THE GROWTH EXPERIMENT pdf

1: LPX First flight of Lunar plant growth experiment | NASA

The Growth Experiment - Christine Envall & Sandy Meisner Usage Public Domain Each of us has the potentialTo become BiggerÃ¢Â¦.To become StrongerÃ¢Â¦.Sandy Meisner plays a scientist dedicated to healing who stumbles upon a formula that changes her meek physique into a hugely muscled and super strong one.

Patterns can be used to identify cause and effect relationships. Unit 3 addresses standards related to the transfer of energy and matter between organisms in an ecosystem. The unit begins with identifying what solar energy is and what two forms of energy solar energy provides to life on Earth. This is an important foundation for understanding standard 5-PS We build on this knowledge throughout the unit in other lessons related to photosynthesis and how animals use the energy they get from food. In this unit students will also be conducting experiments to gather evidence to support their belief that plants get the materials they need for growth from either water, air, or the soil. This is covered in standard 5-LS Support an argument that plants fet the materials they need for growth chiefly from air and water. Students will be creating food chains and food webs to describe the movement of matter among organisms in an ecosystem. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. I combined these three standards all into unit 3 because teaching them together allows students to see how they are all connected. The energy that plants get from the sun is stored in their parts until animals consume them. Plants cannot absorb this energy and reproduce without other materials from the environment such as carbon dioxide from the air, and water and nutrients from the soil. The animals that consume the plants use part of the energy for growth, reproduction, etc. All of the energy that is available in an ecosystem can ultimately be traced back to the sun. Teaching all of these standards together, instead of in isolation of each other, makes that connection easier to see. Support an argument that plants get the materials they need for growth chiefly from air and water. Through the multiple experiments that will be conducted, students will be collecting evidence to determine what is most important for plant growth. By working through the steps of the scientific method and controlling variables, standard ETS Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. Students will demonstrate mastery of this goal by completing all four foldables in their science notebooks and collecting the first set of data for all plants. Each group will need a piece of construction paper and glue stick to create a beginning thoughts poster. Each student will need a copy of each of the experiment trifold boards: A total of 27 identical plants. I used strawberry plants so I could send home strawberries from the plants that grow well. A total of 27 identical planters, I used plastic cups. I write the question on the board: What material is most important for plant growth? I ask groups to discuss the answer to that question for a few minutes. The pictures I selected for the cards include sunlight, water, soil, and air. These are the items identified in the standard and the items that we will be discussing in the next several lessons about the parts of a plant and photosynthesis. I circulate to listen to conversations and to make sure that they are including the "why" in their responses to each other. I want to make sure they are supporting their reasoning with some things they already know about the topic. In this video of group discussion for what is most important for plant growth , the boy in the group is offering information about plants that he knows that do not live in soil and do not need much water such as cacti. After a few minutes of discussions, and I have had time to make it around to all groups, I pass out a piece of construction paper to each group. The choice card that they identified as the material that is most important should be glued on to the poster, then details added about their reasoning to support their choice. I do not require them to write it in paragraph form, they can, but do not have to. Some groups do write a paragraph explaining their reasoning, while others just create a list of their ideas. Purpose of Creating the Posters: I begin the lesson today with the posters for two reasons. One reason is to activate prior knowledge about plants and for me to get an idea of what background knowledge my students already have on the topic. Another reason is so that students will have their original thoughts on this topic recorded in some way to refer back to after the activity. Once the experiments are done, and evidence is collected, students will develop a new answer to this question and will be required to compare it to their original ideas and explain how their reasoning has

