ACTIVITY 8

Testing a Well-Being Strategy

LABORATORY

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ACTIVITY SUMMARY

Students choose one of the four well-being strategies under consideration for Salas High School to test out in their classroom. First, they choose a strategy to investigate with a randomized controlled trial, and then they work as a class to generate a study design for a randomized control trial that can be conducted in the classroom. They run the experiment in their classroom and analyze the results. Finally, students compare their study design and results to those of a study on the same strategy published in a peer-reviewed scientific journal.

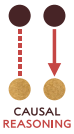
ACTIVITY TYPE
LABORATORY

NUMBER OF 40–50 MINUTE CLASS PERIODS
2–3

KEY CONCEPTS & PROCESS SKILLS

1. Some effects are difficult to identify due to insufficient evidence, multiple causes, delayed effects, or confounding factors.
2. Incorrect conclusions about causation can happen when the result is due to an alternative explanation, such as chance or a confound. Careful study design and analysis can reduce the likelihood of the occurrence of alternative explanations.
3. Randomized controlled trials (RCTs) are the most reliable method for identifying cause-and-effect relationships because they reduce the likelihood that alternative factors are influencing the effect.

CONCEPTUAL TOOLS



VOCABULARY DEVELOPMENT

randomized controlled trial (RCT)
an experiment in which participants are randomly assigned to an experimental group or a control group

TEACHER BACKGROUND INFORMATION

Randomized Controlled Trials

Randomized controlled trials (RCTs) are the gold standard in science for establishing strong evidence for causation. RCTs are designed to isolate the hypothesized causal variable to see if the hypothesized effect is different when the causal variable changes. They accomplish this through two essential features: first, a comparison between an experimental and a control group and second, randomized assignment of participants to the experimental or control group.

The purpose of randomized assignment is to prevent systematic differences between individuals assigned to the two groups. If not randomized, such differences can create confounding variables, which can lead to incorrect results. Without randomized assignment, there is a greater risk that pre-existing differences between the two groups (e.g., demographic, personality, or health-related factors) may affect the outcome, leading to biased results and incorrect conclusions about the effect of the independent variable. The purpose of a control group is to have a group against which to compare the experimental group. This allows researchers to be confident that any changes in the experimental group are due to the treatment and not to some other unconsidered variable (a confound, also referred to as a confounding variable).

Randomized Assignment

Some methods of assignment to groups in an experiment can create obvious confounds, but even a seemingly fair method of assignment can give rise to confounds. For example, assigning participants to a group by last name may lead to an overrepresentation of students of Arab descent in one group, because they are more likely to have names beginning with *A*, or an overrepresentation of students of Irish descent in the group with names beginning with *O'* or *M*. Due to this, scientists often use random number generators to randomize assignments. A common misconception is that random assignment is the same as random sampling (also referred to as random selection), which takes a sample representative of the larger population. However, random assignment only ensures that participants are evenly distributed between selected groups, not that the sample reflects the larger population. For more details about random sampling, see Teacher Background Information in Activity 7.

MATERIALS & ADVANCE PREPARATION

FOR THE TEACHER

- VISUAL AID 8.1 "Sample RCT Procedure" (OPTIONAL)
- 8 SETS OF RCT SUMMARY CARDS (4 CARDS)

FOR EACH GROUP OF FOUR STUDENTS

- RCT SUMMARY CARD (corresponding to the chosen strategy)

FOR EACH STUDENT

- STUDENT SHEET 8.1 "Experimental Design of RCTs"

Review the suggestions in Teaching Step 3 that follows when students choose a classroom RCT for the activity. Some activities may not be appropriate for a classroom, so check in advance with school administrators and determine if there are any possible restrictions.

Prepare the RCT Summary cards in advance by copying sets of all 4 cards. While cards for all 4 well-being strategies are provided, only the card set for the class's chosen well-being strategy will be handed out to each group in Part B, Procedure Step 10. Set aside the remaining 3 card sets as they will be used in Activity 10.

TEACHING NOTES

Suggestions for **discussion questions** are highlighted in gold.

Strategies for the **equitable inclusion of diverse students** are highlighted in lime.

