Teaching the Nature of Technology

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Overview:

- ★ Brief intro to the Nature of Technology (NoT)
- ★ Bit about technology standards
- ★ Examples (and activities) of NoT examples for the classroom
- ★ NoT over and across the curriculum
- ★ Question time (probably won't get here) — but interrupt me at any time

We seem to be fighting an uphill battle against two things:

1. The “humans are like water” argument — we tend to take the path of least resistance.
2. We love novelty, even if bad for us.

Before we get properly started . . .

What do students normally learn about technology in school?

What are the major components of technology education (e.g., media literacy)?

Major Components of Tech Curricula

- Computer Literacy
  - Digital Literacy, Media Literacy
- Digital Citizenship
- Computer Science
- Computational Thinking
- The Nature of Technology

So, what's this Nature of Technology stuff?

- Per Kruse (2013), NoT focuses on "the philosophical underpinnings and social consequences of technology" to help students "more effectively question and more meaningfully reflect on technology use" (p. 391).

In short, we're not focused on how; we want to zoom in on when, what and why.

Today, our major consideration is this:

What goals are we ultimately pursuing, and how can we best get there? How, if at all, can technology help us get there?

Technology is not an end in itself. It is a means to an end.

Something to consider as we go along our merry way:

A major argument for adopting these technologies:

"Students are interested, ***therefore*** we need to adopt them."

"This technology isn't going anywhere, ***therefore*** we need to adopt it."

Would we accept this logic about chemical weapons in the military or phones in the classroom?

In short, these questions are what NoT is about.

Where does the Nature of Technology fit in?

1.1.a – Students can set personal learning goals and leverage technology to improve learning.

1.3.d – Students build knowledge by exploring real-world issues and problems, developing ideas and theories as they do.

1.4.d – Students exhibit a tolerance for ambiguity and persevere in the face of open-ended problems.

1.7.d – Students explore local and global issues to investigate solutions.

International Society for Technology in Education, Standards for Students, 2016

Major Topics in NoT:

- ★ Identifying and defining technology
- ★ The nature of technological progress
- ★ The value-laden, biased nature of technology
- ★ The limitations of technology
- ★ Technological trade-offs
- ★ The interaction of technology and culture
- ★ Technology enhancing and limiting human activity and thinking
- ★ Factors affecting the development and adoption of new technologies

Start Simple: Opening Questions

What *is* technology?

Does a chair count?

Okay, then what about swimming?

And algebra?

What *doesn't count* as technology?

Can animals use/create technology?

1) Get students thinking about technology generally

2) Get them to start noticing what tech **is** and **isn't**

3) Help them reflect on how humans rely on technology for just about everything in life

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Important note:

Trade-offs aren't just random good and bad things. They are **related to one another**.

You **gain** something, but **lose** something related. (The loss and gain are about the same thing. Think of this like a transfer.)

Wetting our feet: Are these trade-offs?

My planner helps me keep track of everything I have to do, but it's easy to lose.

My lawn mower saves me a lot of time, but it kills a lot of bugs.

My calculator makes solving equations easier, but it also keeps me from practicing sometimes-basic math skills.

Trade-Offs Practice

Let’s start easy:

Daylight Savings Time

A little harder:

A bit more difficult:

