



HOW **NICOTINE** AFFECTS THE TEEN BRAIN

Found in both conventional cigarettes and most vaping devices, nicotine is a highly addictive drug with many health risks for teens.

First, some good news: The number of teens who smoke cigarettes today is less than half of what it was 10 years ago. This decrease is a great win for the overall health of young people, but experts are still concerned. Why? While youth cigarette use is decreasing, the number of teens who use vaping devices, or e-cigarettes,

has been increasing. Just like regular cigarettes and smokeless tobacco, most vaping devices contain **nicotine**. In fact, one cartridge of the Juul brand and some disposables like Puff Bars have as much nicotine as a whole pack of cigarettes. No matter what product it comes in, nicotine is a highly addictive drug and a serious risk.

How Addiction Happens

Our brains come with a built-in reward system. When you do anything enjoyable—like laughing—your brain releases a natural chemical called **dopamine**. In essence, dopamine says to your brain, “Hey, I like this activity. It’s worth remembering and repeating.”

Nicotine takes advantage of that same reward system. When someone inhales nicotine, the drug enters the brain and triggers a surge of dopamine. But the amount of dopamine released is much greater than that from pleasurable everyday activities like eating a favorite food. Nicotine also causes the dopamine levels to remain elevated for longer than normal. The result: The brain receives a strong signal that it really wants to vape some more. Over time, this can lead to **addiction**, a disorder that causes a person to continue taking a drug, despite negative consequences.

Long-Term Effects

Once someone has a nicotine addiction, quitting can be very difficult. One reason is that they may have **withdrawal symptoms** (such as cravings, depression, anxiety, and problems focusing and sleeping) just a few hours after they stop using nicotine. The person has a strong urge to vape again to relieve these symptoms, which makes it even harder for them to stop.

Repeated exposure to surges of dopamine from nicotine can change how the brain reacts to natural levels of dopamine. When this happens, activities a person used to like may seem less enjoyable. Nicotine can also cause long-lasting changes to the brain circuits that control memory and self-control—leading to learning issues.

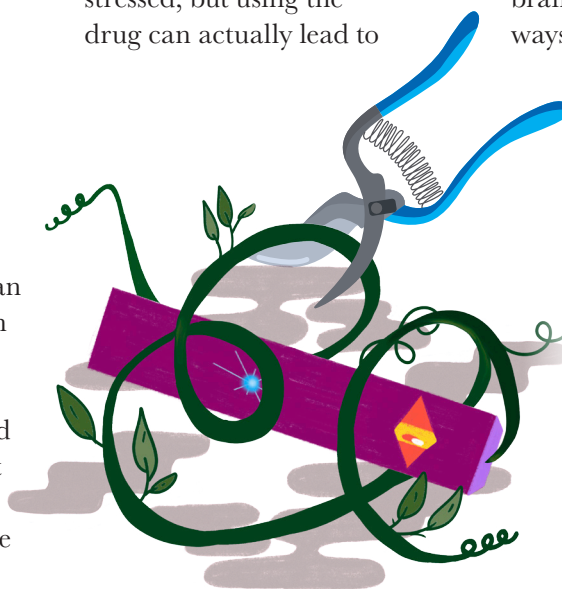
Sometimes people turn to nicotine because they’re stressed, but using the drug can actually lead to

anxiety. If a person becomes dependent on nicotine, they can experience irritability and anxiety when they are without it for too long.

Protecting Your Brain

Your young brain is still developing. In fact, it won’t fully mature until you reach your mid-twenties. That leaves teens especially vulnerable to the negative effects of nicotine, including addiction. Studies have shown that teens who use e-cigarettes are more likely to continue using nicotine as adults, and may be at greater risk of eventually smoking conventional cigarettes.

On the bright side, you have an opportunity during your teen years. If you avoid drugs like nicotine and instead take on healthy and stimulating challenges—learning to cook, playing an instrument, creating videos—you can affect your brain development in positive ways that can last a lifetime.



GETTING HELP

Visit teen.smokefree.gov/quit-vaping for teen-focused tools and tips, including:

- » More facts on nicotine risks
- » Ways to deal with stress and anxiety
- » How to quit vaping



Nicotine and the Teen Brain

While student smoking rates have declined in recent years, e-cigarette use has risen—an alarming trend, because most vaping devices contain the highly addictive drug nicotine. Share the article “How Nicotine Affects the Teen Brain” to help students understand how nicotine is not only highly addictive but also can cause lasting effects on their brain. Then have students complete the “Vaping Health Risks” presentation activity to guide them to conduct deeper research into specific vaping risks and help spread the word to their peers.

