



Manifesto

Humanity's progress has stemmed from one thing: *Curiosity*.

From deploying the internet to sending rovers to Mars—every innovation has only ever existed because its creator was naturally curious about something. Curiosity pushes us to ask questions, explore, and challenge the boundaries of what we know.

Yet, this same curiosity often withers within the confines of modern education. Education, at its core, is the process of transforming raw information into deep, intuitive understanding. And once that understanding takes root, curiosity takes over to drive exploration & innovation. However, the traditional education system relies on lecture based learning, which has consistently fallen short of covering the four components of true education:

1. **What is it?** (The formal definition)
2. **Where does it come from?** (The intuition)
3. **How do I use it?** (Problem-solving and practical application)
4. **So what?** (Its relevance to careers, research, and the real world)

To bridge these gaps, students often turn to external resources. But existing platforms, while valuable, remain fundamentally incomplete. Videos like those from 3Blue1Brown offer rich conceptual explanations and broader applications but fail to show how concepts translate into problem-solving. Conversely, platforms like Khan Academy and Organic Chemistry Tutor excel at procedural learning but lack the deeper intuition and relevance needed to make knowledge truly stick.

And then there's the problem of scope. These resources are inherently limited. If a student wants to explore a niche topic—perhaps the geometric intuition behind eigenvectors or the role of differential equations in neuroscience—they're at the mercy of whatever content/style of explanation happens to exist.

Now you might be wondering, how do we know all of this? Well, we're students! We've spent years navigating these exact challenges ourselves. And now we're here to bridge this gap for the next generation of learners—with Curiosity Education.

Much more to come,
-the curiosity-edu team

Advaith, V. Shlok, R. Vishal Y.

<Our roadmap>

Our first MVP:

Goal: Develop a system capable of automatically generating and recreating a [3Blue1Brown](#)-style video that teaches a subject using a first-principles approach, starting from a given prompt on the topic.

Version 0.1

Prompt: *Teach me about limits*

Result: [VIDEO-2025-01-15-18-34-03.mp4](#) *this was completely AI generated by our system using just the prompt

... **now working on**  **Version 0.2**  !

Our approach: First Principles Thinking

Learning the 21st century way

Simply put, First Principles Thinking (FPT) is a method of learning that focuses on breaking down complex ideas into their most fundamental truths. It forces us to step back from assumptions and what people around us "know" to be true.

And here's Elon Musk, a renowned FPT enthusiast, to tell us why this is important.

"We get through life by reasoning by analogy, which essentially means copying what other people do with slight variations. And you have to do that. Otherwise, mentally, you wouldn't be able to get through the day. But when you want to do something new, you have to apply the first-principles approach."

And, he's right! In our daily lives, we often rely on analogies and assumptions to navigate familiar problems efficiently. This approach works well for routine tasks but falls short when we face challenges that demand creativity, entrepreneurship, & innovation.

How does FPT actually work?

FPT requires a complete breakdown of any problems and assumptions that someone might have.

In its practice, instead of asking “*What has worked before?*” or “*How have others solved this?*”, we ask “*What if this isn’t true?*” and “*Why does this work?*” By doing so, we *reconstruct our understanding from the ground up*, based on evidence and logic rather than inherited beliefs or analogies.

In contrast, analogical reasoning is solving problems based on prior assumptions and the best practices that are widely accepted.

For example, a carpenter using first principles thinking might start by grounding his understanding in the fundamental properties of materials such as wood, metal, or other composites—strength, flexibility, grain direction—and the principles of ergonomics and aesthetics. With this core understanding, they could innovate and create a completely new type of chair or table that is functional and beautiful, perhaps incorporating modern technology or unconventional materials.

A carpenter who doesn't apply FPT might stick to existing blueprints or traditional designs to yield functional furniture—which is perfectly fine and effective. However, the first carpenter is the one who has more potential to keep innovating and redesigning what furniture can be.

FPT in practice...

How to teach via FPT? Here's a high-level example of a lesson that does just that:

Topic: Derivatives

Step 1) Define current assumptions and related knowledge

You must start by identifying what the students already know and understand about related concepts.

