volunteers for 2–3 brief (1–2-minute(s)) debates on fun, accessible topics. In each debate, one side is assigned to sit with bad posture – slumped, hunched shoulders, chin tucked into chest, looking down to the floor. The other side is assigned to stand with good posture – like Superman or Wonder Woman – with strong, standing stance, feet apart, chest open and lifted.

4. Gather data from the participants: how does sitting in bad posture or standing in good posture make you feel? How did you feel about your ability to debate and present your information?

5. Gather data from the observers: how does observing others in bad vs good posture make you evaluate them? Who seems more prepared? Who seems more competent?

6. Have students write up results in report format.

Follow-up and Discussion:

- Watch this Ted Talk from Dr. Amy Cuddy, Your Body Language May Shape Who You Are: https://www.ted.com/talks/amy_cuddy_your_body_language_shapes_who_you_are

- Think about the following questions to guide discussion and check for understanding:
  - What does animal research tell us about body language?
  - Where can you see examples of the importance of body language and posture in your own life – for instance, think about with parents, at school with peers, and in work situations?
  - How might you work on your own posture to improve how you feel, and your own sense of self-confidence? What strategies would be helpful? When could you use them?
  - What connections to the Common Core State Standards (CCSS) could be emphasized as students engage in the instructional sequence?

Section 2: Crosscutting Concepts

Select at Least One

- Students will identify the relationship between body posture and self-confidence / self-esteem.
- Students will identify the relationship between body posture and perceptions of others, related to power, dominance, and competence.
- Students will discuss the potential applications and limitations of animal research about posture and dominance on the understanding of human psychology.
Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- General objective, e.g., to explain the relationship between posture and self-perception.
- Materials used (include measurements, where necessary).
- Procedure described in detail (for replication).
- Graphs/tables of collected data.
- Findings:
  - Individual findings.
  - Summary of group data.
  - What do the findings mean? (use appropriate terminology related to concept).
  - How could the research be improved, if replicated?

References:

Lab Title: Exercise and Psychological Health

Section 1: Performance Expectations

What will the student be asked to do?
- Select one or more performance standards:
  - Formulate a scientific question about the impact of exercise on psychological health.
  - Plan and/or carry out a scientific investigation about the impact of exercise on psychological health.
  - Prepare a written or oral report, sharing their findings about the impact of exercise on psychological health.

Main Idea/Concept Demonstrated or Taught by Lab:

This lab allows students to learn the ways in which exercise improves psychological health, and to discuss potential benefits of regular exercise in their lives.

After concluding this lab, students should be able to:
- Describe exercise and understand recommendations for minimum exercise per week.
- Describe empirically validated effects of exercise on psychological health and well-being.
- Interpret graphical representations of data as used in both quantitative and qualitative methods.

Key Terms and Psychologists Associated with Main Idea/Concept:

Exercise, fitness, physical activity, psychological health, stress management

Materials:
You will need a computer/tablet/iPad/Smart phone with internet access for research and accessing videos; paper and pen/pencil or computer for documenting results and writing report.

Instructions:

1. In pairs or small groups, have students survey classmates. Survey participants should answer (1) Do you exercise at least 3 days per week (yes or no) and (2) complete the Satisfaction with Life Scale, available at https://internal.psychology.illinois.edu/~ediener/SWLS.html.
2. Have students gather and analyze data to determine if there is a relationship between regular exercise (yes, at least 3 days per week) and higher scores on the SWLS (more satisfaction with life).
3. Have students write up results in report format.
Follow-up and Discussion:

- Review Physical Activity Guidelines from National Institute of Health: https://health.gov/paguidelines/guidelines/
- Read this article from Psychology Today about surprising health benefits of exercise: https://www.psychologytoday.com/blog/where-science-meets-the-steps/201605/8-reasons-exercise-have-nothing-do-swimsuits
- Think about the following questions to guide discussion and check for understanding:
  - What are the psychological benefits of exercise?
  - What are some surprising benefits of exercise?
  - What trend did you notice among students (survey participants) who exercised at least 3 days per week? Were they more or less likely to be satisfied with their lives than those who did not exercise regularly?
  - How do you think the results would change if you compared those who exercise at least 6 days a week with those who do not exercise at all? Is there a minimum amount of exercise to gain benefits? Is there a maximum amount of exercise beyond which there are no additional benefits? Read this article about the benefits of just one hour of exercise per week to protect against depression: https://www.psychologytoday.com/blog/the-athletes-way/201710/one-hour-exercise-week-protects-against-depression
  - What will you do differently in your own exercise, knowing that exercise improves well-being and psychological health?
  - What connections to the Common Core State Standards (CCSS) could be emphasized as students engage in the instructional sequence?

Section 2: Crosscutting Concepts

Select at Least One

- Students will identify the impact of exercise on psychological health.
- Students will discuss how different amounts of exercise impact well-being.
- Students will discuss the relationship between physical and psychological health.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in Student Report:

- General objective, e.g., to understand the effects of exercise on psychological health.
- Working definition of exercise and psychological health.
- Materials used (include measurements, where necessary).
- Procedure described in detail (for replication).
- Graphs/tables of collected data.
- Findings:
  - Individual findings.
  - Summary of group data.
  - What do the findings mean? (use appropriate terminology related to concept).
  - How could the research be improved, if replicated?
References:


Lab Title: The Potential Effects of Stress

Section 1: Performance Expectations

What will the student be asked to do?
- Students will work in small groups, e.g., four to eight members.
- Students will be asked to carry out self-studies and analyze data gathered from their group.
- Students will be asked to communicate information by graphing the results from their group and summarizing their analysis in a lab report.
- Students will be asked to discuss and compile recommendations for improved stress management.
- Students will engage in debate about the most effective strategies for managing/dealing with stress.

After concluding this lab, students should understand:
- The potential impact of stress
- How stress may be affecting their bodies, lives, and people in general
- The importance of being proactive and seeking strategies for dealing with stress effectively
- Different perspectives and strategies for appraising and dealing with stress

After concluding this lab, student should be able to (performance standards):
- Describe how stress may impact people’s health and life expectancy
- Describe the different types of stress or stressors
- Apply strategies for managing stress/stressors in their lives
- Plot and interpret graphical representations of data gathered in assessments of stress, as used in both quantitative and qualitative methods

Main Idea/Concept Demonstrated or Taught by Lab:
This lab challenges students to research and critically assess levels of stress in their lives and lives of others, and the impact this may have. It also provides the opportunity for students to explore strategies for effective stress management and engage in debate about the most effective coping mechanisms to deal with stress/stressors.

Key Terms and Psychologists Associated with Main Idea/Concept:
stress, stressors, strategies, stress management, health, health psychology, mindset
Materials:
computers/tablets/iPads or smart phones, Internet Access, graph paper and pens/pencils

Instructions:
1. Each group agrees on their working definition of stress – e.g., as defined in the textbook or another reliable source they find. Each group discusses how individuals might operationally define their own stress level – e.g., above or below average.

2. Each student formulates an individual testable hypothesis about how much or how little stress s/he/they have in their lives. E.g., “I have below average stress in my life;” or “I deal with an above-average amount of stress.”

3a. Each group visits the website https://www.stress.org/holmes-rahe-stress-inventory/ and each student follows the instructions and write down the point value of each life event that has happened to him/her/them during the past year (please note - this inventory is geared towards adults).

And/or

3b. Print out and distribute to each member of each group another survey/questionnaire geared more towards high school students such as the Stress Indicators Questionnaire posted on the Internet by the Counseling Team International http://www.nbanh.com/files/Stress Indicators Questionnaire.pdf

4. Students compare and contrast their individual results, and compile and graph the top five to ten stressors for each group, e.g., a bar graph might be used.