GETTING STARTED (10 MIN)

1 **Review the main concepts related to a randomized controlled trial (RCT).**

- In Activity 7, students informally investigated the elements of a good study design through their exploration of the simulation. The Introduction for this activity builds on that by formally introducing the term *randomized controlled trial*, which was the type of study on which Activity 7 was based. Have students read the Introduction and clarify any questions they have about the definition of that term. Support students, particularly emerging multilingual learners, in sensemaking and language acquisition as they read the text. Circulate around the room and check in with students as they read to support them as they decode scientific ideas and construct meaning.

- Review why randomized controlled trials are a powerful way to study cause and effect. Remind students that correlations only show an association between two things but don't prove that one causes the other. Ask, How do RCTs provide stronger evidence for cause and effect than studies that only identify correlations? Students should be able to think back to Activity 7 and articulate that controlling for variables and randomly assigning people into groups reduces the chances of an alternative explanation for the experiment results, while a correlation does not. If the importance of RCTs in scientific research doesn't come up in the class discussion, bring up the following points:
  - Controlling for variables: RCTs help rule out alternative explanations for the results, keeping everything the same between the control group and the experimental group except for the treatment. Controlling all the other variables reduces the chance that the outcome is from a confound. Correlations only observe the two variables of interest, they don't control for other factors.
  - Randomized assignment: Assigning participants to groups randomly also reduces the chance of possible confounds by distributing any differences into both the control group and the experimental group.
  - If an effect appears in both groups, it may be due to a confound rather than the treatment itself; but if it appears only in the experimental group, it is more likely caused by the treatment.

- Support students, particularly emerging multilingual learners, in sensemaking and language acquisition by adding to the word wall. Record the term *randomized controlled trial (RCT)* and provide an example as needed. For more information on a Word Wall, see Appendix 1: Literacy Strategies.

PROCEDURE SUPPORT (40 MIN)

2 Facilitate the selection of one of the four well-being strategies to investigate as a class.

- Read the fictional scenario in Procedure Step 1 aloud with the class. Reading the scenario aloud can better support comprehension for many students, including neurodiverse students and emerging multilingual learners who often have more highly developed listening and oral skills than reading comprehension skills. Alternatively, students can read the scenario independently.

- In Procedure Step 2, help the class choose which of the four well-being strategies they will investigate. One suggested way to select the strategy is to begin by having students brainstorm in small groups. Ask, Which of the strategies is the most interesting and practical to do in a classroom? Have students talk amongst themselves as they consider all four strategies. Then, have students share their ideas with the class. Students' responses will vary depending on your school setting. After students share their ideas, narrow down the choice by either consensus or vote.

3 Groups brainstorm and select a treatment for the class to test.

- In Procedure Steps 3–4, support student ideation of a study design. As students consider ideas in their small groups, circulate around the room and encourage students to think concretely about the elements of the study they imagine. It may help to inform students that the descriptions for each well-being strategy (in Procedure Step 2) are examples of treatments—for instance, a school garden, regular visits to a park, or adding more plants around campus are all examples of treatment ideas for the Green Spaces strategy. Students should be able to describe a treatment and how they would decide who will be in which group. At this stage, do not share (or ask about) the suggested control conditions listed for each treatment, as students will work through this in Procedure Step 5 when they are in their small groups. The following ideas for treatments can be offered for inspiration.

Gratitude Writing

1 EXPERIMENTAL GROUP
Write three things for which you are grateful.

CONTROL GROUP
Write three things that have happened recently.

2 EXPERIMENTAL GROUP
Write a letter to someone in the class for whom you are grateful and give it to them.

CONTROL GROUP
Write a letter to a friend about something general and give it to them.

3 EXPERIMENTAL GROUP
Write an email to someone not in your class for whom you are grateful and send it to them.

CONTROL GROUP
Play a computer or phone game or work on homework.

School Therapy Dog

1 EXPERIMENTAL GROUP

Watch a video of cute dogs for 10 minutes.

CONTROL GROUP

Play a computer game or work on homework.

2 EXPERIMENTAL GROUP

Have someone bring in a friendly dog for students to play with.

CONTROL GROUP

Students are not allowed to play with the dog, but they may watch.

NOTE: This could create a confound as students who are not allowed to touch the dog may be disappointed.

School Garden

1 EXPERIMENTAL GROUP

Go outside to the area of the school grounds with the most nature and sit there for 10 minutes.

