Developing a Research Question Using a Structured Process

Tutorial 01

CHL5402H — January 6, 2026

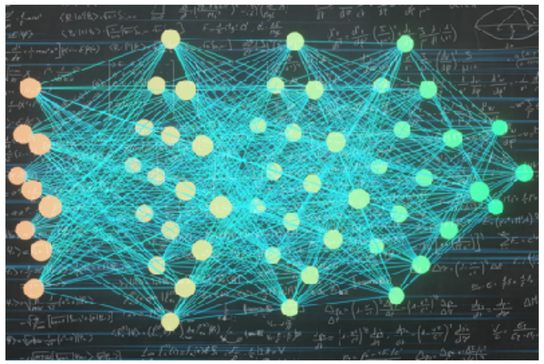
Agenda

- Attendance
- Introductions
- Review Research Idea Prompts
- PEOTS Framework Introduction
- PEOTS Framework Exercises

Learning Goals

- Brainstorm research ideas using exposure–outcome pairs
- Develop a causal epidemiological study using a systematic framework
- Practice “bread and butter” epidemiology skills
- Prepare for Assignment 1

Introductions



PhD

MSc

BSc

Fun Fact

Research Idea Prompts

Image

Pin

10 Top Home Remedies for Flu Symptoms: Get Healthy Fast!

Content not included. Students can imagine natural or alternative health remedies they have heard of and then imagine how to study proposed benefits, harms, etc. from immediate (within day) to intermediate (time to return to daily activities) to longer term (e.g., absenteeism, seasonal quality of life…)

Abstract

Hassen MZ. The Impact of AI on Students' Reading, Critical Thinking, and Problem-Solving Skills. American Journal of Education and Information Technology. 2025;9(2):82-90.

Abstract

The integration of Artificial Intelligence into instructional ecosystems represents a paradigm shift. It has profound implications for student cognitive development. This article presents an analysis of the effect of AI on three cornerstone capabilities of education. These are reading, critical thinking, and problem-solving. AI offers extraordinary opportunities for personalized gaining knowledge of and adaptive comments. It also introduces great dangers. These include cognitive offloading, intellectual passivity, and the erosion of deep engagement. This paper employs a qualitative approach. It proposes a conceptual framework of "Cognitive Augmentation vs. Cognitive Atrophy" to dissect this duality. The evaluation suggests AI's impact isn't always monolithic. It is closely contingent on pedagogical strategy, tool design, and scholar mindset. AI gear can act as effective Socratic partners and simulators. They can help develop superior skills. They are also able to function as "solution engines" that shortcut vital cognitive methods. This could probably lead to a decline in foundational skills. The dialogue examines the interconnected nature of those capabilities. It argues that a decline in deep studying can immediately impair the raw fabric wished for crucial wondering. This in turn cripples trouble-solving. The article concludes with a fixed of actionable pointers for educators, policymakers, AI builders, and college students. It advocates for a human-targeted technique that leverages AI as a tool to enhance human intellect, in preference to replace it. The central thesis is that addressing the age of AI in education requires a deliberate focus. Promoting AI literacy and metacognitive awareness is necessary to ensure that technology serves as a catalyst for cognitive growth, not a crutch for cognitive decline.

Blog Post

EQUITY IN THE CLASSROOM

By Beckie Supiano

April 29, 2022

Robert Talbert is convinced that traditional grading practices are due for an overhaul. Talbert, a professor of mathematics at Grand Valley State University, is co-writing a book, *Grading for Growth*, about alternative approaches that focus on providing feedback and allowing several attempts rather than awarding points. "For too long," Talbert and his co-author, David Clark, write in their newsletter, "grades have gotten in the way of learning, and learners have focused on scoring points and playing school instead of on learning and growth."

Estimand, Estimator, and Estimate

Ingredients

- 150g unsalted butter, plus extra for greasing
- 150g plain chocolate, broken into pieces
- 150g plain flour
- ½ tsp baking powder
- ½ tsp bicarbonate of soda
- 200g light muscovado sugar
- 2 large eggs

Method

1. Heat the oven to 160C/140C fan/gas 3. Grease and base line a 1 litre heatproof glass pudding basin and a 450g loaf tin with baking parchment.

2. Put the butter and chocolate into a saucepan and melt over a low heat, stirring. When the chocolate has all melted remove from the heat.

Causal Estimand: Parameter of population. What quantity or parameter are you interested in measuring? What you want.

Estimator: A function of the sample data to estimate the unknown population parameter. How to get it.

Estimate: A specific value when the estimator is applied to the sample data. What you get.

PEOTS Framework

- **Mental Health:** Among university students **(P)**, daily social media use above 3 hours **(E)** is associated with higher incidence of clinically significant depression **(O)** over 2 years **(T)**, estimated as a relative risk from a prospective cohort study **(S)**.
- **Environmental Health:** Among adults living in urban areas of Beijing **(P)**, long-term exposure to $PM_{2.5}$ above 35 $\mu g/m^3$ **(E)** is associated with increased incidence of ischemic heart disease (O) over 10 years **(T)**, estimated as a hazard ratio from a longitudinal cohort study **(S)**.
- **Maternal and Child Health:** Among pregnant women in their first trimester **(P)**, exposure to high air pollution **(E)** is associated with preterm birth **(O)** within the same pregnancy **(T)**, estimated as an adjusted odds ratio from a population-based cohort study **(S)**.

PEOTS Framework

Population	Exposure	Outcome	Time	Study Design and Statical Estimand
Target population to which the estimate applies (e.g., adults ≥65 years, Ontario population)	Exposure, risk factor, or intervention of interest (e.g., smoking, air pollution level, vaccination)	Health outcome being measured (e.g., incidence of disease, mortality, hospitalization)	Time over which the exposure is assessed or follow-up duration (e.g., 30-day mortality, 5-year incidence).	Study and the effect measure(e.g., risk ratio, odds ratio, hazard ratio; intention-to-treat vs per-protocol).
Define a study population in whom the health state/ outcome occurs. Then, define a study sample that includes the necessary range or variability in levels of exposure.	Define exactly what exposure is being measured. When is it being measured? How is it being measured? Is it a physical test, a scale, etc.? What are the units of measurement? What are you doing to minimize measurement error?	Define exactly what outcome is being measured. When is it being measured? How is it being measured? Is it a physical test, a scale, etc.? What are the units of measurement? What are you doing to minimize measurement error?	When is too early or late to capture the exposure? Think about incubation/induction periods. When can the outcome or effects be detected? How long should follow-up or the observation window be? Fixed, variable, long, short, repeated?	Choose a general study design that works for the question, and then refine the details of the study to minimize threats to the validity Is it possible to recruit and gather information needed?
• External vs. internal validity • Selection bias • Representativity and effect modification	• Positivity • Consistency • No interference	• Outcome definition and construct validity • Non-differential misclassification • Differential misclassification	• Immortal time bias • Differential loss to follow-up • Survivor bias • Competing risk	• Confounding • Over-adjustment • Under-adjustment • Misclassification bias • Missing data