

## Computer Innovations

### Textbook

## Computer Innovations



We are experiencing new innovations all the time in the modern world. Technology is advancing quickly, and it seems like every year more and more inventions and updates are becoming commonplace. When a new technology is introduced, it often changes the way people complete tasks, approach problems, and ultimately live their lives. What are the impacts of these innovations? How might they affect society in the long run? What might immediate consequences be?

We will explore a communication innovations as an example and examine what kinds of effects it has had on our lives and society. Not every effect of a computing innovation is anticipated in advance, so we will discuss the positive and negative effects.

## Communication Innovation Example

One of the most obvious innovations is in communication. Communication methods are almost instantaneous now. Before the internet, people either wrote a letter that took a few days to arrive, called them on the phone when they were available, or sent a fax if they had a fax machine.

Now, emails and messaging services make it so we can communicate whatever we want to whoever we want instantly. The introduction of conference call softwares like zoom or google meet have expanded the ability for people to meet from anywhere in the world. The purpose of these innovations was to improve communication speed and efficiency.

Discussion Questions: What other effects have instant communication had on society? What about your personal life?

With such fast communication methods, have we as a society become less patient with things that take more time? Does the anonymity of email and messaging encourage people to communicate more harshly? Or does it help people to monitor their words and choose what they say more carefully?

## Unintended Effects

Computing innovations can be used in ways that their creators had not originally intended. For example, social media was intended as a way for people to stay in touch, but it can also be used for angry groups to collaborate. The World Wide Web was originally intended only for rapid and easy exchange of information within the scientific community, but it's also used to spread crime. Targeted advertising is used to help businesses, but it can be misused at both individual and corporate levels to manipulate behavior.

Sometimes when a new innovation expands really quickly to many people it opens the possibility for it to have an impact beyond the control of the programmer. This can be a good or a bad thing.

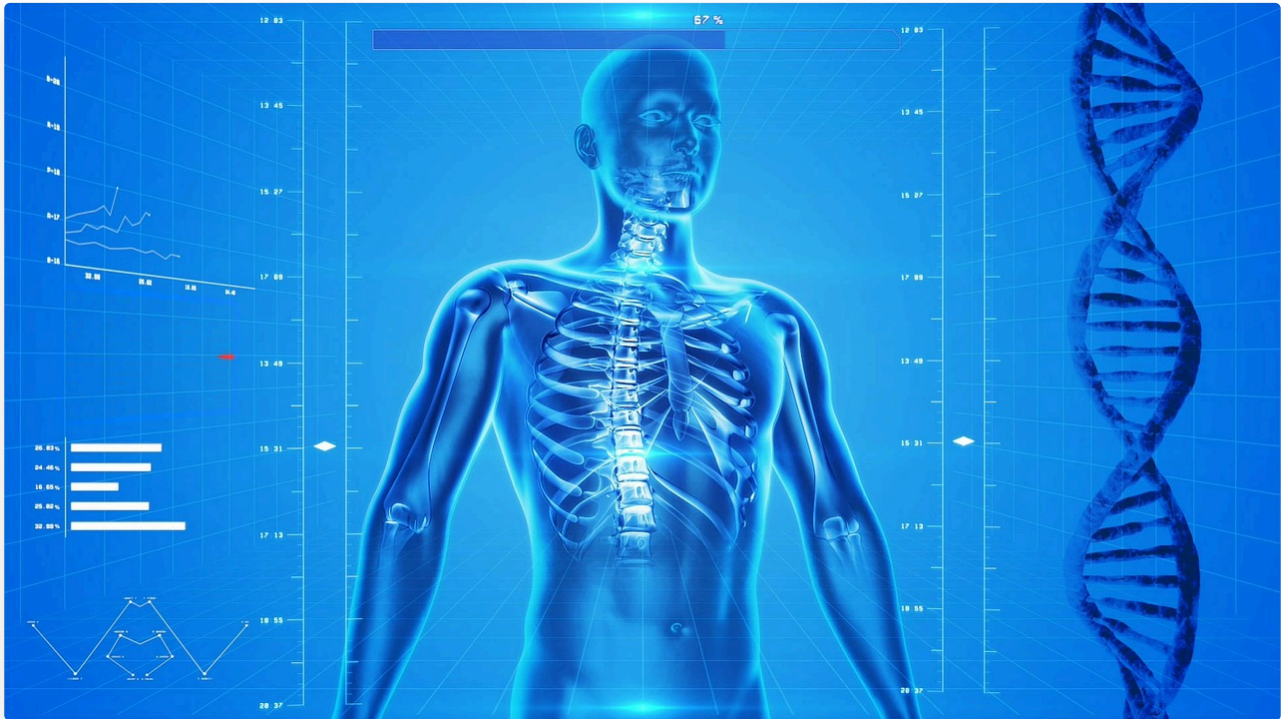
Responsible programmers try to consider the unintended ways their computing innovations can be used and the potential beneficial and harmful effects of these new uses. It's impossible to anticipate the many varied and twisted ways that someone might use an innovation, but programmers have a responsibility to try to do what they can to mitigate these potential uses. If a programmer has an innovation with an intended use, they should test it with smaller groups to see how it is used and observe how people respond. This method of testing can help to reveal potential negative uses.