CONTROL GROUP

Remain inside the classroom.

2 EXPERIMENTAL GROUP

Watch a nature video for 10 minutes.

CONTROL GROUP

Watch a video of a cityscape.

3 EXPERIMENTAL GROUP

Examine a plant, interesting branch, or shoebox filled with natural objects for 8 minutes.

CONTROL GROUP

Examine a box with simple human-made objects.

Later School Start Time

1 EXPERIMENTAL GROUP

Half the students in the class go to bed earlier than they normally would for 1 night. The next day, follow up with data collection on mood and alertness, using self-reported ratings from 1 to 5.

CONTROL GROUP

The other half of the class goes to bed when they normally do.

2 EXPERIMENTAL GROUP

Allow a 15–minute nap on desks, with lights dimmed.

CONTROL GROUP

Spend the time quietly doing homework or playing on their computers.

- Once students have discussed and brainstormed treatment ideas in their small groups, have groups share their ideas with the class. As a class, evaluate the options and agree on one treatment to test. Help students choose a treatment that is a version of the strategy, could easily be done in the classroom, and is likely to have an effect.

Sample Group Response, Procedure Step 4

Our group was thinking that for the experimental group for gratitude writing, we could have students write a letter to a friend and give it to them. Another idea for a treatment is to have students just write in a journal about things they are grateful for.

- For students with learning disabilities and neurodiverse learners, provide targeted support. Adapt the selection of the strategy to best suit the needs of your particular students. Consider providing the suggested lists of treatments to choose from, or select one yourself. Students who need more time processing language (such as students with dyslexia) can be provided with these suggestions in advance of the day's activity.

4 Groups propose study designs for the classroom RCT.

- In Procedure Step 4, hand out Student Sheet 8.1, "Experimental Design of RCTs." Once the class agrees on a general idea for a treatment, each group designs a study to test its effects.

- In Procedure Step 5, you might want to quickly review the following design elements to help students before they create their study designs:

Hypothesis
The class should come to a consensus on the hypothesis—what they think the results will show.

Sample Size
The sample size is usually the size of the class, with students as participants.

NOTE: If you are running this activity in multiple classes, you may wish to combine the data from all your classes to obtain a larger sample size.

Method of Assignment to Group
Assignment should be random (e.g., by coin flip). Some students might suggest nonrandom methods of assignment, such as by choice or by class. Encourage students to consider weaknesses of this method and to recall the simulation from Activity 7 in which this was addressed.

Experimental Group
Although the class should have come to a consensus on a general treatment in Procedure Step 4, students may develop more details in order to make it easier or more likely to show an effect. Encourage students to consider details that may impact the results of the experiment. For instance, the duration of the treatment (such as watching a 30–second pet video vs. a 5–minute pet video) and the intensity of the treatment (such as writing 1 thing vs. 10 things you are grateful for) can

both influence outcomes.

Control Group
Encourage students to consider whether their control might give rise to confounds. It may not be possible to come up with a control that eliminates all possible confounds, and this is acceptable. The point is to get students to come up with the best control they can.

Measurement of Effect
The most straightforward way to measure an effect is with a self-reporting rating scale from 0 to 10. For example, the scale might include a prompt such as *What is your mood?* with responses identified as 0 = terrible mood, 5 = neutral mood, 10 = excellent mood. Some students might begin to consider how they will analyze and average their data; if not, these details can be addressed later as a class in Procedure Step 6.

Possible Confounds
Noticing confounds may help students improve other aspects of their study designs: adjusting treatments, control groups, and/or method of assignment to the control and experimental groups.

- Have students record their design ideas in the "Group Proposal" column on the student sheet.

5 The class combines the best ideas into one experimental design, performs the classroom RCT, and analyzes the data.

- In Procedure Step 6, hold a class discussion to review each group's study design proposal from Student Sheet 8.1. Come to consensus on the RCT procedures the class will conduct by combining the best elements from their designs. At this point, you may need to address specific details in the experimental procedures that students have not yet addressed (such as treatment duration or how measurements will be made). Have students record the consensus study design in the "Classroom RCT" column on the student sheet. To ensure that all participants are doing the same thing during the experiment, consider writing the treatment procedure on the board for students to follow.