changed. Plant growth experiment - choice cards video of group discussion for what is most important for plant growth Guided Practice 30 minutes Setting Up the Experiments: It is important to conduct 3 trials for each experiment to ensure the results we get are accurate. Because this experiment entails a lot of set up, this portion will be done whole group, instead of each group doing it individually. Groups will however, be collecting their evidence independently each day. All students get out their science notebooks to set up the four experiments together. I have the trifold boards of experiment steps copied for each student to save time. You can set up each of these experiments on separate days and take the time to write out each of the steps for each experiment if you choose. I provide the trifold boards one at a time and go over each step of the experiments together. Each experiment should only take about 8 minutes to go over as students do not have much to write, they are doing more listening then writing. They title a page in their science notebook "How Does Water Affect Plant Growth" and glue their experiment foldable on that page. I read the question out loud to the class and ask the students what the independent variable test variable is for this experiment. They can easily identify this variable from the question and tell me it is water. Students close their foldable and record the independent variable on the front cover. I move on to the hypothesis. After reading it out loud, I ask students to fill in what they believe will happen. I circulate to ensure that all students have the hypothesis filled in and to get an idea of what the majority of the class believes will happen. We go over the materials and procedure together. While we go through the steps of the procedure, I show the materials that will be used at each step and model how each step will be completed. I stress control variables without pointing them out as control variables. After going over all of the steps of the procedure, I ask them to identify at least four control variables. Students tell me the pot, the soil, the sunlight, the time measurements are taken, and the type of plant. They record these on the cover of the foldable where they wrote the independent variable. The last thing we do is to review the data charts in the center of the foldable. Because there are three trials, two plants for each trial, I separated them into three charts. I feel that this will help make collecting the data each Friday easier for students. As we review the charts, I ask students what the data will be that is going to be collected. The tell me the height of the plant. I ask them what type of variable the height of the plant will be and they answer dependent variable. They title the next page in their science notebooks "How Does Air Affect Plant Growth" and glue their foldable in on that page. We go over each of the steps just as we did in the above experiment. I point out each of the variables in this experiment and students record them on the front cover of their foldable. The independent variable is air and no air. The dependent variable is the height of the plant. The control variables are the type of plant, the amount of water, how often water is given, the type of water given, the pot it is planted in, the soil used, and the sunny location. They title the next page in their science notebooks "How Does Soil Affect Plant Growth" and glue their foldable in on that page. We go over each of the steps just as we did in the other two experiments. The independent variable is the type of soil. The control variables are the sunny location, type of plant, amount of soil, clay, and sand used, the amount and type of water and how often it is given, the type and size of pot. They title the next page in their science notebooks "How Does Sunlight Affect Plant Growth" and glue their foldable in on that page. We go over each of the steps just as we did in the other experiments. The independent variable is sunlight and no sunlight. The control variables are the type of plant, the type and amount of soil, the type and size of pot, the amount type of water and frequency they are watered.

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2: The Growth Experiment Management System that Tripled Our Testing Velocity â€” Reforge

We use this to alert team members when the experiment is launched for an idea they submitted, detailing the hypothesis, goals, and method that the growth team has applied to their idea, as well as the expected launch and completion dates.

