TGR EDU: EXPLORE

Career Connections: Transforming Passion into Purpose at Facebook
Virtual Field Trip Educator Companion Guide

Overview

Take a Virtual Field Trip (VFT) with TGR EDU: Explore and Discovery Education to the Facebook headquarters in Menlo Park, California to see some of the innovative careers that fuel this Silicon Valley powerhouse.

Facebook builds products to bring the world closer together, and this means drawing from a team that understands and reflects a broad range of experiences, thoughts, geographies, ages and backgrounds. During the VFT, students will hear from experts in software and infrastructure engineering, product design and data security to learn how hands-on work in the classroom can lead to engaging careers that create positive change.

The pre-field trip activity in this companion guide has been designed to introduce students to the topics they will learn about and the during and post-field trip activities have been designed to connect and extend student learning to classroom concepts.

Students will:

- Identify STEM careers that match their skills, interests, and experiences
- Examine innovations and technologies that gather data to solve problems
- Utilize a mathematical algorithm, used in many modern technologies, to solve complex problems with limited data

National Standards:

Algorithms Everywhere

K-12 Computer Science Framework

Practice 3. Recognizing and Defining Computational Problems
The ability to recognize appropriate and worthwhile opportunities to apply computation is a skill that develops over time and is central to computing. Solving a problem with a computational approach requires defining the problem, breaking it down into parts, and evaluating each part to determine whether a computational solution is appropriate.

Next Generation Science Standards
Disciplinary Core Idea

ETS1.A: Defining and Delimiting Engineering Problems
The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles to other relevant knowledge that are more likely to limit possible solutions.

Crosscutting Concept
Influence of Science, Engineering, and Technology on Society and the Natural World
The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions.

Science and Engineering Practice
Developing and Using Models
Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs.

Materials:
Pre VFT Activity
- Signs posted on either side of classroom: "fact" and "misconception"

During VFT Activity
- The Applying Your Knowledge and Skills to Careers in Technology student capture sheet

Post VFT Activity:
Algorithms Everywhere
- The Customer Profiles student capture sheet
- A chalkboard or whiteboard
- Large-format sticky paper (one piece per student group)
- Markers

Before the Virtual Field Trip
Activity: Fact or Misconception
Before you view the VFT, see what students already know about careers in technology and computer information systems. On opposite sides of the classroom, post a "fact" sign and a "misconception" sign. Explain to students that a series of statements will be read aloud. After each statement is read, invite students to move to the sign that corresponds with their response. Students should then form small groups to discuss and explain their responses. Invite students to share out their thinking on both sides before revealing the correct answer. *(Answers are in italic. You can share the responses before or after the field trip.)*

- **Fact or Misconception:** You need to be good at math or science to be successful in a tech field. *(Misconception: There are several careers in the tech field that aren't directly involved with the development or application of the technology itself but are critical to the success of the company or product.)*
- **Fact or Misconception:** You need to code to work in tech. *(Misconception: Technology changes at a rapid pace in this industry. 21st century skills like critical thinking, creativity, collaborating with others and communication are extremely helpful and transferable.)*
- **Fact or Misconception:** Only students with the best grades and test scores can get into college and move on to STEM careers. *(Misconception: Close to 500 colleges and universities accepts more than 70% of applicants.)*

- **Fact or Misconception:** 93 out of 100 STEM occupations had wages above the national average. (*Fact: 93 out of 100 STEM occupations had wages significantly above the national average wage of $48,320, according the U.S. Bureau of Labor Statistics.)*

During the Field Trip

Activity: Applying Your Knowledge and Skills to Careers in Technology

Guide students to brainstorm their personal talents and interests and write them on the **Applying Your Knowledge and Skills to Careers in Technology** student capture sheet. Then, direct students to watch the Virtual Field Trip. While they watch, they should look to match some of their talents and interests with the careers featured.

After the Virtual Field Trip

Apply how Facebook uses algorithms to how we use algorithms every day.

Activity: Algorithms Everywhere

You might not realize it, but you rely on algorithms every day. Algorithms form the basis of terrific tech, like video games, GPS navigation, social media sites and search engines, but they also help us complete fundamental human tasks like brushing our teeth and making food. That's because algorithms are essentially a set of instructions that tell a computer (whether it's a machine or a person) what to do. And just the way that a batch of brownies don't turn out right if a key ingredient is not listed in a recipe, a computer program will glitch and crash if it isn't based on a structurally sound algorithm.