Working while a full-time student

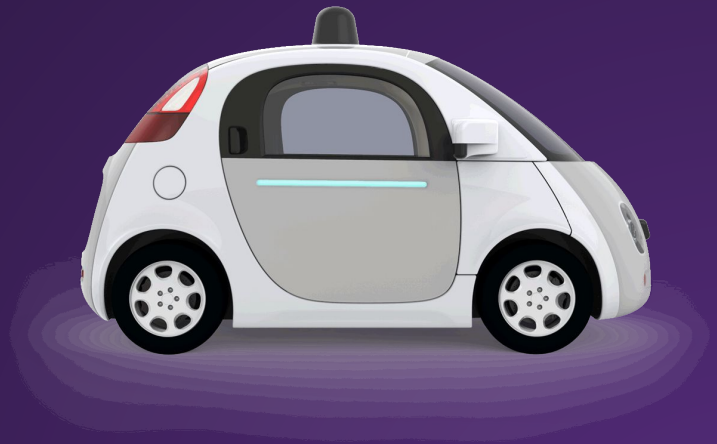
Always keeping track with lists,

memos, day-planners, notifications

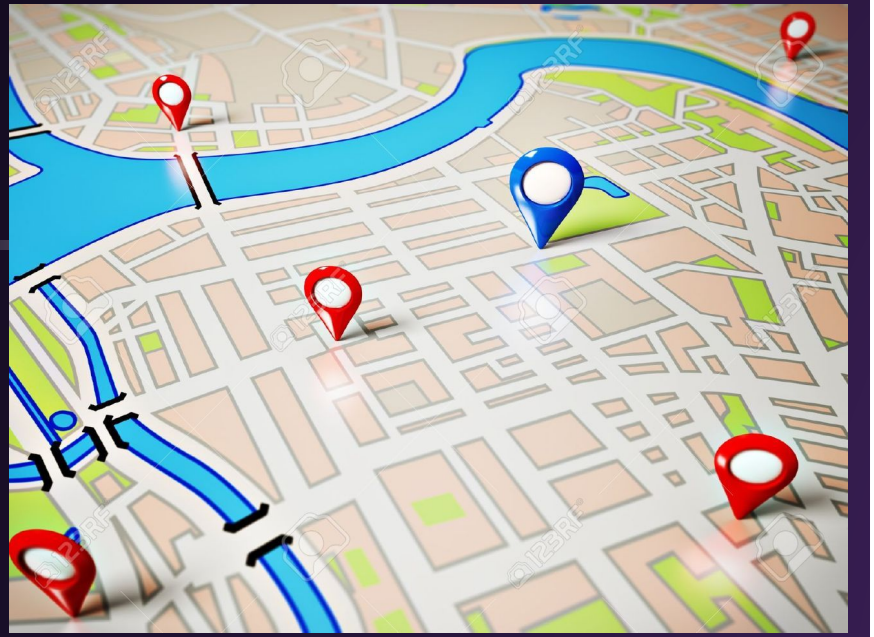
Moving into technologies

This is an automobile. Let's analyze.

Gained	Aspect	*Lost*
Fast	Speed	
Independence	Social	



Example 2: What is this technology?



Gained	Aspect	*Lost*
Precision	Navigation	Exploration
Following directions	Skills	Mental map/Sense of direction
Functional	Relationship to place	Intimacy/ "lived-in"

Famous London cab studies, larger hippocampi, decreased spatial awareness, loss of mental maps

Where you knew we were headed . . .

Gained	Aspect	*Lost*
Access	Skills	Mental work
Solution	Problem S.	Perseveren ce
Gain time	Time	long-term

Points for Discussion:

- “Main danger” is incorrect information.
  - Is that right?
  - Pretend it only gives correct information. What other problems remain?
- On the tutoring front, we heard today that AI don’t actually have knowledge, which is true. The don’t understand anything.
  - What problem does this immediately raise?
  - How effective is this as a tutor?

1) Get students thinking about the trade-offs hiding behind all the technologies we use on a daily basis — What is lost? What is gained?

2) Give them opportunities to think about the mixed effects of technologies: Is there ever a purely good or bad technology?

3) Help them realize that we never gain anything without losing something else (and we need to ask ourselves: is that okay? What am I giving up? Is it worth it to me?)

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Cognitive Artifacts

Cognitive:

Having to do with thinking or perception.

Artifact:

Any object (usually tangible) created by humans for use.

Cognitive Artifact:

Any object that we create that shapes the way we deal with information in the world.

(A bit complicated, I know.)

Simply put:

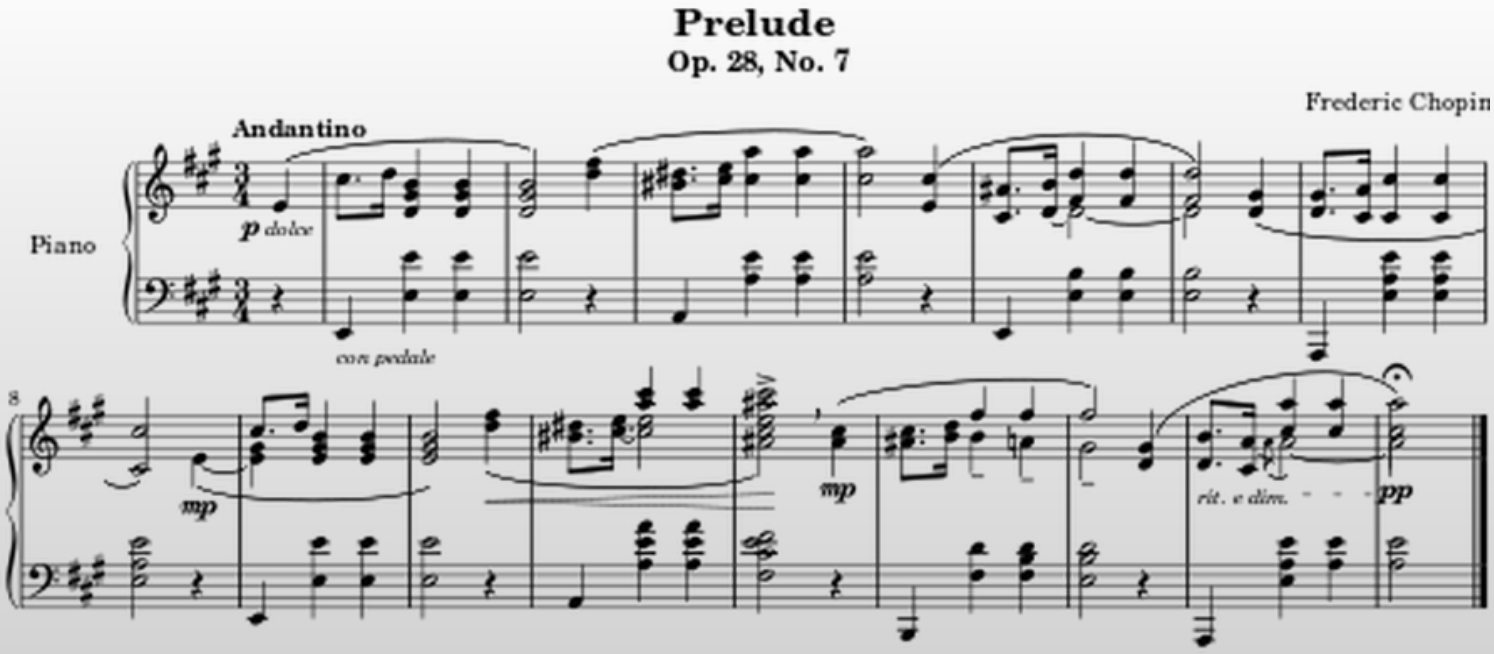
Technologies that help us deal with information better. (They aid with mental processes.)

Is this an artifact?

Is this a cognitive artifact?

Is the written word an artifact?

Is it a cognitive artifact?



What about a musical score or musical notation?

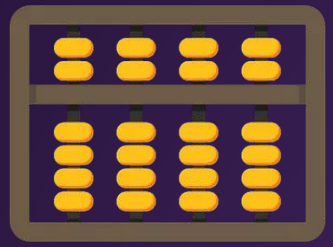
With the person next to you (or by yourself),

Come up with three additional cognitive artifacts (a tool that helps us deal with information).

A (specious) binary

Complementary

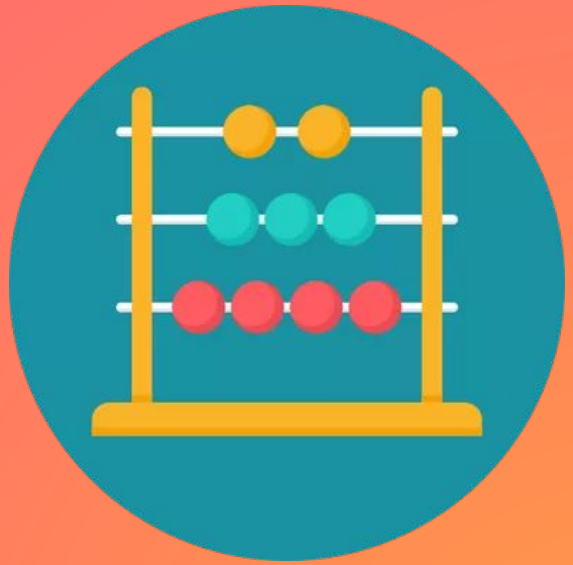
Cognitive artifacts that improve human abilities. They help us think or manage information when we use them and even when we don't have them on hand. **We gain a mental equivalent.**



Competitive

Cognitive artifacts that improve human abilities. They enhance our abilities when using them, but when we take them away, our abilities either stay the same, or get worse. **We do not gain a mental equivalent.**

Complementary cognitive artifact: the abacus



Types of Cognitive Artifacts — Activity

Complementary:

Those that help when we have them on hand and even when we don't.