Do Plants Like Music? Do plants have feelings? Can they hear sounds? Do they like music? To the skeptic, the idea that plants have feelings or feel pain is ridiculous. Over the years, several studies have indicated that plants may respond to sound. However, the subject is still hotly debated in scientific circles. Studies Find Positive Effect of Music on Plants If plants respond to the ways they are nurtured and have several sensory perceptions, then how do they respond to sound waves and the vibrations created by musical sounds? Several studies have looked at this question, specifically how music effects plant growth. He initially experimented with classical music. Later, he experimented with raga music improvisations on a set of rhythms and notes played on flute, violin, harmonium, and reena, an Indian instrument. He found similar effects. Singh repeated the experiment with field crops using a particular type of raga played through a gramophone and loudspeakers. Through his several experiments, Singh concluded that the sound of the violin has the greatest effect on plant growth. He also experimented on the effects of vibrations caused by barefoot dancing. Sir Jagadish Chandra Bose , an Indian plant physiologist and physicist, spent a lifetime researching and studying the various environmental responses of plants. He concluded that they react to the attitude with which they are nurtured. He also found that plants are sensitive to factors in the external environment, such as light, cold, heat, and noise. In order to conduct his research, Bose created recorders capable of detecting extremely small movements, like the quivering of injured plants, and he also invented the crescograph, a tool that measures the growth of plants. Luther Burbank , an American botanist and horticulturist, studied how plants react when removed from their natural habitat. He talked to his plants. Based on his horticultural experiments, he attributed approximately 20 sensory perceptions to plants. The book has short description of the experiments with a brief biography of these scientists. It should be mentioned that some, including botanists Arthur Galston and Leslie Audus, consider the book to be a piece of fiction, not science. A lot of the science in The Secret Life of Plants has been discredited but nevertheless, the book has made its mark on our minds and culture. Singh also discovered that seeds that were exposed to music and later germinated produced plants that had more leaves, were of greater size, and had other improved characteristics. Do Plants Like Rock Music? In a experiment by Dorothy Retallack, then a student of Professor Francis Brown, three groups of plants were exposed to various types of musical sounds. For one group, Retallack played the note F for an 8-hour period. For the second group, she played similar note for three hours. The third controlled group remained in silence. The first group died within two weeks, while the second group was much healthier than the controlled group. Plants exposed to Hayden, Beethoven, Brahms, and Schubert grew towards and entwined themselves around the speakers. Another plant group grew away from a speaker that played rock music. That group even tried to climb a glass-walled enclosure in what appeared to be an attempt to get away from the sound. Retallack later replicated the experiment with rock music like Led Zeppelin and Jimi Hendrix on a variety of plants. She observed abnormal vertical growth and smaller leaves. She also observed the plants to have damage similar to that associated with excessive water uptake. In the experiment, marigolds died within two weeks. No matter which way they were turned, plants leaned away from the rock music source. What About Country and Jazz? Plants that are exposed to country music have the same reaction as those who are subjected to no sound at all, showing no unusual growth reaction. According to some studies, jazz music appears to have a beneficial effect, producing better and more abundant growth. The science television show MythBusters did a similar experiment and concluded that plants reacted well to any type of music, whether rock, country, jazz, or classical. Their experiments however, were not thoroughly conducted and are highly debatable. They believe the vibrations help not just of the plants but also in the soil and produce good fungi and bacteria in the soil that are vital for healthy vines, which encourages better and stronger root development, resulting in vigorous growth and better fruit. Many commercial growers play music for their crops, regardless of the fact that there