In this activity, students will explore how algorithms analyze behavior in order to recommend content (such as songs, movies and news stories). Students will act out the process of machine learning-sorting data to identify patterns with increasing precision—to create a flowchart algorithm that can accurately recommend a food item a shopper would be interested in purchasing when shopping at an online grocery store. Students will work in teams to complete their flowcharts using large-format sticky paper and color-coded markers.

Additional Resources

How everyone feels in a school impacts how they act–how students learn and grow and how teachers teach. inspirED is a partnership between Facebook and the Yale Center for Emotional Intelligence with the goal of bringing social and emotional learning (SEL) and greater wellbeing to high school students across the nation. Their collection includes ten-minute activities, one-hour class lessons, and school-wide projects that provide flexibility to choose the ones that will work best in your school.

Applying Your Knowledge and Skills to Careers in Technology

Computers and information technology touch nearly every aspect of modern life. The excitement about innovations and connecting our global world result in strong job opportunities in this area. Your interests, abilities and goals all influence your career choices.

What are your talents and skills? List at least four.

1. _____ 2. _____

3. _____ 4. _____

What are interests or hobbies you enjoy? List at least four.

1. _____ 2. _____

3. _____ 4. _____

While watching the Virtual Field Trip, match some of your talents and interests related to three careers highlighted.

	Career: _____	Career: _____	Career: _____	List two careers that best match to your talents and/or interests	Careers highlighted in *Career Connections*
List two skills the professional highlighted as being critical to their work.					Software Engineer Graphic Designer Sound Engineer
List two talents or interests that you have related to this job.					Marketing & Public Relations Product Design Manager Data Scientist

Next steps:
Select a career you would be interested in investigating further. Conduct research to learn more about the pathways and opportunities to fulfill this type of career. The Bureau of Labor Statistics is a good resource to start with: https://www.bls.gov/ooh/

Salary range:
Educational requirements/minimum training necessary:
Schools/colleges that offer education/training programs for this career choice:
Total number of years post-high school) the required education/training takes:
If there is a particular college or university that you're interested in attending, does that college or university offer the education/training necessary for this career choice?:
Does this job/career require any special certification or license? What kind?:

Activity 1: Algorithms Everywhere

Students will be able to:

- **Analyze** how algorithms form the basis of computer programs
- **Apply** that knowledge to the real-life situation of grocery shopping
- **Create** an algorithm that can successfully predict an item that a grocery shopper would be interested in buying

Procedure:

1. Begin by asking students the following questions. Record their answers in a central location.
    - Have you ever used an app or software program that recommended a show, song or product to you? How accurate was the prediction?
    - How and why do you think the program chose that content for you?
    - Can you think of a situation in life where computer predictions would be helpful?

2. Explain to students that computers use algorithms to make predictions. Ask students to raise their hands if they have heard the term "algorithm." Ask where they have heard the term before—was it on a TV show or in the news? Maybe in another class?

3. Demonstrate the concept of an algorithm by having students identify the steps needed to travel within the school building:
    a. Write "How to safely exit our classroom during a fire drill" on the board.
    b. Tell students that they are to give you step-by-step instructions on how to exit the classroom and evacuate the school building in case of an emergency. Instruct students that they should pretend that this is the first time they have ever navigated this path, so they must be very thorough in identifying the steps.
    c. Call on a different student for each step in the process.
    d. When the class feels they have completed the task, walk through the steps to see what is missing. For example, did students mention opening doors? How many steps to take? Taking stairs? Explain that these steps may seem obvious, but they are important parts of telling someone else how to get somewhere.
    e. Call on different students to provide any steps they think might still be missing.

f. When the steps look complete, inform students that they have collaborated to create an algorithm. Algorithms aren't just for computers—they are the step-by-step guides like recipes and directions that help humans solve problems and operate efficiently.
g. Going back to the steps they missed—ask students why they think these little steps were skipped? Students will likely answer that they seemed obvious or that they didn't have to think about them.
h. Explain that like humans, some computers get better at performing tasks the more they do them. Navigating our school building is easy now, but it wasn't as easy the first time. The more we make the journey, the easier it gets. We learn tricks and techniques to navigate more efficiently, we know what steps will get us there the fastest, and so on.
i. Inform students that computers help humans make sense of lots of data—we call them computers because they "compute" data in order to complete tasks. When computers are programmed using an algorithmic model called machine learning, it means that the more data they compute, the better they get at finding answers and making predictions. With machine learning, computers adapt with every data point they process, becoming dynamic and flexible based on the input they receive.
    - Give students the real-life examples of facial recognition technology and suggested videos on streaming sites. In these examples, the computer is analyzing data (images of faces and videos) and making predictions based on that data. The more data the computer sees, the more accurate the predictions get.
    - Ask students to think of other examples of programs that use machine learning.