- Depending on your students, you may want to provide an advance copy of the finalized procedure and conduct the experiment the next day so students can preread it. Alternatively, you may want to have students write a more detailed procedure for the chosen classroom RCT idea on the back of the student sheet. A sample procedure is shown on optional Visual Aid 8.1, "Sample RCT Procedure."

- In Procedure Step 7, groups conduct and record the data from the class experiment. Analysis and results will vary depending on the RCT the class designs. The following tables show an example of class data for one possible RCT.

Example of Class Data, Procedure Step 7

CONTROL GROUP
Mood Rating (0 to 10)

STUDENT	BEFORE	AFTER	DIFFERENCE (POST - PRE)
1	5	5	0
2	4	8	4
3	6	5	-1
4	4	4	0
5	5	6	1
6	5	5	0
7	5	6	1
8	6	6	0
9	5	5	0
10	5	4	-1
	Average Difference =		*0.40*

EXPERIMENTAL GROUP
Mood Rating (0 to 10)

STUDENT	BEFORE	AFTER	DIFFERENCE (POST - PRE)
1	5	7	2
2	4	4	0
3	3	5	2
4	5	6	1
5	5	8	3
6	4	9	5
7	5	7	2
8	6	5	-1
9	5	6	1
	Average Difference =		*1.67*

- As students interpret the results, facilitate a discussion about whether the results support their hypotheses. Students may find that the difference between the two groups may be small, since the treatment is not very strong. If there is no difference between groups, or if the difference is in the opposite of the expected direction, discuss the possible reasons for this. Ask, Why do you think the hypothesis was not supported, and do you think this means that the well-being strategy is ineffective? Student responses may vary. Students may feel that the hypothesis was wrong, the treatment duration or the treatment intensity was too low, the sample size was too small to detect a real effect, or the strategy itself was not very effective. Remind students that a negative result for a single experiment does not necessarily mean that the strategy is not effective; it just means that more investigation is needed.

6 In Part B, compare groups' results with a summary of a published RCT.

- In Procedure Step 10, give each group the RCT Summary card that matches the well-being strategy your class chose to investigate. Point out that the information in the summary is from a peer-reviewed scientific journal. Support students, particularly emerging multilingual learners, in sensemaking and language acquisition as they read the text. Circulate around the room and check in with students as they decode the scientific ideas and construct meaning as they read.

- Support students as they work in pairs to complete the "Published RCT" column of the table on Student Sheet 8.1. A sample completed student sheet is shown at the end of this activity.

- For Procedure Steps 12 and 13, students should come up with similar observations when they compare the classroom RCT to the published RCT. Ask, What are the differences between the classroom RCT and the published RCT, and what are the possible reasons for these differences? Students are likely to observe that the published RCT had the following differences:

  - a larger sample size
  - stronger or different treatments
  - control groups with fewer possible confounds
  - potentially a wider array of effect measurements

  Students are likely to suggest that these differences may be due to a longer time frame, a larger sample size, and/or more resources for the published RCTs. This makes it likely that the published RCTs are more reliable and have fewer confounds. Responses will vary, but one sample response follows:

  Sample Student Response, Procedure Step 13

  Our classroom RCT for gratitude writing was much shorter than the published study—ours lasted just 1 day, while theirs went on for 10 weeks. That could matter because happiness might change over time. Also, the published study had 129 college students, but we only had 29 sophomores from the same school. A bigger sample with lots of different people might make the results more reliable. Another big difference was the control groups. In the published study, people wrote about annoying things, which could have made them feel worse. Our control group just wrote journal entries, so they weren't focused on negative things. That could explain why our results were different.

SYNTHESIS OF IDEAS (20 MIN)

7 Connect what students have learned in this activity with their previous knowledge about evidence for cause and effect.

- Have students reflect on both the RCT they created and the RCT summary from the published study. Remind students that asking about alternative explanations is one of the questions about causation that can help to evaluate cause-and-effect relationships. Ask, How do RCTs prevent alternative explanations? Students should respond in a way that shows they understand that by design, the only difference between the experimental and control groups is the treatment itself. Review how this is done through random assignment, which helps balance out other factors that could influence the results, and by using control groups to compare outcomes. By keeping all other conditions the same, RCTs make it more likely that any differences in results are caused by the treatment rather than by other variables.