Reading-Comprehension Questions

1 Describe how the brain’s reward system works. (*The brain’s reward system is activated when you experience something enjoyable, like laughing with friends. That causes a release of the natural chemical dopamine. Dopamine helps your brain note this activity as something that should be remembered and repeated.*)

2 What is addiction? (*Addiction is a brain disorder that causes a person to continue to seek out and use a drug despite negative consequences in their lives.*)

3 Explain how using nicotine can lead to addiction. (*When someone uses nicotine, it causes the brain to release dopamine. Nicotine causes a larger- and longer-than-normal release of dopamine. The surge in dopamine causes a strong reaction in the reward system, so the person feels a strong desire to use nicotine again. Over time, this leads to addiction.*)

4 Why are teens especially vulnerable to nicotine addiction? (*The adolescent brain is still developing and won’t be fully mature until the person reaches their mid-twenties. Because it is still developing, the brain is more vulnerable to the changes caused by nicotine.*)

5 Explain one reason it can be challenging for someone who is addicted to nicotine to quit. (*If someone who is addicted to nicotine tries to quit, they can experience uncomfortable withdrawal symptoms, including depression and powerful cravings, that make it hard to stop.*)

6 What are some ways teens can help support a healthy development

of their brains? (*Don’t use drugs like nicotine. Take on new challenges that have a positive and stimulating influence on brain development, such as learning a new skill.*)

Critical-Thinking Writing Prompts

Grades 6–8 Both conventional cigarettes and vaping devices are illegal for teens. Write an argument to support the existence of this law. Include supporting evidence.

Grades 9–10 How does the brain’s reward system reinforce certain types of behavior? Explain how this can have positive and negative effects on a person’s development.

Grades 11–12 Some people who use nicotine report using it because they think it helps them relax. Explain why, in reality, nicotine can have the opposite effect. Then, suggest healthier alternatives for relaxation.

Remote Learning Suggestions

Send students links or print copies of the student article and student activity, and instruct them to read independently. Share the reading-comprehension questions on a digital discussion board, on a video call, through email, or in a print packet, and have students respond online or in hard copy. When students have completed the student activity, presentations can be delivered over a class video call, through a prerecorded video clip, or by sharing links or attachments. Wrap up by having students share (digitally or in writing) 3–5 new things they learned or thought about in a new way as a result of their classmates’ presentations.

Subject Areas

- Science, Biology, Public Health
- English Language Arts
- Health/Life Skills

Standards, Grs. 6–12

Common Core State Standards (CCSS)

RI.2

- Determine central ideas or themes of a text; summarize key supporting details

RI.9

- Analyze how two or more texts address similar topics

SL.4

- Present information and supporting evidence appropriate to task, purpose, and audience

Next Generation Science Standards (NGSS)

MS-LS1.D/HS-LS1.D Information Processing

Practice Obtaining, Evaluating, and Communicating Information

Cross-Cutting Concept Cause and Effect: Mechanism and Prediction

Additional Lesson Resources

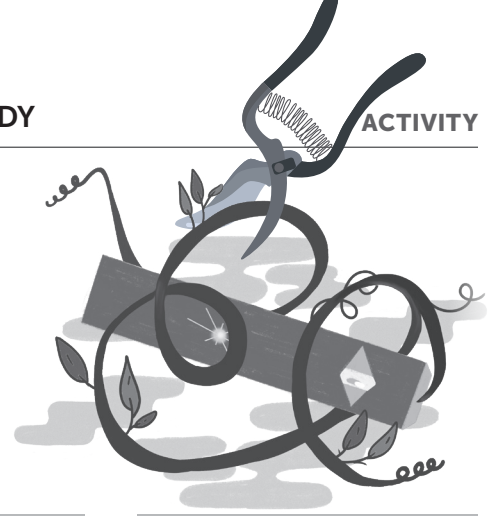
Vocabulary Support: Download terms and definitions at scholastic.com/headsup/how-nicotineaffectsthetenbrain

More Lessons on Science and Health:

- headsup.scholastic.com/teachers
- teens.drugabuse.gov



Vaping Health Risks: Presentation Activity



Many teens don't know the real health risks of vaping or assume it is safer than smoking conventional cigarettes. Follow the steps below to create a presentation to help your peers get the real facts.

