Lesson Plan: Teaching AI Research Through Andrej Karpathy

Course: Grow Your Own Educator Preparation Program

Grade Level: 9-12 (Future Educators)

Duration: 35-40 minutes

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Learning Objectives

By the end of this lesson, students will be able to:

1. Define AI research, neural networks, deep learning, and transformers in plain language
2. Explain Karpathy's "build from scratch" teaching philosophy
3. Apply the principle of unpacking complexity (no black boxes) to lesson design

Standards Alignment

Texas TEKS - Instructional Practices (Education and Training Career Cluster):

TEKS	Standard
4	**The student understands the learner and the learning process.** Demonstrate techniques for development of effective relationships with students that foster mutual respect and rapport and result in effective instruction.
5	**The student understands instructional planning and delivery.** Present subject matter effectively, including selecting and using a variety of instructional strategies to promote student success.
7	**The student creates an effective learning environment.** Describe and implement a safe and effective learning environment; demonstrate teacher characteristics that promote effective learning.

Texas TEKS - Communication and Technology in Education:

TEKS	Standard

130.123(c)(4)	The student uses technology tools to enhance learning. The student is expected to identify emerging technologies and evaluate their applications.
130.123(c)(6)	The student understands digital citizenship. The student is expected to analyze the impact of technology on society.

Connection to Educator Preparation:

- Models first-principles teaching (define terms precisely, build from basics)
- Demonstrates how to unpack complexity rather than hide it
- Prepares future educators to teach students who will live in an AI-shaped world
- Shows the importance of sequencing (simple → complex)

Source: TEKS from `teks/practices/generated/` and `teks/communication-and-technology-in-education.pdf`

Materials Needed

- ■ Presentation slides (slides.yaml) - displayed via projector/screen
- ■ Reading passage (reading.md) - displayed for students to follow along
- ■ Group discussion worksheet (worksheet.md) - students access on their devices
- ■ Paper and pencils for group note-taking
- ■ Google Classroom quiz (created from quiz.md via Automagical Forms)

Lesson Sequence

Opening (5 minutes)

0:00 - 0:05

- Begin with definitions: "AI, neural networks, deep learning—these words are everywhere. But what do they actually mean?"
- Define each term in plain language
- Ask: "Why does it matter for future teachers to understand these terms?"
- Present learning objectives
- Introduce Karpathy: Stanford PhD, OpenAI co-founder, Tesla AI lead, YouTube educator

Direct Instruction (10 minutes)

0:05 - 0:15

- Present slides covering:
  - ■ Who Karpathy is and his background
  - ■ His core philosophy: build from scratch, no black boxes

- How neural networks actually work (simplified)
- The difference between understanding something and just using it
- Read aloud the reading passage while students follow along on screen
- Key check: "What does Karpathy mean by 'no black boxes'?"

Guided Practice - Group Discussion (15 minutes)

0:15 - 0:30

- Organize students into groups of 3-4
- Direct students to access the worksheet on their devices
- Explain instructions: discuss prompts verbally, summarize key points on paper
- Circulate among groups to:
    - Ask: "What's the simplest version of a concept you might teach?"
    - Push for specifics: "What do students need to understand FIRST?"
    - Connect to real classrooms: "What black boxes exist in your subject area?"
- At 0:28, give a 2-minute warning to wrap up discussions

Closure (5 minutes)

0:30 - 0:35

- Bring class back together
- Invite 2-3 groups to share one concept they'd "build from scratch" and how
- Summarize main takeaways:
    - Define terms precisely—don't assume students know
    - Don't hide complexity; unpack it step by step
    - Start with the simplest version, then add complexity
    - If you understand how it's built, you understand it
- Transition to assessment

Assessment (5-8 minutes)

0:35 - 0:40

- Direct students to Google Classroom to complete the quiz individually
- Remind students: questions are randomized, no retakes, answers not shown at end
- Remain available for technical questions

Differentiation Strategies

For students needing additional support:

- Pair with supportive peer during group discussion
- Focus discussion on Prompts 2 and 4 (most accessible)
- Provide concrete examples: "Building from scratch is like learning to cook by making the ingredients yourself, not just following a recipe"

• Use visual diagrams of neural network layers during instruction

For advanced students:

- Assign discussion facilitator role within their group
- Pose extension: "How would you explain machine learning to a 5-year-old? A 15-year-old?"
- Challenge them to identify black boxes in their current courses
- Explore Prompt 6 (preparing students for an AI-shaped future)

Assessment

Formative Assessment:

- Observation during group discussions (use of precise definitions)
- Quality of "simple to complex" sequencing students propose
- Understanding of the "black box" concept and its implications

Summative Assessment:

- Google Classroom quiz: 8 multiple choice and true/false questions
- Tests understanding of AI terms and Karpathy's teaching philosophy
- Quiz data informs whether concepts need reinforcement in future lessons

Reflection (Post-Lesson)

To be completed after teaching:

What worked well:

What needs adjustment:

Student engagement observations:

Notes for next time:

Appendix

Key Vocabulary:

- **Artificial Intelligence (AI)**: Machines that can do tasks normally requiring human intelligence
- **Neural Network**: A computational system that learns by adjusting connections, inspired by biological brains
- **Deep Learning**: Neural networks with many layers, each extracting progressively abstract features
- **Transformer**: A neural network architecture that processes all inputs simultaneously using attention mechanisms
- **Black Box**: Something that works but whose internal workings are hidden or not understood

About Andrej Karpathy:

Andrej Karpathy is a computer scientist and AI researcher. He earned his PhD from Stanford under Fei-Fei Li, co-founded OpenAI, and served as Senior Director of AI at Tesla where he led the Autopilot vision team. He is known for his educational YouTube videos, including "Let's build GPT from scratch" and "Neural Networks: Zero to Hero." His teaching philosophy emphasizes building systems from first principles, understanding every component, and rejecting black-box thinking.

Additional Resources:

- Karpathy's YouTube channel
- "Neural Networks: Zero to Hero" series
- "Let's build GPT" video (2+ hours, step by step)
- Stanford CS231n course materials (Karpathy was an instructor)