- Another major point that helps explain why RCTs provide such reliable evidence is because they address the other three questions about causation previously brought up in this unit. Ask, Do RCTs offer evidence to answer the other three questions about causation? Students should be able to recall that the three questions relate to indicators of causation: timing, association, and mechanism. Students should respond that, yes, RCTs do provide evidence that supports the indicators, at least for timing and association, but possibly not for mechanism. You may want to go through the indicators individually and emphasize the following points:
  - **Timing**
    By controlling when the treatment changes and when the effect is measured, RCTs control timing.
  - **Association**
    If the results for the experimental and control groups in an RCT are different, that shows an association between the treatment and the effect.
  - **Mechanism**
    RCTs do *not* generally offer evidence about mechanisms, unless the possible mechanisms are also measured or changed.
- Finish the activity by revisiting the Guiding Question, *How do you design a randomized controlled trial?* Use responses to this question to formatively assess students' understanding of the key concepts and process skills related to the design of these kinds of experiments.

EXTENSION (10 MIN)

8 **Use the Extension as an opportunity for advanced learning.**

Students should be able to connect the structure of the RCT they ran in their class to the structure of an RCT used to test a new medication. All RCTs should include the components discussed in this activity. Have students choose a medication or treatment they are interested in. It can be something recently approved by the FDA, such as GLP–1 medications, a new gene therapy for sickle cell anemia, the mRNA-based COVID–19 vaccine, or groundbreaking medications approved years ago, such as penicillin, aspirin, or oxycontin. Students may also choose to research and present how these medications have impacted health and well-being over time or how they could impact health and well-being in the future.

For this extension, you may need to explain the term *placebo*, which is commonly used in RCTs that test medications. A placebo is a treatment that looks the same as the real medication but has no actual effect, such as a sugar pill. A placebo is used to prevent participants from knowing whether they're in the control group or the experimental group. The placebo effect occurs when the treatment has no real effect, and participants feel better simply because they believe they are receiving a treatment. This can create a potential confound.

SAMPLE STUDENT RESPONSES

BUILD UNDERSTANDING

① **There are limitations in any scientific experiment, but this is especially true for the RCT you conducted in your class. Now that you've compared your class experiment to a published RCT, describe at least three ways you could improve your class study design to reduce confounds and make the results more reliable.**

One way we could improve our study is by testing more people in different places. Our class only had 29 students, so the sample size was small. If we included more teenagers from different schools and backgrounds, the results would be more reliable. Another improvement would be testing people separately or in different rooms. Since we only had one room, the control group could see what the experimental group was doing, which might have influenced their responses. Also, we could have measured well-being in more ways and over a longer time. Instead of just asking about mood, we could have also measured stress levels or even heart rate to get a physical measure. Lastly, tracking results over one week instead of just one day could show if the effect lasts or is stronger.

② **Researchers sometimes call RCTs the strongest kind of evidence for cause-and-effect relationships. What features of RCTs help make them better for studying cause and effect than an observational study, which only looks for a correlation? In your response, explain how RCTs compare to correlation studies in terms of the following:**

a timing

b association

c mechanism

d alternative explanations

RCTs are stronger than correlation studies because of the way they are designed.

a ***Timing:*** *In a correlation study, two things might change together, but you don't know which one came first. In an RCT, researchers make sure the possible cause happens before measuring the effect (timing).*

b ***Association:*** *Both types of studies show associations but in different ways—correlation studies show it by measuring the strength of a relationship, while RCTs compare differences between groups.*

c ***Mechanism:*** *While RCTs can confirm whether a treatment causes an effect, they don't always explain the mechanism, so we might not fully understand why the effect happens. Correlation studies can suggest ideas, but RCTs give stronger evidence of cause and effect.*

d ***Alternative explanations****: RCTs use random assignment and control conditions to make the treatment the only difference between groups. This helps rule out alternative explanations, like a hidden factor causing the results.*

CONNECTIONS TO EVERYDAY LIFE

③ **Randomized controlled trials are used in many different fields of science, such as medicine, psychology, and education, to test the effects of treatments or interventions. Imagine a friend is choosing between two medicines to take for their stomach pains. There is a strong correlation between taking Medicine A and reporting less stomach pain. People who took Medicine B in an RCT experienced significantly greater relief from stomach pain than those who took a sugar pill. Which medicine, A or B, would you recommend to your friend and why? Base your answer on the kinds of evidence a correlation provides and an RCT provides.**

I would recommend they take Medicine B, which was tested using a randomized controlled trial (RCT) because it's a better way to know if it's effective. Correlation only shows that two things are related, but it doesn't prove that one causes the other.