We should also take note that an effect can be seen as positive by some people and negative by others. Sometimes, even the same person can change their opinions or behaviors. Good and bad, right and wrong are not always clearly defined.

Fortunately, computing innovations have often have unintended beneficial effects by leading to advances in other fields as well. It's true that a programmer can't predict all the ways their innovation will affect society, but it could also greatly help out other fields in ways they never imagined.



# Advancing Other Fields (Medicine, Engineering, Communication, the Arts)



Advances in computer science help other fields advance as well. Consider our new ability to compute with extremely large sets of data. This has enabled us to chart out and map entire DNA sequences which have helped the medical field. Not to mention the libraries of medical information that are more readily available to all medical professionals with the internet.

**Engineering** fields also are better able to generate simulations of possible solutions. These simulations allow them to analyze different options of solutions and determine the best way to move forward. This saves a lot of time and resources.

**Animation** studios have greatly benefitted from advances in computer algorithms. Think about how older animated movies were made by drawing each and every frame. Now with computer programs we are able to animate movies in greater detail at a fraction of the time.

**Marketing** has also been completely revolutionized with the internet. Before the internet, avenues like newspaper articles, highway billboards, and mail pamphlets were the way to get advertising out to the people. Now we have websites, YouTube videos, social media, and blogs to catch people's attention.

Every other field is affected by advances in computer science.

Question: What are some unintended negative effects computer science advances have had on the medical, engineering, arts, and communication fields?

## Activity

Design an app! What kind of app do you think would be really awesome and useful? Get a piece of paper and draw out what the app user interface would look like. What would the home screen look like? How would they navigate? What would the app do for them? Why would people want to use it?

Consider the following as you design your app:

- What can you do to make your app accessible by all kinds of people? Consider people with different physical and mental abilities.
- How can your app be used to narrow the Digital Divide? In other words, how can people from different socioeconomic, cultural, or digital backgrounds use your app?

- How might your innovation be used for good or bad? Can you think of ways people might misuse it?  
How can you minimize this possibility?

## Summary

Computer science innovations have a huge effect on society. Often the person who created the innovation had an intention by creating the new innovation. Since so many people use the innovation, it gets used for purposes beyond what was intended. This can be for good or bad. Programmers need to be cautious about the innovations they create and to consider all the possible ways they might be used.

## AP Standards

CRD-2.F.2

CRD-2.F.6

IOC-1.A.1

IOC-1.A.2

IOC-1.A.3

IOC-1.A.4

IOC-1.A.5

IOC-1.B.1

IOC-1.B.2

IOC-1.B.3

IOC-1.B.4

IOC-1.B.5

IOC-1.B.6

IOC-1.D.1

IOC-1.D.2

IOC-1.D.3

IOC-1.F.8

IOC-1.F.9

IOC-1.F.11

## CSTA Standards

3A-IC-24

3A-IC-26

3A-IC-27

3B-IC-25

3B-IC-26

3B-IC-27

3B-IC-28

## Questions (10)

**1. True or False: A programmer can predict all the ways their innovation might be used.**

MULTIPLE CHOICE

Choose the correct answer:

- A. True
- B. False

**2. Responsible programmers should do which of the following? Select all that apply.**

SELECT MULTIPLE

Select all that apply:

- A. Test their innovation with a smaller group of people and observe what they do.
- B. Try to think through all the possible ways their innovation might be used--for good or bad.
- C. Try to minimize the way their innovation could be used for bad.
- D. Try to expand their innovation to as many people as possible before thinking through varied ways it can be used.