5. Each group then watches the Ted Talk on “How to Make Stress your Friend” and discuss the implications of this research. https://www.ted.com/talks/kelly_mcgonigal_how_to_make_stress_your_friend

6. Following this video, each group of students is asked to discuss the implications of the information presented and write a short list of their main “takeaways” for dealing with stress.

7. Students discuss their group data/results in light of the research findings presented in the TED talk and compile recommendations for dealing effectively with stress in a lab report.
8. Schedule a debate whereby each group of students shares their recommendations and debates about the best strategies for dealing with stress culminating in a synthesis of the “Top 5.”

Follow-up and Discussion:

Use the following questions to guide discussion and check for understanding:

- What are some commonly held student ideas about stress?
- Were there any differences in how each group defined stress?
- Does this lab debunk any myths students may have about stress?
- Are there any common areas of stress/stressors when comparing and contrasting results from all groups?
- What studies does the TED Talk reference that may change how students conceptualize stress?
- What representations or media influence student understanding of stress and its potential impact?
- What strategies might students explore and/or adopt after learning more about the potential impact of stress?
- What connections to the Common Core State Standards (CCSS) could be emphasized as students engage in the instructional sequence?

Section 2: Crosscutting Concepts

Select at Least One

- Students will identify patterns of behavior or life events that may impact people’s lives and health.
- Students will identify similarities and differences (different types of life events and varying quantities) through data analysis of their self-studies and discuss how these relate to stability and change in people’s lives.
- Students will discuss possible cause and effect as presented through the Holmes and Rahe Inventory or Daily Stressors Survey.
- Students will discuss the research findings presented in the TED TALK and the societal function of effective strategies for dealing with/managing different types of stress.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in the Student Report:

- General objective, e.g., to explore the impact of stress
- Working definition of stress
- Individual working hypotheses
- Materials used (include measurements, where necessary)
- Procedure described in detail (for replication)
- Graphs/tables of collected data
- Findings
  - Did the data disprove the individual hypotheses? Explain
  - Summary of group data
  - What do the findings mean? (use appropriate terminology related to concept)
  - How could the research be improved, if replicated?
- Recommendations from the group for dealing with stress effectively
References:
1. Holmes-Rahe Life Stress Inventory retrieved on October 26, 2017
   https://www.stress.org/holmes-rahe-stress-inventory/
2. Stress Indicators Questionnaire from the Counseling Team International. Retrieved on October 26, 2017
   http://www.nbanh.com/files/Stress Indicators Questionnaire.pdf:
   https://www.ted.com/talks/kelly_mcgonigal_how_to_make_stress_your_friend
Lab Title: Nutrition and Health

Section 1: Performance Expectations

What will the student be asked to do?
- Students will work individually or in groups
- When the lab is complete, students will be able to formulate scientific questions about nutrition and health
- Students will be asked to carry out an investigation and analyze data gathered from surveys and observations
- Students will watch a TED talk on the subject matter
- Students will be asked to communicate information in a lab report

After concluding this lab, students should understand:
- The connection between eating habits, nutrition and health
- Dietary guidelines to promote good health
- The importance of nutrition in health maintenance

After concluding this lab, student should be able to (performance standards):
- Describe common dietary recommendations from reliable sources
- Discuss the discrepancy between theory (dietary guidelines) and practice (how people eat and drink)
- Differentiate between healthy and unhealthy dietary habits
- Plot and interpret graphical representations of data gathered via surveys and observations as used in both quantitative and qualitative methods
- Reflect on their own eating habits and possibly revise in accordance to the information and conclusions reached in this lab

Main Idea/Concept Demonstrated or Taught by Lab:
This lab provides students with the opportunity to write scientific questions about their peers’ eating habits, and to research, critically compare and contrast their data with dietary guidelines from reputable sources.
Key Terms and Psychologists Associated with Main Idea/Concept:
nutrition, healthy eating, dietary recommendations, health, diet, food