Training Wheels:

Those that help us as we learn a skill, but we don't need them forever. They help us transition to a mature ability.

Competitive:

Those that compete with our native abilities. Helpful when we have them, but they leave us no better off than before.

More points for discussion:

- Two examples from this morning:
  - ChatGPT rewrites your sentences.
  - ChatGPT expands your writing to include more detail all while improving grammar and flow.

"This left the writer off in a much better place than before."

In what ways is this true/untrue?

What is our ultimately goal, and is ChatGPT getting us there?

Back to our main course: AI in education

Based on our discussion:

Where does AI (like Chat GPT) fit into this scheme?

What responsible ways (if any) could we incorporate AI into education that wouldn't **compete** with our native skills and abilities? How can it help us without hurting us in the long run?

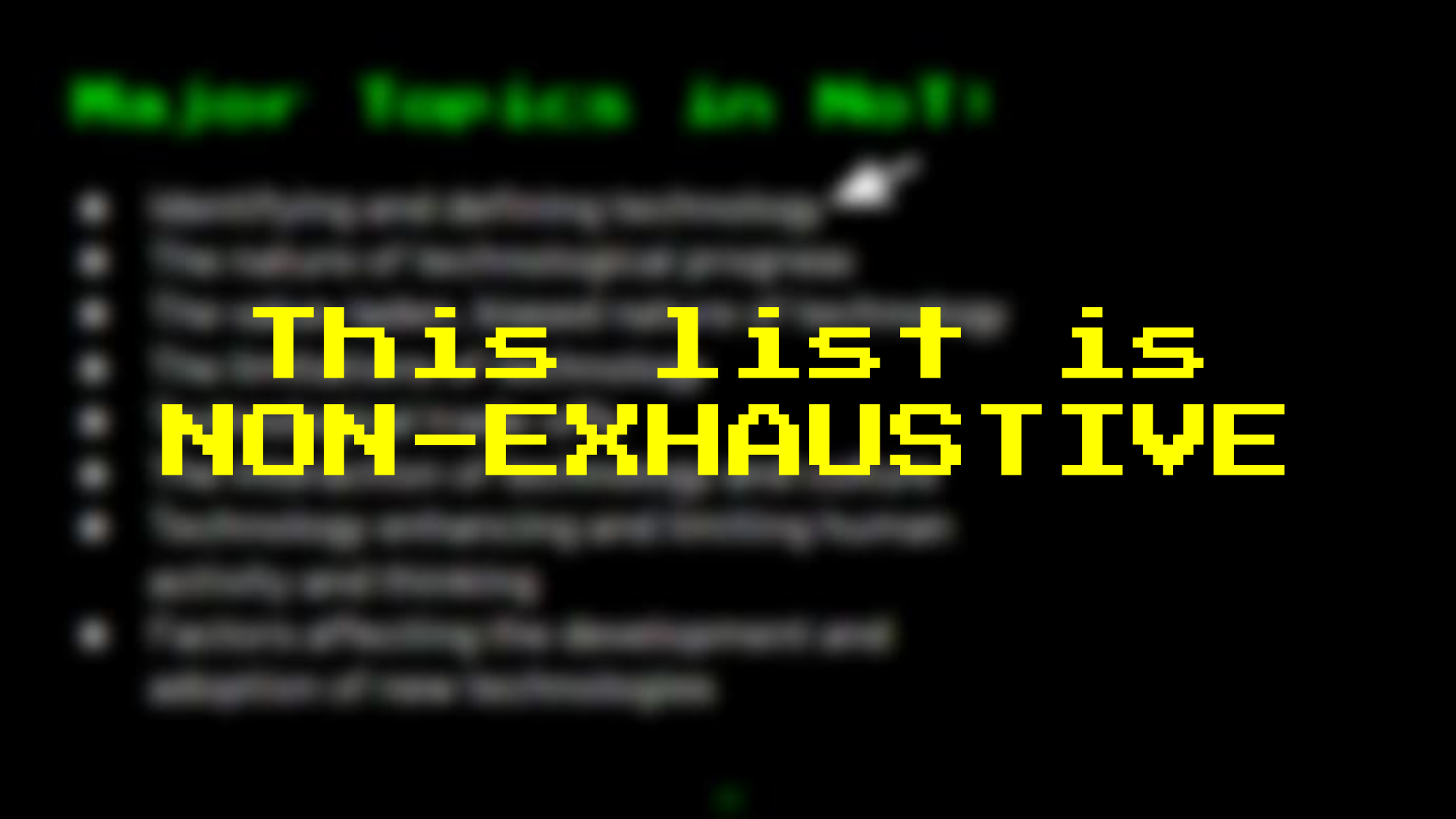
Thinking of cognitive artifacts:

- ★ *Who – or what – is doing the thinking?*
- ★ *Who – or what – is improving?*
- ★ *Who – or what – is expressing your thoughts, opinions, and feelings?*

1) Continue having students think about their personal use of technology — and our responsibilities when using certain tech

2) Ask them to consider technology more broadly: Which technologies are good for society?

3) Get them to confront the question: which skills and abilities do I care about having myself, and which am I okay "outsourcing" to AI or other technologies?


This list is
NON-EXHAUSTIVE

Scope of Technology standard across the grades

International Technology and Engineering Educators Association, 2007. pp. 21 - 31.

Grades K-2

Students learn that . . .

1) The natural world and the human-made world are different.

2) All people use tools and techniques to help them do things.

Grades 3-5

Students learn that . . .

1) Things that are found in nature differ from things that are human-made in how they are produced and used.

2) Creative thinking and economic and cultural influences shape technological development.

Grades 6-8

Students learn that . . .

1) New products and systems can be developed to solve problems or to help do things that could not be done without technology.

2) Technology is closely linked to creativity, which has resulted in innovation.

Grades 9-12

Students learn that . . .

1) The nature and development of technological processes are functions of setting.

2) The rate of technological development and diffusion is increasing rapidly.

Big Questions across the grades

Grades K-6

1) What things are part of nature, and what things are made by people?
2) Why do people make new tools and technologies?

Grades 6-8

1) What counts as technology? Can animals use technology?
2) How does technology transform over time?

Grades 9-12

1) Is it fair to say that technology can both be a *thing* and a *process*?
2) What is the nature of technological progress: evolution or revolution?

Scaling activities across the grades

Grades K-6	Grades 7-8	Grades 9-12
List some good and bad things about video games.	What *related* trade-offs can you see for a smartphone?	Is any technology ever 100% good or bad? Does it matter how it's used?
Is the car a good technology? Why or why not?	On the whole, are cars more positive, negative, or neutral?	Can you think of any technologies without trade-offs?

Infusing NoT across the curriculum

English/Language Arts:

Evaluate the effects of the written word on human history.

Discuss why dependence on editing software (e.g., Grammarly) might not be a positive thing.

Give a nuanced definition of what technology is and isn't.

Keep a log of personal tech use.

Mathematics:

Discuss what values are inherent in math (e.g., logicality, the concept of proof, visual/spatial thinking).

Ponder: is math a technology?

Debate the use of mathematics outside of school.

Infusing NoT across the curriculum

Sciences:

Examine the benefits and costs of automation and artificial intelligence.

Debate the limits of the scientific method.

Have young scientists list pros and cons for various technologies.

Social Studies:

Debate the role of technology on governance and control.

Trace the history of a given technology over time.

Analyze technology's impact on politics and culture.

Infusing NoT across the curriculum

Arts:

Examine and debate art created by artificial intelligence. Is it art?

Debate whether or not creativity is only found in humans, or if an AI can be creative.

Teach art history and the influence of new techniques and materials in different schools of art.

Foreign Language:

Discuss the trade-offs of translation software.

Debate whether instant translation via computers makes learning a second language useful or not.

In the end:

(Almost) Everything we engage with is technology.

NoT provides the *why* and *how should* to technology education.

We'd better start helping students understand how to engage with it *intelligently*, *ethically*, and *responsibly*.

It engages students in philosophy, critical thinking, problem-solving, and critical reflection.

Humans + AI* > Humans || AI

It gives us a framework as educators for including technology meaningfully and thoughtfully in our classrooms.

*AI used wisely and responsibly

Questions?

That's all, folks!

Feel free to reach out:

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