**3. True or False: Advances in computer science help other fields progress as well.**

MULTIPLE CHOICE

Choose the correct answer:

- A. True
- B. False

**4. True or False: An effect can be seen as positive by some people and negative by others.**

MULTIPLE CHOICE

Choose the correct answer:

- A. True
- B. False

**5. True or False: Computing innovations are always nonphysical, like software or websites.**

MULTIPLE CHOICE

Choose the correct answer:

- A. True
- B. False

**6. Which of the following fields is affected by computer science innovations? (Select all that apply)**

SELECT MULTIPLE

**Select all that apply:**

- A. Medicine
- B. Engineering
- C. Animation
- D. Marketing

**7. Discussions that include diverse perspectives that help avoid bias in the development of computing innovations are called what?**

MULTIPLE CHOICE

**Choose the correct answer:**

- A. Collaborations
- B. Simulations
- C. Algorithms
- D. API's

**8. What is an approach that helps facilitate collaboration in innovating?**

MULTIPLE CHOICE

**Choose the correct answer:**

- A. Pair programming
- B. Simulations
- C. Bias
- D. Outside libraries

**9. True or False: The more people who look at an innovation and give feedback, the better the innovation will be.**

MULTIPLE CHOICE

**Choose the correct answer:**

- A. True
- B. False

**10. True or False: Collaboration that includes diverse perspectives helps to avoid bias.**

MULTIPLE CHOICE

**Choose the correct answer:**

- A. True
- B. False

## Answer Keys & Solutions

### Questions

**1. True or False: A programmer can predict all the ways their innovation might be used.**

MULTIPLE CHOICE

**Correct Answer:**

A. True

✗ Incorrect

B. False

✓ Correct

**Explanation:**

There are infinite ways a computer program can potentially be used.

**2. Responsible programmers should do which of the following? Select all that apply.**

SELECT MULTIPLE

**Correct Answers:**

A. Test their innovation with a smaller group of people and observe what they do.

✓ Correct

B. Try to think through all the possible ways their innovation might be used--for good or bad.

✓ Correct

C. Try to minimize the way their innovation could be used for bad.

✓ Correct

D. Try to expand their innovation to as many people as possible before thinking through varied ways it can be used.

✗ Incorrect

**Explanation:**

It's important to think through varied ways an innovation might be used before expanding.

**3. True or False: Advances in computer science help other fields progress as well.**

MULTIPLE CHOICE



**Correct Answer:**

A. True

✓ Correct

B. False

✗ Incorrect

**Explanation:**

Computer science helps all other fields progress.

**4. True or False: An effect can be seen as positive by some people and negative by others.**

MULTIPLE CHOICE

**Correct Answer:**

A. True

✓ Correct

B. False

✗ Incorrect

**Explanation:**

People have their own backgrounds and perspectives.

**5. True or False: Computing innovations are always nonphysical, like software or websites.**

MULTIPLE CHOICE

**Correct Answer:**

A. True

✗ Incorrect

B. False

✓ Correct

**Explanation:**

Computing innovations can be either physical or nonphysical.

**6. Which of the following fields is affected by computer science innovations? (Select all that apply)**

SELECT MULTIPLE

**Correct Answers:**

- |                |           |
|----------------|-----------|
| A. Medicine    | ✓ Correct |
| B. Engineering | ✓ Correct |
| C. Animation   | ✓ Correct |
| D. Marketing   | ✓ Correct |

**Explanation:**

Every other field is affected by advances in computer science.

**7. Discussions that include diverse perspectives that help avoid bias in the development of computing innovations are called what?**

MULTIPLE CHOICE

**Correct Answer:**

- |                   |             |
|-------------------|-------------|
| A. Collaborations | ✓ Correct   |
| B. Simulations    | ✗ Incorrect |
| C. Algorithms     | ✗ Incorrect |
| D. API's          | ✗ Incorrect |

**Explanation:**

Collaborating helps improve innovations

**8. What is an approach that helps facilitate collaboration in innovating?**

MULTIPLE CHOICE

**Correct Answer:**

- |                      |             |
|----------------------|-------------|
| A. Pair programming  | ✓ Correct   |
| B. Simulations       | ✗ Incorrect |
| C. Bias              | ✗ Incorrect |
| D. Outside libraries | ✗ Incorrect |

**Explanation:**

Working in pairs helps programmers avoid bias.

**9. True or False: The more people who look at an innovation and give feedback, the better the innovation will be.**

MULTIPLE CHOICE

**Correct Answer:**

A. True

✓ Correct

B. False

✗ Incorrect

**Explanation:**

The more people that participate, the more well rounded the innovation.

**10. True or False: Collaboration that includes diverse perspectives helps to avoid bias.**

MULTIPLE CHOICE

**Correct Answer:**

A. True

✓ Correct

B. False

✗ Incorrect

**Explanation:**

The more perspectives you get on a project, the less bias there will be.