4. Divide students into small groups, ideally with 3-4 students in each group.

5. Explain that students are going to simulate website developers for a national grocery store that is trying to launch a new online shopping tool. The grocery store would like to suggest new brands and items that shoppers have not considered purchasing before but they do not want the suggested items to be at random. The grocery chain has hired web developers (the students) to solve this problem by creating an algorithm that suggests items for a customer to buy based on what they have previously purchased and rated. They must demonstrate the effectiveness of their algorithm to the grocery chain's top executives by walking them through the logic behind each statement of the algorithm. Each group will organize customer data points in a table and develop an algorithm in order to demonstrate how they would analyze the customer's items and determine what items to recommend.

6. Provide groups with the **Customer Profiles** student capture sheet and allow students 2-3 minutes to read through the data and discuss the following questions with their group:
    - What different types of data have been collected?

7. Explain that students will now organize the data to help create their algorithm. Instruct students to transfer the ratings data from the customer profile columns to the table at the bottom of the student sheet. The rows and columns have already been labeled for the students.

8. Once students have organized the customer data points, have each group discuss the following question:

- What patterns can be observed by comparing the data from the customers, items, and ratings?

9. Provide students 15-20 minutes to develop an algorithm using markers and chart paper that will determine whether or not to recommend an item to each customer. An example algorithm is provided below:
    1. Compare customer X with customer Y and see if they have similar ratings. They are considered similar if two or more ratings have at most a difference of 1.
    2. If customer X does not have similar ratings than customer Y, then do not recommend any items from customer Y and go back to step 1 to compare another customer.
    3. If customer X has similar ratings than customer Y, then go through customer Y's list to see if item should be recommended.
    4. Recommend item from customer Y if customer X has not purchased the item before and customer Y has rated the item 3 or higher. Otherwise, do not recommend item.

10. When groups have finished, have each group place their algorithms on the wall at different locations throughout the classroom.

11. Provide students with 5 minutes to conduct a gallery walk, observing the different algorithms. Allow students opportunities to share to the class how their algorithm would recommend certain items to customers.

12. When students have seen all the developed algorithms, ask students the following questions:
    - On a scale of 1-10, how confident are you that your algorithm will accurately predict an item the customer will want to buy? Why or why not?
    - Are there customers in your algorithm that will not receive any suggestions? If not, is your algorithm working as intended?
    - What would you need in order to be 100% confident in your algorithm? Why?
    - How are you applying the concept of machine learning to this activity?
    - Now that you have practiced machine learning and building algorithms, what other real-life problems could you solve using these tools?

Customer Profiles Student Sheet

Items listed below have been previously purchased and rated by customers. Ratings scale: 1 (poor) to 5 (excellent)

Customer A	Customer B	Customer C	Customer D	Customer E
Tasty Milk – 4 Crunch Cereal – 5 Acres Granola – 2 Yummy Granola – 4 Bananas – 4	Moo Milk – 4 Grain-O Cereal – 5 Bananas – 2 Oranges – 2	Moo Milk – 5 Crunch Cereal -4 Yummy Granola – 5 Bananas – 4	Tasty Milk – 4 Crunch Cereal – 3 Acres Granola – 3 Bananas – 3 Oranges - 2	Tasty Milk – 1 Acres Granola – 5 Yummy Granola – 4 Oranges – 4

Complete the table below using ratings data from customer columns above. Look for patterns to help you develop an algorithm that determines whether or not an item is suggested to the customer.

	Customer A	Customer B	Customer C	Customer D	Customer E
Tasty Milk	*4*				
Moo Milk					
Crunch Cereal					
Grain-O Cereal					
Acres Granola					
Yummy Granola					
Bananas					
Oranges					