Materials:
Internet access, printer, pens/paper

Instructions:
1. Students work individually or in groups to formulate scientific questions about student eating habits.
2. Students observe, survey (e.g., written survey) and/or interview other students to collect data on student eating habits for a specific timeframe – for example for one day or one week.
3. Students summarize and chart their findings.
4. Students research nutritional guidelines at well-known and trustworthy sources such as Mayo Clinic http://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/mediterranean-diet/art-20047801

John Hopkins Bloomberg School of Public Health

U.S. Government - 2015 Federal Dietary Guidelines Advisory Committee (Recommendations for 2015 – 2020 – link may need to be updated.)
https://health.gov/dietaryguidelines/2015/guidelines/

5. Students compare the data collected with the information on nutrition and health from reputable institutions.
6. Students reach conclusions about peer nutritional intake – have their scientific questions been answered?
7. Students discuss the connection between everyday eating habits, nutrition and overall health.
and/or
the TED talk by Ann Cooper, “What’s wrong with school lunches”
https://www.ted.com/talks/ann_cooper_talks_school_lunches
9. How does the information presented by Mark Bittman and/or Ann Cooper - TED Talks relate to student findings; are there any other recommendations for improving eating habits and nutrition to stay healthy?
Follow-up and Discussion:

Use the following questions to guide discussion and check for understanding:
- What are some commonly held student ideas about diet and health? How can this lab and instruction build on them?
- Are there differences in student findings and what might these indicate?
- How does the information presented on reputable websites on nutrition and presented in TED talks compare to the data collected on student eating habits?
- What are the main issues or recommendations?
- What representations or media influence student’s opinions and attitudes about diet and nutrition?
- What practices could students engage in to explore further the significance of nutrition on health?
- What connections to the Common Core State Standards (CCSS) could be emphasized as students engage in the instructional sequence?

Section 2: Crosscutting Concepts

Select at Least One:
- Students will identify eating patterns that have a high impact on people’s lives and health.
- Students will compare and contrast their compiled data and findings with others.
- Students will discuss possible cause and effect after comparing collected data on student eating habits to information on reputable websites on dietary recommendations for healthy living.
- Students will discuss their research findings in light of the information presented in the TED TALKs and discuss recommendations for students and possibly for their school and families.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in the Student Report:
- General objective, e.g., to explore eating habits
- Working definition of nutrition
- Scientific questions
- Materials used (include measurements, where necessary)
- Procedure described in detail (for replication)
- Graphs/tables of collected data
- Findings
  - Summary of individual and/or group data collected
  - Were answers to the scientific questions found? Explain
  - Data analysis: what do the findings mean? (use appropriate terminology related to concepts)
  - Connections between eating habits/nutrition and health
How could the research be improved, if replicated?
• Recommendations from the group for improving eating habits for healthy living

References:


https://health.gov/dietaryguidelines/2015/guidelines/

4. TED talk by Mark Bittman, “What’s wrong with what we eat”
https://www.ted.com/talks/mark_bittman_on_what_s_wrong_with_what_we_eat

5. TED talk by Ann Cooper, “What’s wrong with school lunches”
https://www.ted.com/talks/ann_cooper_talks_school_lunches
Lab Title: Habits for Successful Students

Section 1: Performance Expectations

What will the student be asked to do?
- Students work individually or in groups.
- Students will be asked to carry out an online investigation and analyze data gathered from review of scholarly literature — e.g., peer-reviewed journal articles.
- Students will be asked to communicate information in an oral report or summary.

After concluding this lab, students will better understand:
- The connection and relationship between student choices, student habits and student success
- Intrinsic versus extrinsic motivation

After concluding this lab, students should be able to (performance standards):
- Summarize current thought and research on student success
- Discuss different factors — e.g., habits and strategies that foster student success
- Differentiate between helpful and unhelpful student habits
- Explain the significance of intrinsic motivation
- Reflect on their own habits and possibly revise in accordance to the information and conclusions reached in this lab

Main Idea/Concept Demonstrated or Taught by Lab:
This lab provides the opportunities for students to research and review scholarly literature and research on specific habits and strategies that lead to student success. Students will be challenged to address the choices students make that impact their success or lack thereof as a student.

