Coming up with ideas for educational research

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Sources of educational research ideas

Teaching perspective

- *Instructional activity*
- *Instructional media*
- Pedagogical approaches
- Measurement and evaluation
- Classroom management
- Professional development
- Curriculum

Learning perspective

- *Learning problems*
- *Misconceptions*
- Cognitive skills
- Psychomotor skills
- Learning styles
- Attitude
- Awareness

Examples of learning problems

Topic	Description	Problems	Examples	Causes
Molecular symmetry	How to identify symmetry elements and operations	Cannot visualize operations on molecules	Rotate a water molecule around its primary axis	Nonsystematic and insufficient mental practice
Exoplanet detection	How to detect exoplanets	How a detection method works	How a factor affects transit method	Never see a real detection at work
Algorithmic thinking	How to sequence commands together	Cannot solve even simple problems	Write a program to calculate factorial	Cognitive overload from syntax
Titration dynamics	How species change during titration	Cannot tell from a titration experiment	What interacts with added hydroxide ions	Focus only on calculation
Relations among supply-chain modules	Dependency among modules in a supply chain	Cannot explain how a module affects others	What factors affect loyalty to a chain	Never be in a supply chain

Activity 1: Learning problems

- Create a table of topics that involve conceptual understanding (not mere memorizing) with which your students (or you) have trouble understanding

Topic	Description	Problems	Examples	Causes

Generating educational research ideas from learning problems

- Which question would you ask first?

What can be done about it?

- Your thought are free
- Solution is based on your way of understanding
- May not be innovative

What has been done about it?

- Influenced by what you read
- Gaps may be hard to spot
- Solution is based on the gap
- May not suit your style/preference

Finding research idea by yourself

- How well do you understand the topic?
  - Find a way to enhance your understanding
- What steps lead you to understand the topic? Or
- What steps can lead students to understand the topic?
- Can they be implemented in class and how?
  - How does it help students construct concept(s)?
  - How complicated is the construction of concept(s)?
- Brainstorm (maybe with a GenAI)

Generative AIs to try

- GPT
- Copilot
- Gemini
- Claude
- LLaMA
- DeepSeek
- Pi
- YOU

Research idea example

- Topic: Supply chain
- Problems: Relations among modules in a supply chain
- Cause: Never make decision in a supply chain
- Innovation: Simulated game that
  - Encompass whole supply-chain activities
  - Provide opportunities to make strategic business decision
  - Simple, transparent, and yet realistic
  - Modifiable to suit other objectives

Research idea example (cont.)

- Simplistic, transparent, and modifiable
  - Spreadsheets, one for instructor (raw material and retail markets), supplier (raw material provider), manufacturer, and wholesaler
- Realistic: Incorporate demand and cost functions
- Gameplay
  - 6 groups (on-going companies) divided into 2 supply chains
  - Switch roles after each game (2 or 3 roles)
  - Slight advantage to do transactions within a chain

Activity 2: Your research idea

- Select a topic from Activity 1
- Reflect on your aha moment (maybe with AI)
- Is the aha moment possible for your students?
- How do you teach? Does or can it lead to that moment?
- How can you help students have similar experiences?
- Can you simplify?
- Has it been done?

Finding gap in the literature

- What is the topic?
- What can be the learning problems?
- What are potential ways to solve the problems?
- What keywords should be used in searching the literature?
- Once an article is found, does it cite others that solved the same or related problems?
- Are there other articles that cite this one?
- Are there still gaps?

Activity 3: Gap in the literature

- Read the introduction part of Jittivadhana et al.'s (2009) article
- Answer the questions:
  1. What were the topic and the learning problem?
  2. What innovation was developed to solve the problem?
- Watch Muscle Contraction - Cross Bridge Cycle, Animation. (youtube.com)
- Is the problem present in the animation?
- Were there gaps in Jittivadhana et al.'s innovation?
- Find an article trying to close a gap

Activity 4: Gap in the literature

- Select a topic from Activity 1 or 2
- What has been done in terms of teaching and learning?
  - May need to be very specific (topic, learning problem)
  - May use AI research tools
- What innovation(s) came before/after?
- Are there still gaps?
- Can you close one of them and how?
- What are the trends?

AI research tools to try

- Connected Papers
- Consensus
- Elicit
- Keenious
- ResearchRabbit
- Scholarcy
- Scite
- Semantic Scholar
- Scispace