STEP 1: RESEARCH AND GATHER INFORMATION

Read the passage below, then explore the links in the Find Out More section beneath it. As you read, make notes of details you think teens should know about the health risks of vaping and nicotine.

What Are the Dangers of Vaping?

Recent surveys show that the number of teens who have tried vaping devices (also called e-cigarettes) is on the rise. While many kids assume that e-cigarettes are safe, the truth is that vaping is harmful to teens in many ways.

All vaping devices basically work the same. When someone puffs on the mouthpiece, a battery heats up a liquid made up of chemicals like nicotine and flavoring. The liquid gets turned into an aerosol that the user inhales. (The aerosol resembles a vapor—that's where vaping gets its name.)

Almost all vaping devices, including Juul products and Puff Bars, contain nicotine. Found naturally in tobacco, nicotine is especially harmful to teens because their brains are still developing. Using nicotine can affect parts of the brain that control learning and attention as well as cause addiction. In fact, the number of teens who say they use e-cigarettes because they are "hooked" more than doubled between 2018 and 2019.

Teens who vape may not realize how much nicotine they're being exposed to. The nicotine content of one Juul cartridge and some Puff Bars is the same amount found in an entire pack of cigarettes.

Vaping also exposes people to other dangerous materials. Flavoring chemicals are added to many vaping liquids, which can be harmful if inhaled into the lungs. Vaping aerosols may also contain formaldehyde—a hazardous chemical that can cause cancer—and toxic metals like cadmium.

STEP 2: CREATE YOUR PRESENTATION

Think about how you can use information you've gathered to create a presentation that will help your peers understand the dangers of vaping. Be creative! For example, test your classmates' knowledge by creating one of the following:

- **Online quiz game** (try using the game platform Kahoot!)
- **Flip cards with questions about key facts**
- **Video**
- **Blog post**
- **Collection of sample social media posts**
- **Choose your own idea!**

Make sure your presentation includes important facts and surprising details that will capture your audience's attention. Be sure your facts come from trusted sources only.

Find Out More

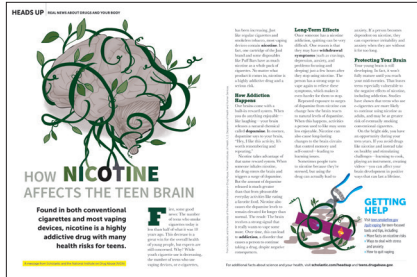
• **Vaping Risks interactive:** scholastic.com/headsup/vapingrisksinteractive

• **Three Surprising Risks From Vaping:** teens.drugabuse.gov/vapingrisks1

• **Monitoring the Future 2019: The Highs and Lows of Vaping:** teens.drugabuse.gov/vapingrisks2

VOCABULARY LIST

How Nicotine Affects the Teen Brain



Find the article at:
scholastic.com/headsup/hownicotineaffectstheetenbrain

addiction (*noun*): a brain disorder or illness associated with compulsive (uncontrollable) behavior, such as drug use, despite negative consequences

addictive (*adjective*): something, such as a drug, that causes addiction

conventional (*adjective*): traditional

cartridge (*noun*): a container that can be easily changed and holds a substance such as a liquid that is difficult to handle

circuit (*noun*): a path between points over which signals can move

consequence (*noun*): a result or outcome

dopamine (*noun*): a chemical in the brain that helps send signals between nerve cells and is associated with feelings of pleasure

elevated (*adjective*): increased, especially to an abnormal level or amount

exposure (*noun*): the condition of being affected or influenced by something else

nicotine (*noun*): the chemical found in tobacco that is addictive

stimulating (*adjective*): exciting or interesting in an enjoyable way

surge (*noun*): a sudden increase to a high level

tobacco (*noun*): a plant with nicotine-rich leaves that are processed in order to be chewed or smoked

vaping device (*noun*): an electronic device, often shaped like a cigarette, that uses a battery to heat up a liquid, which usually contains nicotine, so that it can be inhaled. Also called an electronic cigarette (e-cigarette).

vulnerable (*adjective*): able to be hurt or damaged

withdrawal symptom (*noun*): a physical change that occurs as part of the body's response to the sudden removal of a drug to which it has gotten used to being exposed