④ **You read an article online that described a new pain medication awaiting approval from the Food and Drug Administration (FDA), a federal agency within the United States Department of Health and Human Services. The article mentioned that the researchers who developed the medication ran an RCT to test it before it could be approved for sale to the public.**

a Why would it be important to use an RCT to test a new medication before it is sold to the public?

It is important to make sure the medicine actually works and is safe. Just because people take the medicine and feel better doesn't mean the medicine caused it. An RCT makes sure the medicine is tested in a way that shows cause and effect, not just a coincidence.

b Why is it important to have a control group when testing a new medication?

So you know if people in the experimental group (the ones who get the medicine) improve more than people in the control group. Sometimes people get better without medicine, or because they think they got medicine.

c Why is it important to randomly pick who goes into the experimental and control groups when testing the medication?

It helps make sure the two groups are as similar as possible. If people got to pick their group, or if one group had more sick people in it than the other, it could mess up the results.

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Well-Being Strategy: _____ **Treatment:** _____

STUDY DESIGN	GROUP PROPOSAL	CLASSROOM RCT	PUBLISHED RCT
a Hypothesis			
b Sample Size			
c Method of Assignment to Group			
d Experimental Group			
e Control Group			
f Measurement of Effect			
g Possible Confounds			
Results			

Well-Being Strategy: *Gratitude Writing* **Treatment:** *Letter to a classmate*

STUDY DESIGN	GROUP PROPOSAL	CLASSROOM RCT	PUBLISHED RCT
a Hypothesis	*Writing about things you're grateful for will cheer up people.*	*People who write gratitude letters will be happier and have more life satisfaction.*	*Participants who write in a gratitude journal for 10 weeks will be happier than those who write about annoyances.*
b Sample Size	*30 kids in our class*	*The 29 students here today: 15 girls and 14 boys, all sophomores*	*129 college students*
c Method of Assignment to Group	*by choice*	*by coin flip*	*random assignment*
d Experimental Group	*Write 3 things you were grateful for this week.*	*Write a gratitude letter to someone in the class and read it to them.*	*Once a week, wrote 5 things they were grateful for.*
e Control Group	*Write three things that happened this week.*	*Write a journal entry just for yourself.*	*Once a week, wrote 5 things that were annoying to them.*
f Measurement of Effect	*Ask people their mood.*	*Ask people to rate their mood on a scale from 1 to 5 (1 = miserable, 5 = great).*	*Rating questions about gratitude, emotion, life satisfaction, and expected life satisfaction.*
g Possible Confounds	*Maybe people who are already happy might be more likely to choose the gratitude group.*	*Maybe writing to yourself is more frustrating than writing to someone else.*	*Writing about something annoying could make you less happy and less grateful.*
Results		*Students who wrote gratitude letters wound up in a better mood than those who didn't.*	*Participants who wrote in a gratitude journal for 10 weeks were happier than those who wrote about annoyances.*

Well-Being Strategy: *Pet Therapy* **Treatment:** *Cute animal video*

STUDY DESIGN	GROUP PROPOSAL	CLASSROOM RCT	PUBLISHED RCT
a Hypothesis	*Seeing animals will cheer up people.*	*People who watch the animal videos will be in a better mood than people who did their homework.*	*Participants who spend time with dogs will be less stressed and homesick than those who don't.*
b Sample Size	*30 kids in our class*	*The 29 students here today: 15 girls and 14 boys, all sophomores*	*163 American college students*
c Method of Assignment to Group	*by choice*	*by coin flip*	*random assignment*
d Experimental Group	*Watch a 5-minute cute animal video.*	*Watch cute animal videos for 10 minutes.*	*Spent 20 minutes with a therapy dog.*
e Control Group	*Watch whatever videos they want for 5 minutes.*	*10 minutes of quiet homework time.*	*Spent 20 minutes studying as usual.*
f Measurement of Effect	*Ask people their mood before and after.*	*Ask people to rate their mood on a scale from 1 to 5 (1 = miserable, 5 = great).*	*Self-reported stress, homesickness, and a sense of belonging before and after.*
g Possible Confounds	*Maybe people in the control group watched something else that was more fun.*	*Maybe doing the homework is stressful and makes people less happy.*	*Maybe just getting a break from normal schoolwork is relaxing.*
Results		*Watching the video was associated with a better mood than doing homework.*	*Participants who played with dogs decreased stress and homesickness and felt an increased sense of belonging.*