Key Terms and Psychologists Associated with Main Idea/Concept:
study habits, strategies, life style choices, scheduling, student success, exercise, sleep

Materials:
Computer/tablet/smartphone – technology to access the Internet, Internet access,
access to an online data base with full-text peer-reviewed articles available and/or access to journal articles via Google Scholar
Instructions:
1. Students search peer-reviewed resources in a data base or on Google Scholar – e.g., “habits for student success” search on October 29, 2017 yielded 739,000 results
   https://scholar.google.com/scholar?hl=en&as_sdt=0%2C14&q=habits+for+student+success&btnG
2. Individual students review at least five different studies on habits for student success [It is also possible to assign small groups of students to review studies together]
3. Students synthesize information and compile a short list of “top” habits or strategies
4. Students compare and contrast their short list of “top” habits or strategies in pairs and then compare their findings in small groups and write a data analysis

Follow-up and Discussion:

Use the following questions to guide discussion and check for understanding:
- What are some commonly held student ideas about being a successful student? How can this lab and instruction build on them?
- Are there differences in student findings and what might these indicate?
- What representations or media influence students' opinions and attitudes about student success?
- What practices could students engage in to explore further the significance success as a student?
- What connections to the Common Core State Standards (CCSS) could be emphasized as students engage in the instructional sequence?

Section 2: Crosscutting Concepts

Select at Least One
- Students will identify patterns between student habits and student success.
- Students will evaluate the possible cause and effect of student choices with student habits and student success.

Section 3: Lab Report (written, verbal, or recorded)

Suggested Content to be Included in the Student Report:
- Students will summarize their findings in either a written report or a verbal presentation that includes the following
- Objectives of this study (significance of student success)
- Questions that were answered
- Why didn’t we form a hypothesis at the beginning? What would have happened had you been looking to disprove a hypothesis?
- A reference page formatted according to APA
- A summary of the findings
- Appropriate graphs/tables (related to the most effective habits or strategies)
Discussion of unexpected or new understandings about student success
What other type of data might be collected to consider when researching habits for student success?
A list of references formatted according to APA

Supplementary Information:
1. Does Random Look Random?

2. Everyone Knows what a Smile is. Right?
Lab Title: Does Random Look Random?

Adapted from an activity by Perilou Goddard, Northern Kentucky University. Unpublished.

Section 1: Performance Expectation

What will the student be asked to do?
Students will generate a hypothetical series of random coin flips and compare the results to a real series of coin flips.

Main Idea/Concept Demonstrated or Taught by Lab:
Students are able to (performance standards):
3.5 Explain other statistical concepts, such as statistical significance and effect size.

This lab allows students to gain a more accurate idea of what random really means. This is necessary to know why randomness is important in both sampling and assignment of participants.

Key Terms and Psychologists Associated with Main Idea/Concept:
Randomness (can be extended to random sampling and random assignment)

Materials:
You will need a coin, paper, and a pen or pencil for each student,

Instructions:
1. Instruct your students to do the following:
   a. Draw a vertical line down the center of a blank piece of paper. On one side of the line, write a random series of H’s and T’s that represent the results of 25 imaginary random coin tosses (example: H T T H T T H H T T H, etc.).
   b. On the other side of the line, record the results of 25 actual coin flips.
   c. Make sure you remember which side of the line represents your made-up coin tosses and which represents the actual coin tosses.

2. When the coin flipping is done, tell students you are going to try to identify the list of real coin tosses. Establish that, if you were just guessing, you would be right about 50 percent of the time. Have a student volunteer at the board keep a running tally of how many times you are right and wrong.