are no reliable studies to support the idea. How Can Plants Hear? To explain how it may work, let us look at how we humans receive and hear sound. Sound is transmitted in the form of waves that travel through a medium, such as air or water. The waves cause the particles in this medium to vibrate. When you switch on your radio, the sound waves create vibrations in the air that cause your ear drum to vibrate. This pressure energy is converted into electrical energy for the brain to translate into what you understand as musical sounds. In a similar manner, the pressure from sound waves create vibrations that could be picked up by plants. Plants would not "hear" the music, they would feel the vibrations of the sound wave. Protoplasm, the translucent living matter of which all animals and plant cells are composed, is in a state of perpetual movement. The vibrations picked up by the plant might speed up the protoplasmic movement in the cells. This stimulation then could affect the system and improve performance, such as the manufacture of nutrients that develop a stronger and better plant. Different forms of music have different sound wave frequencies and varying degrees of pressure and vibration. Louder music, like rock, features greater pressure, which some people think might have a detrimental effect on plants. Imagine the effect of strong wind on a plant compared to a mild breeze. Playing Music in Vineyards for Grape Production In , a hectare vineyard, DeMorgenzon wine estate in Stellenbosch, South Africa, experimented with two vineyard blocks, exposing one to baroque music and the other to no music at all. This allowed the vineyard owner to monitor and observe any differences in the production. The musical repertoire consisted of 2, pieces of classical baroque music. With this vast collection, they could play the music nonstop for 7. Despite the outcome of the experiment by Dorothy Retallack, where plants exposed for an eight-hour period died two weeks later, the DeMorgenzon wine estate played the music around the clock with no negative results, not just in the vineyard but also in the wine cellar and tasting room. Another vineyard, Paradiso di Frassina in Tuscany, Italy, uses classical music to get better production from its vineyards. They observed that plants mature faster when exposed to the soothing sounds of Mozart, Vivaldi, Haydn, and Mahler when compared to a controlled site. This project to wire the vineyard for musical sound started in as an attempt to keep pests away. Just like DeMorgenzon wine estate, the music is played non-stop 24 hours a day with no negative results. In both of these vineyard examples, there were no negative results noticed after extensive exposure to music, and the benefits of the music remain anecdotal. But there are sounds that, at least theoretically, it could be advantageous for them to hear. It is true that the positive effects of music on plant growth is still highly debated among scientists. Because the scientific community only values results that can be repeated, and thereby verified, there are many skeptics who regard the studies mentioned above as bad science since most of them were unreplicable, meaning that when others tried to re-do the study as described, their results did not match those of the original study. In some cases, upon further analysis, the original studies themselves were found to be faulty. It was reported in the The Telegraph that scientists from National Institute of Agricultural Biotechnology in Suwon, South Korea played classical music in rice fields, and concluded that plant genes can "hear" and had improved yield. The research was published in the August, issue of New Scientist. Others say too few samples were analyzed for it to be conclusive. She listed several concerns, including: Citing the works of professors in physics and theology, but not in biology. Lack of relevant references. Poor reasoning and biased expectations. Insufficient number of samplings. Publisher that does not specialize in science. Another skeptic, biologist and author of What a Plant Feels, Daniel Chamovitz, criticizes both the Retallack study and The Secret Life of Plants by Peter Tompkins and Christopher Bird both described above as not only perfect examples of bad science but for being detrimental to science as a whole. He also says that "Although research in this area has a long history, most of it is not very scientific and, if you think about it, experiments studying music and plants were doomed from the start.

3: Growing Bean Plants for Science in Grade School: Experiments & Ideas

Awesome reply, wish to find the full movie thoght, but is a good begin.

Print To capture enough data on the overall health of your plants, we recommend that you record at least one final weight measure, one measure of root health, and all of the observation measurements that pertain to the type of plant you are using. Dry Weight Measuring Fresh Weight: While you can technically measure the fresh weight of plants without harming them, the simple act of removing a plant from its growing "medium" can cause trauma and affect the ongoing growth rate and thus your experiment. Measuring the fresh weight of plants is tricky and should probably be saved as a final measure of growth at the end of the experiment. Here is the process for measuring fresh weight: Remove plants from soil and wash off any loose soil. Blot plants gently with soft paper towel to remove any free surface moisture. Weigh immediately plants have a high composition of water, so waiting to weigh them may lead to some drying and therefore produce inaccurate data. Since plants have a high composition of water and the level of water in a plant will depend on the amount of water in its environment which is very difficult to control , using dry weight as a measure of plant growth tends to be more reliable. You can only capture this data once as a final measure at the conclusion of your experiment. Remove the plants from the soil and wash off any loose soil. Blot the plants removing any free surface moisture. Let the plants cool in a dry environment a Ziploc bag will keep moisture out - in a humid environment the plant tissue will take up water. Once the plants have cooled weigh them on a scale. Plants contain mostly water, so make sure you have a scale that goes down to milligrams since a dry plant will not weight very much. Root Mass Root mass is recommended as a final measurement as the plant must be removed from its growing medium in order to capture accurate data. There are quite a few different methods for measuring root mass depending on the type and structure of the roots Grid intersect technique: Remove the plant from the soil. If you are working with thin or light roots, you may want to dye the roots using an acidic stain. Lay the roots on a grid pattern and count the number of times the roots intersect the grid. Trace the roots on paper, measure each of the tracings, and calculate root length from the tracings. Count the number of roots. Measure the diameter of the root. This is especially useful for root vegetables such as beets, carrots, potatoes, etc. Root Shoot Ratio Roots allow a plant to absorb water and nutrients from the surrounding soil, and a healthy root system is key to a healthy plant. Your control group of plants will provide you with a "normal" root: It is important to combine the data from the root: For example, an increase in root: To measure the root: Remove the plants from soil and wash off any loose soil. Let the plants cool in a dry environment a Ziploc bag will keep moisture out - in a humid environment the tissue will take up water. Separate the root from the top cut at soil line. Separately weigh and record the root and top for each plant. The following table describes some of the measures that you can make and also recommends how frequently you should make these observations during the course of your experiment.