Well-Being Strategy: *Quality Sleep* **Treatment:** *Taking a nap*

STUDY DESIGN	GROUP PROPOSAL	CLASSROOM RCT	PUBLISHED RCT
a Hypothesis	*Sleeping more will make people feel more alert and happier.*	*People who nap will be in a better mood and more alert.*	*Participants who nap will be more patient and attentive, with better well-being.*
b Sample Size	*30 kids in our class*	*The 29 students here today: 15 girls and 14 boys, all sophomores*	*452 low-income urban workers in Chennai, India.*
c Method of Assignment to Group	*by choice*	*by coin flip*	*random assignment*
d Experimental Group	*Sleep 1 extra hour.*	*Nap on a desk for 15 minutes.*	*Took a 30-minute nap during the day in a quiet office once a day for 3 weeks.*
e Control Group	*Go to sleep 1 hour later than usual.*	*Work quietly for 15 minutes.*	*Did not take a nap in a quiet office.*
f Measurement of Effect	*Ask people their mood.*	*Ask people to rate their mood on a scale from 0 to 10 (0 = miserable, 10 = great).*	*Questionnaire about well-being and a data-entry task to measure attention.*
g Possible Confounds	*Maybe people in the control group spent their extra time awake and reading stressful news.*	*Maybe doing the work is stressful and makes people less happy.*	*Perhaps access to the quiet office, rather than the nap, made the experimental group feel special and relaxed.*
Results		*People who took naps wound up in a better mood than those who did work.*	*Participants who napped reported higher well-being and showed more patience and attentiveness.*

Well-Being Strategy: *Green Spaces* **Treatment:** *Watching a nature video*

STUDY DESIGN	GROUP PROPOSAL	CLASSROOM RCT	PUBLISHED RCT
a Hypothesis	*Taking a hike will leave people feeling more peaceful and happy.*	*People who just watched a nature video will be in a better mood than people who watched a city video.*	*Participants who walk through nature will have more positive emotions and be better able to reflect than city walkers.*
b Sample Size	*30 kids in our class*	*The 29 students here today: 15 girls and 14 boys, all sophomores*	*76 college students*
c Method of Assignment to Group	*by choice*	*by coin flip*	*random assignment*
d Experimental Group	*Take a hike in the woods.*	*Watch a nature video.*	*Walked through a nature preserve.*
e Control Group	*Walk around campus.*	*Watch a city video.*	*Walked through a quiet urban setting.*
f Measurement of Effect	*Ask people their mood.*	*Ask people to rate their mood on a scale from 0 to 10 (0 = miserable, 10 = great).*	*Rating questions about positive emotions, ability to reflect, connection to nature.*
g Possible Confounds	*Maybe people in the control group have bad memories from campus, but the woods are a new place.*	*Maybe watching the city video is stressful because of all the cars and noise.*	*The urban walk could have stressed out participants with all the cars and noise.*
Results		*Watching the nature video was associated with a better mood than watching the city video.*	*Participants who walked in nature had more positive emotions and greater ability to reflect than urban walkers.*

Experiment Protocol: Testing the effects of gratitude letters on well-being

Materials Needed

- PAPER OR DIGITAL DOCUMENT FOR WRITING
- PENS OR PENCILS (if writing by hand)
- PRE-EXPERIMENT AND POST-EXPERIMENT MOOD-RATING SURVEYS
- COIN FOR RANDOM GROUP ASSIGNMENT

Procedure

1 Assign Participants to Groups

- The 29 students in class today (15 girls, 14 boys, all sophomores) will participate.
- Each student will flip a coin:
  - Heads = assigned to the gratitude-letter group (experimental group)
  - Tails = assigned to the journal-writing group (control group)

2 Pre-Experiment Mood Rating

Before starting the activity, all participants use the pre-experiment mood-rating survey to rate their mood on a scale from 1 to 5:

1 = MISERABLE
2 = NOT GREAT
3 = NEUTRAL
4 = PRETTY GOOD
5 = GREAT

Participants should be honest in their mood ratings.