3. The key to making the right choice is to look for the piece of paper with the longest string of H’s or T’s. When students are generating what they believe is a random series, they rarely
have a string of more than 3 H’s or T’s. The real coin flips almost always have longer strings of H’s or T’s. By looking for long strings, you will be able to identify the real coin flips more than half the time. Most of your students will be very impressed with your “psychic ability.”

**Follow-up and Discussion:**

1. Begin discussion by asking students to generate hypotheses about how you were able to beat chance so effectively. Psychic ability and trickery are the most common hunches. You will probably have to tell them how you did it.

2. Make sure students understand that random events in real life (e.g., winning the lottery twice in a short period of time, getting a call from an old friend shortly after thinking of her, etc.) often don’t look random. We don’t need to generate elaborate explanations, like psychic ability, because randomness can almost always account for weirdness in our world.

**Section 2: Crosscutting Concepts**

- Patterns: random data can include apparent patterns like streaks

Cause and effect: because patterns may be perceived in random data, there is a temptation to assume there are causative factors at work.

**Section 3: Lab Report (written, verbal, or recorded)**

**Suggested Content to be Included in Student Report:**
Once students have seen the class demonstration and know how it was done, ask them to replicate it with ten other people. They should
- Record the number of times out of ten that they were able to identify the real coin flips.
- Ask their participants the reason for the correct identification, if it was made, and record the answers.

Summarize what they have learned about randomness as a result of this lab.
Lab Title: Everyone Knows what a Smile Is. Right?

Section 1: Performance Expectations

What will the student be asked to do?
Students will participate in an exercise that requires them to identify which students in yearbook photos are smiling. They will then compare their results and recognize the need to develop and operational definition of “smiling.”

Main Idea/Concept Demonstrated or Taught by Lab:
Content Standard 1: Research methods and measurements used to study behavior and mental processes
Students are able to (performance standards):
  1.1 Describe the scientific method and its role in psychology.

This lab allows students to better understand what operational definitions are and why they are important in research.

Key Terms and Psychologists Associated with Main Idea/Concept:
Operational definition

Materials:
You will need six photos of student yearbook senior photos. You can use an old yearbook from your school to find these photos or do a Google image search on “senior yearbook photo.” Pick photos where there is some ambiguity as to whether the student is smiling. Once you’ve identified the photos, put them in a single slide (PowerPoint, Prezi, etc.) so they can be projected to your class.

Instructions:
1. Have the class imagine a research scenario where the researchers will have to classify the subject of yearbook photos as either smiling or not smiling.
2. Caution students not to talk during the data collection phase.
3. Project the six senior photos. Distribute small paper “ballots” and instruct students to write down the number of photos where the subjects are smiling. Each student should note a number between 0 and 6.
4. Collect the ballots and create a quick frequency distribution on the board. There should be a broad range—with the photos I use the range is typically 2-6.

Follow-up and Discussion:
1. Ask students why there is such a broad range. Their answers will quickly establish that there is no agreement on what constitutes a smile.
2. Spend some time trying to create an operational definition of “smile.” You can either do this in small groups or as a whole class exercise.

3. Ask students what this exercise teaches them about operational definitions. Make sure the following points get made:
   a. There is usually an arbitrary nature to operational definitions. Not everyone will agree on what’s best. When evaluating research done by others, it is important to identify what the researchers used for operational definitions (e.g., how did the researchers measure “best,” or happiness, or learning?).
   b. Data collection may not be reliable unless operational definitions are clearly established. If each coder decides on his or her own what constitutes a smile, their conclusions have little meaning.
   c. Without clear operational definitions, a study cannot be replicated.

Section 2: Crosscutting Concepts
Systems and system models. Research must be systematic, and the scientific method has rules that must be followed. One aspect of this is generating operational definitions

Section 3: Lab Report (written, verbal, or recorded)
Suggested Content to be Included in Student Report:
Once students have seen the class demonstration, give them a handout with the six pictures and have them to replicate it with 20 other people. They should
   • Present the data. This can be done with a frequency distribution or a bar graph.
Summarize what they have learned about the importance of operational definitions.