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4: Measuring Plant Growth

Top 10 Celebrities With The Biggest Boobs [CLifeStyle] - Largest NATURAL Breasts in the World - Duration: CLifeStyle , views.

Plant your seeds, water them, and place them in a well-lit location. Many type of seeds will work, but radish or lettuce are often chosen because they grow quickly. Melon seeds are sensitive to fungal diseases, and thus they provide a sensitive indicator of whether fungi have been killed through heating or curing of the compost. Keep all the pots in the same setting to minimize any variation in temperature, lighting, pests, and other environmental factors. Even when the environmental conditions are kept as constant as possible, it is a good idea to randomize the grouping of plants rather than placing all the plants that are receiving the same treatment together in one group. This helps to further minimize the effect of any environmental differences. Record on a daily basis the number of seeds that have germinated, plant growth, and observations about plant health such as color, vigor, or damage due to pests and diseases. You can decide what measurements to use as indicators of plant growth; possibilities include plant height, number and size of leaves, and dry weight of the entire plant at the end of the experiment. For dry weight, weigh the plant after drying in a C oven for 24 hours. Analysis and Interpretation 1. Graph germination rates and plant growth over time for the different treatments. Also, determine the mean number of seeds germinated and mean size or mass of the plants at the end of the experiment. Compare average germination rates, plant growth, and health for the different experimental treatments. Based on your experiments, what was the optimal potting mix for plant germination? Some things may have gone wrong in your experiments. For example, you may have over-watered your plants, causing them all to die from fungal infection regardless of the treatment. Or you may have taken measurements only on plant height, and later decided that measuring the number of leaves and length of the main stem would have given better information. These types of problems are normal and can be used as a basis for redesigning the experiment. How might you change your experimental design if you were to carry out another set of growth experiments? You may not find any differences between the treatments. Or, you may discover that the plants grown without compost did best. If this is the case, it may be difficult to determine whether the compost had no effect, or you did something wrong. The tendency is to assume the compost really has an effect and to attribute insignificant or negative results to experimental mistakes. However, the interpretation of results should not be biased by your predictions or preconceived ideas about the way experiments will turn out. Often unexpected results lead to important insights and questions. Maybe your compost is of poor quality, or maybe the plant species you chose grows well in poor soils. Explore all the possibilities for explaining your results with an open mind, through discussions and new experiments. The conclusions and recommendations that you are able to make based on your results will depend on how and where you carried out your experiments. For example, if you used potted plants in a classroom or greenhouse, it may be difficult to extrapolate from your results to what would happen if the same plants were grown outdoors in a garden. However, your results may give you some ideas about what would happen, allowing you to make predictions or hypotheses. You could then use these predictions to design a new experiment on plant growth in a garden setting.

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5: Plant Growth Experiments - Cornell Waste Management Institute

*The Growth Experiment [Lawrence B. Lindsey] on www.enganchecubano.com *FREE* shipping on qualifying offers. President Bush's key advisor on tax matters demonstrates the success of Reagan's great tax experiment.*

