



Learn More & Achieve More — An Innovative Teaching Method

Applying Economic Theories to Secondary Science Education

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Abstract

- > The goal of this study is to examine the effect of an innovative **teaching method** from an **economic-based perspective**, i.e., it considers students' STEM education as a production activity, which consumes time and energy and aims to maximize achievements.
- > This teaching method mobilizes **greater parental involvement** using a technology-enhanced learning environment, Flipgrid, before-,in- and after-class.
- > As Adam Smith metaphorized, the free market economy, as an “invisible hand”, promotes the public good. As does this innovative teaching method. It “**Nudges**” students to use a **more efficient method** to have “**more productive studying**”. Thus, it prompts students to learn more and achieve more because students can see their improvements.

Why

- > Despite considerable growth in STEM-related occupations these days, the interest and academic achievements in STEM among the primary and secondary school students have lagged.
- > As the National Assessment of Educational Progress (NAEP) reported in 2005, about 77% of fourth grade students' scientific achievements scored below the NAEP's Basic rank.
- > Thus, this innovative teaching method aims to use more parental involvement to boost minority students' scientific achievements.

Nudge Theory

- > It's a behavioral economic theory studied by Richard Thaler and Cass Sunstein. Thaler was the laureate of Nobel prize in 2017 by this theory.
- > As they defined: “A nudge is any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options”. e.g. “Putting fruit at eye level counts as a nudge. Banning junk food does not.”
- > The core idea of this theory is not requesting, but assisting people to do something better. An appropriate nudge should induce better choices or behaviors without using explicit requirements.

II How / Theory

A. A More Efficient Method

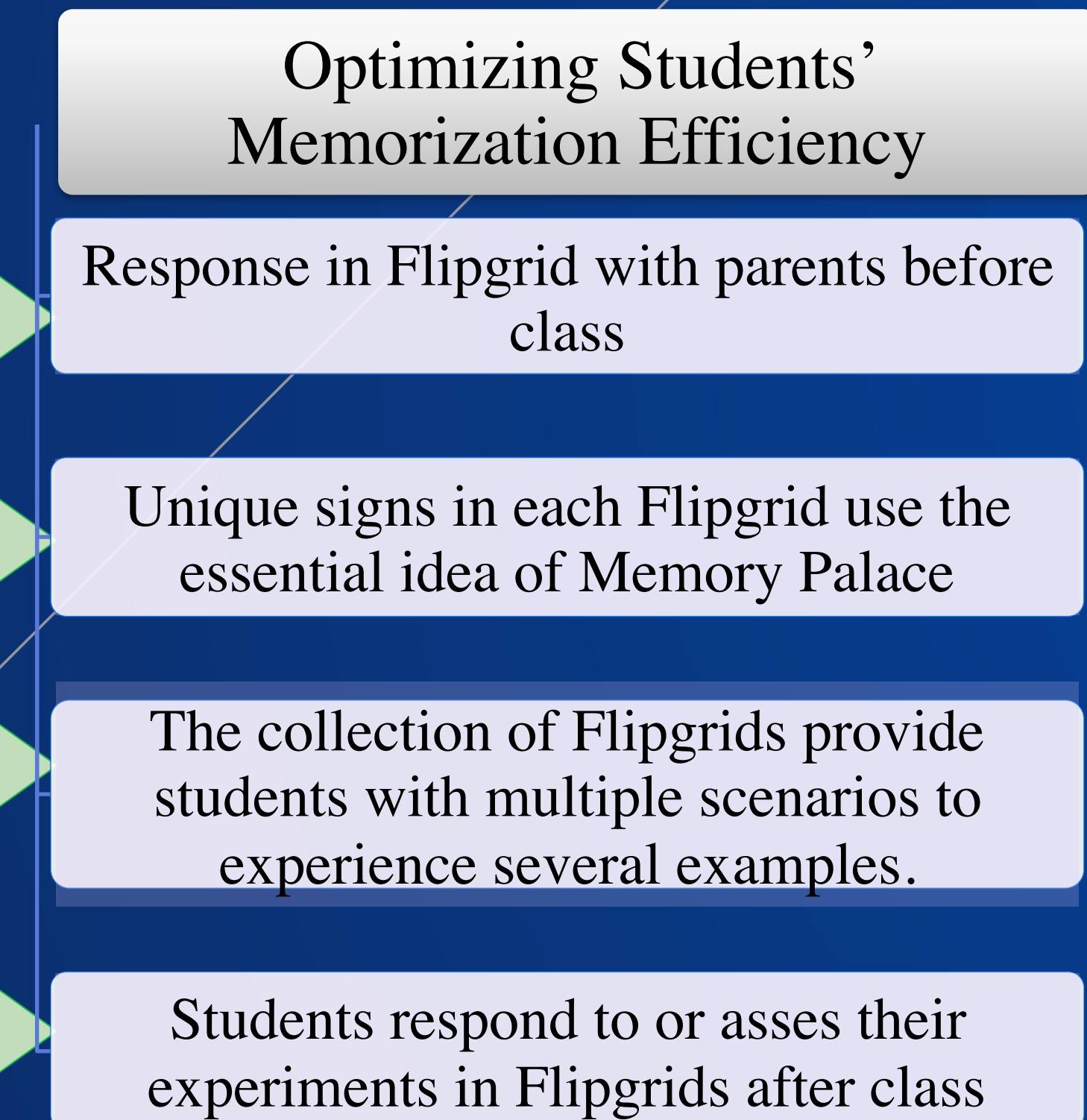
- > Although they have interest in scientific courses, some kids do not know how to study efficiently. As courses get harder, their interest may be impaired due to delayed or no positive feedback. Thus, an appropriate teaching method which nudges students to follow the **law of memory**, i.e., a more efficient method, could boost their achievements.
- > The following tables show the students' views of science, the law of memory, and an underlying mnemonic device in this teaching method.