3 Writing Task

- Experimental Group (gratitude letter):
  - Write a letter to another participant in the class expressing appreciation for them.
  - Read the letter aloud to the person.
- Control Group (journal entry):
  - Write a journal entry about anything on their mind.
  - The entry will not be shared with anyone.

4 Post-Experiment Mood Rating

After completing the writing task, all participants will use the post-experiment mood-rating survey to record their mood on the same scale as in Step 2.

5 Data Collection and Analysis

- Participants' pre-experiment and post-experiment mood ratings will be compared.
- The class will look for differences in mood changes between the experimental group (gratitude letter) and the control group (journal writing).
- Calculate and graph the difference in scores for each group, using the following:

$$\text{SCORE DIFFERENCE} = \text{AVERAGE POST-TREATMENT MOOD RATING} - \text{AVERAGE PRE-TREATMENT MOOD RATING}$$

RCT SUMMARY

Gratitude Writing

STUDY DESIGN

- **Participants**: 129 college students
- **Assignment randomly into 2 groups**:

  Experimental Group: Once a week, participants wrote 5 things they were grateful for.

  Control Group: Once a week, participants wrote 5 things that were annoying to them.
- **Measurement**: After 10 weeks, all participants answered questions about their gratitude, emotions, life satisfaction, and expected life satisfaction.

STUDY RESULTS

Compared to the control group, participants in the experimental group reported 1) higher gratitude levels, 2) higher life satisfaction overall, 3) higher expected life satisfaction for the upcoming week, and 4) more positive emotions.

RCT SUMMARY

Pet Therapy

STUDY DESIGN

- **Participants**: Sample size of 163 college students from the United States.
- **Assignment randomly into 2 groups**:

  Experimental Group: Participants had 20 minutes interacting with a trained therapy dog.

  Control Group: Participants had 20 minutes of studying.
- **Measurement**: All participants completed a survey before and after the 20 minutes. Afterward, they rated their stress, homesickness, and sense of belonging at school.

STUDY RESULTS

Participants in the control group showed no change in their stress levels. However, participants in the experimental group reported 1) less stress and homesickness and 2) a stronger sense of belonging at school after spending time with a therapy dog.

RCT SUMMARY

Quality Sleep

STUDY DESIGN

- **Participants**: 452 adults from a low-income urban area in Chennai, India, who slept an average of only 5.6 hours a night, even though they spent nearly 8 hours in bed.
- **Assignment randomly into 2 groups**:

  Experimental Group: Participants took a 30–minute nap during the day in a quiet office once a day for 3 weeks.

  Control Group: Participants did not take a nap.
- **Measurement**: Participants completed questionnaires about their physical and mental well-being. To measure attention, researchers observed how focused participants were while doing a data-entry task at work. Participants also answered survey questions about their level of patience.

STUDY RESULTS

Participants in the experimental group who took naps had significantly better 1) psychological well-being, 2) patience, and 3) attention at work as compared with participants in the control group who did not take naps.

RCT SUMMARY

Green Spaces

STUDY DESIGN

- **Participants**: 76 college students in a town in the Midwestern United States.
- **Assignment randomly into 2 groups**:

  Experimental Group: Participants took a 10–minute walk through a nature preserve with woods and a river and stopped at a creek in the woods.

  Control Group: Participants took a 10–minute walk through an urban area with cars and buildings, ending at a quiet concrete area next to a parking lot.
- **Measurement**: Both groups were asked to think about a small problem in their lives (such as finding time to study for a test) and not talk to one another during the 10–minute walk. After the walk, all participants completed a survey to rate their emotions, ability to reflect, and connection to nature.

STUDY RESULTS

On average, participants in the experimental group reported 1) slightly more positive emotions, 2) a better ability to reflect, and 3) a stronger connection to nature as compared with participants in the control group who were not in nature.