There are also some plants that are not affected by the presence of caffeine in the soil. Caffeine can be introduced to the soil by sprinkling grounded coffee over the soil, adding leftover coffee to the pot or watering with a caffeine solution made by dissolving a caffeine tablet in water. The grounded coffee is actually organic matter and will help in adding nutrients to the soil. It will also attract worms that feed on the grounded coffee and at the same time help to aerate the soil. The mung beans watered using the coffee mixture will grow the fastest. The independent variable is the solution used to water the plants â€" water, caffeine solution and a coffee mixture. The dependent variable is the growth of the mug bean plants. This is determined by measuring the height of the plants every day using a ruler. The constants control variables are the size of the pot, the concentration of caffeine and coffee, the amount of sunlight, the temperature of the environment which will remain at room temperature and the amount of water added daily. Fill the 3 pots with equal amounts of soil. Plant ten mug beans in each pot and allow them to germinate. Additional seeds can be placed in the pots in case some of the seeds do not germinate; the additional plants can be removed later. For the first 5 days, water the 3 pots with tap water only. Allow the seeds to germinate for the first 5 days. After 5 days, measure the height of the 10 plants in each pot. Add up the individual heights and divide by 10 to obtain the average height. Record the average heights in a table, as shown below. Prepare the caffeine solution by dissolving 10g of caffeine tablets in ml of water in a beaker. Over the next 10 days, water the pots once a day with ml water, caffeine solution or coffee mixture, according to the labels on the pots. Measure and calculate the average height of the mung bean plants every day for the next 10 days. Record all calculations in a table. The hypothesis that mung beans watered using a coffee mixture will grow the fastest has been proven to be true. The effect of caffeine on plant growth is still a subject under study. Using grounded coffee in garden lawns is a common practice to make plants grow faster. However, coffee also contains other ingredients like potassium and phosphorous, which are known to enhance plant growth. Experiments on plant growth using only caffeine have resulted in the plant leaves becoming wrinkled, turning brownish and exhibiting retarded growth.

6: NASA - NanoRacks-Espoo Christian School-Fungus Growth Experiment

This feature is not available right now. Please try again later.

Not just visit for a few days but stay for decades? A first step in long term presence is to send plants. As seedlings, they can be as sensitive as humans to environmental conditions, sometimes even more so. They carry genetic material that can be damaged by radiation as can that of humans. They can test the lunar environment for us acting as a "canary in a coal mine". Thriving plants are needed for life support food, air, water for colonists. And plants provide psychological comfort, as the popularity of the greenhouses in Antarctica and on the Space Station show. Good idea, but how can we send plants to the Moon soon? Thanks to Google, there are many potential rides to the moon in the near future, with commercial spacecraft companies competing to collect the Google Lunar X-Prize in We are constructing a small technology demonstration unit to study germination of plants in lunar gravity and radiation on the Moon. The self-contained habitat will have a mass of about 1 kg and could be a payload on any NASA or commercial lunar lander; for example the Astrobotics and Moon Express landers, both potential entries in the Google Lunar X-prize competition. After landing in late , water will be added to the seeds in the module and their growth will be monitored for days and compared to Earth based controls. Seeds will include Arabidopsis, basil, and turnips. This will be the first life sciences experiment on another world and an important first step in the utilization of plants for human life support. Follow up experiments will improve the technology in the growth module and allow for more extensive plant experiments. Study germination of plants in lunar gravity and radiation. Create a simple version of the lunar plant growth chamber that can be reproduced in large numbers for use in K education. The first Moon Express lander late To develop a very simple sealed growth chamber that can support germination over a day period in a spacecraft on the Moon. Upon landing on the Moon a trigger would release a small reservoir of water wetting the filter paper and initiating germination of the seeds. The air in the sealed container would be adequate to for more than 5 days of growth. No additional air supply or air processing would be necessary. The seedlings would be photographed at intervals with sufficient resolution to compare with growth in Earth controls. We would use the natural sunlight on the moon as the source of illumination for plant germination as a first ISRU in situ resource utilization demonstration. Science background Plant growth at Earth gravity has been well studied and there has been a lot of research on plant growth in microgravity on Shuttle and Space Station. Recently, ISS payloads have been able to simulate partial gravity eg. The surface of the Moon however is the only location in which the effects of both lunar gravity and lunar radiation on plant growth can be studied. Eventually human exploration of the Moon will require plant growth systems for life support. Germination is the first step in plant growth and thus forms the focus of this first experiment. We will also look for phototropism and circumnutation. The basic data from the experiment would be the growth rate, expressed as leaf area, over time. This would be extracted from images of the plant growth area. In addition image data would be collected to investigate both phototropism plant motion in response to changes in position of the light source and circumnutation plant circular motion. The growth and movement of the plants on the Moon would be compared to similar data from Earth controls in identical growth units. Germination Shows that minimum environmental factors for Earth-normal growth are available; sensitive to hazards, temperature, moisture and light. Phototropism Shows that plants on the Moon responds normally to external environmental cues Circumnutation Shows that Earth-normal endogenous growth patterns and growth rates are expressed in lunar conditions Follow-on science: After LPX-0 demonstrates germination and initial growth in lunar gravity and radiation, we anticipate follow on experiments that expand the biological science. Survival to 60 days demonstrates that sexual reproduction meiosis can occur in a lunar environment. Afterwards, the experiment may run for months through multiple generations, increasing science return. This classroom activity is written for the prototype, stay tuned to this website for updates about the flight version.