In the case of the derivative,

- Discuss familiar ideas, like the slope of a straight line ($y=mx+b$) and how “m” represents the rate of change.
- Highlight the assumption that the slope applies uniformly to the entire line and challenge this by introducing the idea of variable rates of change (e.g., for a curve).

Encourage questions like:

- “What happens when the rate of change isn't constant, like on a hill or a speeding car?”

- "How can we describe what's happening at a specific point instead of across an interval?"

After some elaboration, by the end of this step, the student should be able to answer or at least be actively thinking about these types of questions.

1. What does the slope of a line **represent in real-world terms** (e.g., rate of change)?
2. How does the concept of a slope **relate to** instantaneous rates of change?
3. How might the concept of a tangent line **help describe** changes at a single point?
4. **Why is it important to understand** how something changes at a specific moment rather than over an interval?

Notice how the term derivative hasn't even been introduced yet - but the concept has! This not only builds a strong foundation for the students to go off of, but it also doesn't become overwhelming

Step 2) Break down the topic into its fundamental principles

This step is about inserting the concept of the derivative into the current cloud of thought we've built in the students.

- Frame the derivative as a natural extension: *"The derivative is the slope of a function at a single point."*
- Show how a tangent line represents the slope at one specific point. Use graphs to illustrate this.
- Demonstrate how the slope of a secant line (average rate of change) evolves as the two points get closer together.
- Introduce the concept of a limit: "As the interval between the points approaches zero, the secant line becomes the tangent line, and its slope is what we call the derivative."

Then, formally write the derivative using the limit definition, but also make sure to break down the formula and point to what each part means, and how it connects to the overall concept of a derivative.

If demonstrating practice problems ensure that a mix of them are open-ended.

It's perfectly fine to have numerical answers but dig deeper into the meaning of the answer. Mainly, how could you have tried to solve this problem without knowing this new concept? Why would it have failed? Why does this one work? Is there an alternate way to arrive at the solution?

Step 3) Relevance

"You can't remember what you can't connect!"

This step is arguably one of the most important steps in fostering FPT. Research has consistently shown that students are more engaged and retain information better when they see how abstract concepts connect to their lives and the world around them.

Real-world scenario: Driving a car

"If the speedometer shows your car's speed at a specific moment, that's an instantaneous rate of change—a derivative of distance"

You could even go a bit deeper and discuss how acceleration is the *derivative* of velocity—include the units - how velocity (mph) goes to miles per square hour.

Real-world application: Economics

"In business, derivatives are used to find how profit changes as production increases or how cost varies with different levels of output."

Further reading

Our inspiration

- **3Blue1Brown (3B1B)**– <https://www.3blue1brown.com>
- 3Blue1Brown is a YouTube channel by Grant Sanderson that uses stunning visual animations to intuitively explain complex mathematical concepts. ***This is a living example of how to teach via first-principles***
 - Check out his Calculus videos!
<https://www.youtube.com/watch?v=WUvTyaaNkzM&list=PLZHQObOWTQDMsrgK-rj53DwVRMYO3t5Yr>
- **[Elon Musk's 2 Rules For Learning Anything Faster](#)**
- This video outlines two key principles for effective learning—and ***breaks it down how to structure content in a practical manner***. Here's a quick summary:
 1. Start with the Basics: Focus on understanding the core concepts—the “trunk of the tree”—before diving into the finer details, which represent the “branches.” Mastery of the basics provides a solid foundation for deeper exploration. At this stage, you can leverage guidance from teachers or mentors to refine specific techniques or problem-solving skills.
 2. Create Meaningful Connections: Link your knowledge to something significant by placing it in context. This involves connecting the “branches” of different trees, fostering interdisciplinary understanding. For instance, relate a mathematical concept to other areas within math, and then bridge it to fields like biology, engineering, or aerospace, creating a web of interconnected insights.

- The **DRAPA Digital Tutor Paper** provides insights into a Navy study that explores a first-principles approach to technical education via a scientifically backed study. You can access the full paper here: <https://apps.dtic.mil/sti/tr/pdf/AD1002362.pdf>.

Contact Us

We'd love to hear from you! Whether you have **questions, suggestions, or want to collaborate**, feel free to reach out.

 **Email:** team@curiosity-edu.org

 **Website:** curiosity-edu.org

Let's build the future of education—together! 

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