THE GROWTH EXPERIMENT pdf

7: The Effect of Music on Plant Growth | Dengarden

Each of us has the potential To become Bigger. To become Stronger. Sandy Meisner plays a scientist dedicated to healing who stumbles upon a formula that changes her meek physique into a hugely muscled and super strong one.

Plant Experiments in Elementary Science Class: Growing Bean Plants written by: Enjoy the miracle of growing seeds with your classroom and teach your students lessons on plants and biology at the same time. All you need for each plant is: You can use a bean to grow a bean plant in a simple paper towel science project. Just wet a paper towel and fold it up so that it will fit around the inner edge of a foam cup. Then slide a bean between the wet paper towel and the cup. Wet the towel every day, and you will soon see a green shoot emerging from your bean! Eventually, the shoot will turn into a plant. Create three foam cups as described above. Place one in a very sunny area, one in a partially sunny area, and one in a dark area such as the inside of a drawer or closet. Each day, compare the growth of the three plants. If possible, measure the plants daily and create a chart showing their respective growths. This experiment can help your students see the impact of sunlight on the growth of bean plants. However, there are several different types of bean plant experiments that can help you explore their growth in more depth: Water â€" Do bean plants grow better with a lot of water? Add different amounts of water to the paper towel each day to discover the ideal amount of water a bean plant needs to grow. Fertilizer â€" Do fertilizers really help bean plants grow? Try different types of fertilizers and see which makes your bean plant grow the tallest and healthiest. Remember to grow one plant without fertilizer as a control. Soil â€" Once your bean plants have shoots that are a decent size, try planting some of them in cups with different types of soil. You might want to try sand, dark soil, reddish soil, or whatever other types of earth you can find. Music â€" Some people believe that music can help plants grow. Design an experiment to test this by giving some of the bean plants different amounts of music each day. Do those plants grow better than the ones that were not around music? Looking for even more experiments? Try this lima bean plant experiment for preschool and leave your own ideas in the comments! The science fair project ideas in this series are the perfect place to start.

8: Manduca Caterpillar Growth Experiment | Ask A Biologist

Enter the Lab - Overview. The Manduca growth experiment can be used to uncover the impact that temperature has on the size and growth rate of an www.enganchecubano.com are three options for using the experiment, the quick virtual lab, the full virtual lab, and growing your own Manduca at a warm and cool temperature.

Losers Overview of the pipeline Depending on your goals you could opt for a more streamlined or more detailed flow. Our goal was to create the lowest possible barrier to entry for a new idea, so the only required field to get into this phase is a title. In order to move an idea from the backlog to the queue, several required fields must be fulfilled: Goal Hypothesis of the expected result Area of focus Confidence of success Ease The area of focus for the experiment, such as retention, monetization, activation, etc. Additionally, we use the ICE prioritization framework impact, confidence, ease , to rank queued ideas in order of priority. Scheduled to Launch During our weekly meeting, we move ideas from the queue into our schedule and assign management of any necessary tasks or reminders to team members directly on the card. In Progress Once an experiment has launched, it moves into this phase, along with any relevant tracking links, reminders, attachments, and tasks. Analyze When an experiment has ended, it moves into this phase where it must be analyzed against its original goal and hypothesis before it can move forward. We record the result, any observations, and whether the experiment significantly underperformed, met, or significantly overperformed the original hypothesis. This allows us to understand not only whether our experiments are successful, but how accurately we are estimating outcomes over time in different types of experiments. Example of an experiment card in the Analyze phase Winners Experiments that achieve their goal move into this phase. This connects the cards so previous experiments and learnings are easily accessible in further projects. Losers Experiments that did not achieve their goal move into this phase note: Follow up experiments can be created directly in the card, as described above. Archived Experiments removed from the pipeline go on to this phase, with a reminder to revisit them if necessary note: Building Prioritization and Analysis Reports One of the main motivations of building a sequential pipeline is that it makes prioritization and reporting a breeze, which opens up a path to greater efficiency, impact, and buy-in from company leaders. You can build some reports directly into Pipefy, while you need to export other more advanced reports to Excel or other data analysis and visualization platforms. The reports you can easily create from this flow are nearly endless, but here are a few reporting ideas with which to start. It lives directly in Pipefy, where we can easily go through and move high priority tasks to the schedule. Cadence Pipefy has built-in cadence reports, though we decided to build a simple dashboard to drill down further. To do so we set up a report in Pipefy that logs when experiments are launched and completed along with what area of the company they address, and a few other key fields. Then we set up the dashboard in Chartio a simple data visualization platform , and can easily refresh the data from the pre-built Pipefy report, a process that takes less than a minute. Team Adoption Using the same report as we do for cadence, the dashboard or pre-built Excel pivot tables if you prefer calculates how many different team members growth and non-growth submit ideas over time. Our efforts to improve the process have increased the number of experiment idea contributors by 2x since the pipeline was built. Hypothesis Improvement and Success Rate Again using the single Pipefy data export detailed above, the dashboard calculates how the results of our experiments are tracking against our hypotheses over time. For example, we learned we typically overestimate the results of full-funnel projects and underestimate the results of simple copy and design changes. This reminded us to keep up the pace of small, low-hanging-fruit style tests. Automations and Integrations The above details everything you need to know to create a functional system to use within your growth team. Adding cards, setting alerts and reminders, and facilitating teamwork between users in Pipefy is easy, so integrations and automations are mostly useful to facilitate interaction between the growth team and other areas of the organization. They can create a system that is incredibly lightweight for collaborators, and automates the communication necessary to keep everyone in the loop. Reducing the friction for team members to surface ideas is a key lever for increasing cadence and adoption. Any time someone starts a post with experiment, the post text creates a card in the backlog and adds the email of the submitting user to the card.

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Instrument Email Notifications as Cards Move to Certain Phases Using the Pipefy email template system, you can trigger emails as cards move into new phases, pulling in dynamic info based on card values. We use this to alert team members when the experiment is launched for an idea they submitted, detailing the hypothesis, goals, and method that the growth team has applied to their idea, as well as the expected launch and completion dates. By passing the owner of the experiment into the reply-to field, the email recipient is encouraged to simply reply to the email to add any comments or additional info to the card. This allows for any necessary back-and-forth between the growth team and other team members, without the need for everyone to have Pipefy accounts and become familiar with another tool. Make it Your Own The best growth practitioners are results oriented and find satisfaction and excitement in learning and experimenting to make the best possible product. Yet they often use systems to manage their processes that run counter to that mantra: For us, this system has evolved quickly. Since everyone is actively using and contributing to the flow, opinions for how to improve the system are constantly being added to the backlog in addition to product ideas.

9: The Effect of Caffeine on Plant Growth | Science project | www.enganchecubano.com

The plant-growth experiment is an example of a factorial experiment. A factorial experiment consists of several factors (seed, water) which are set at different levels, and a.

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