Students' views of science	1. The Memory Palace	2. The Essential Idea
Static— Prefer memorizing	The Memory Palace is an ancient Greek mnemonic device. It asks people to make an imaginary location in the mind where people can store mnemonic images.	Its essential idea is about making connection. Every symbol is associated with a particular (ideally surprising or at least unconventional) behavior or event.
Dynamic— Prefer understanding	3. The Memory Palace & this Teaching Method	
Mixed--Both	Once a piece of knowledge is associated with the unique signs on each Flipgrid, that knowledge can be recalled when that “particular behavior or event,” i.e., that unique sign is triggered.	

The Law Of Memory

0. Pre-knowledge
1. Encoding
2. Consolidation
3. Retrieval

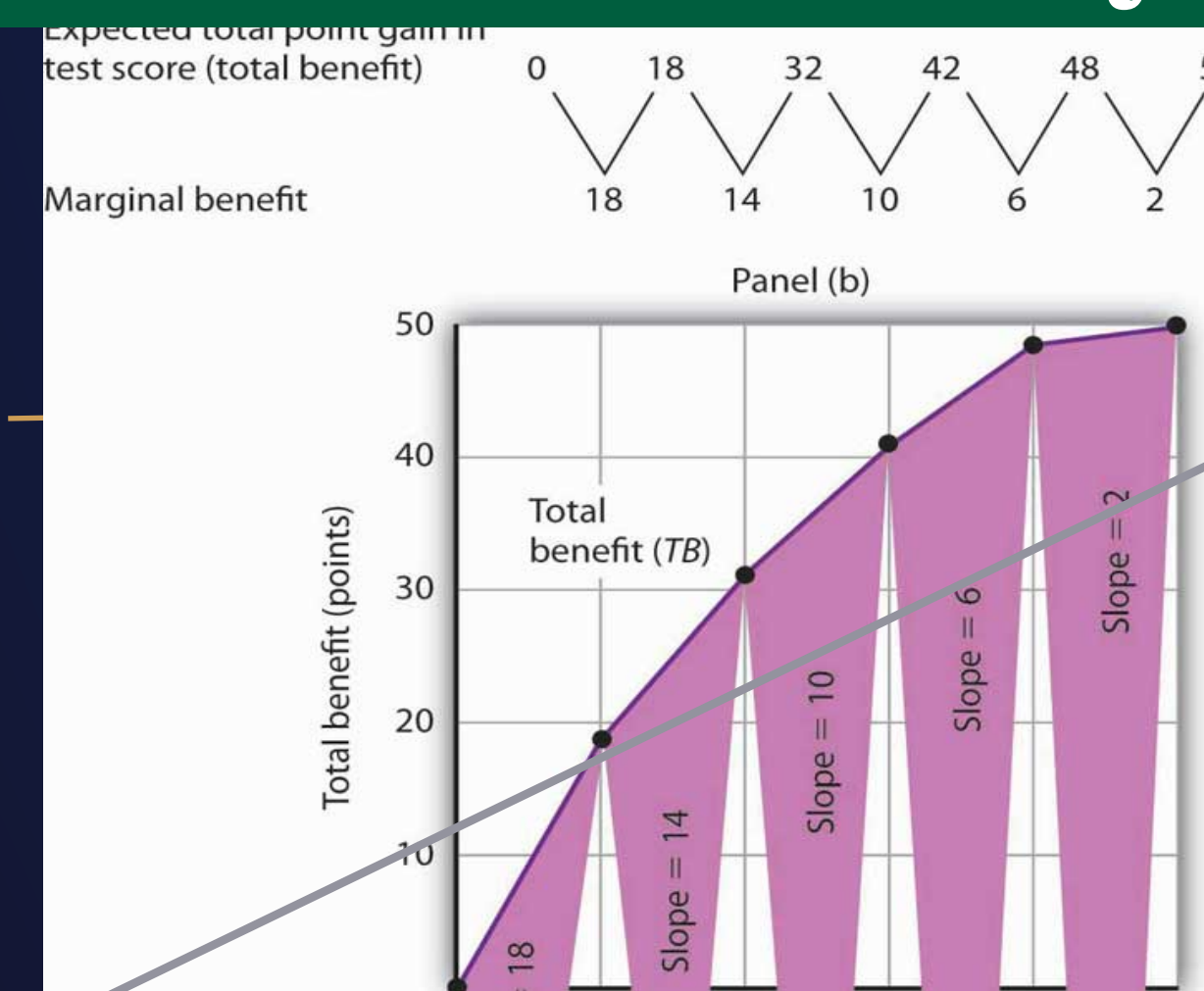
The Application To This Teaching Method



B. More Productive Studying

1. The law of diminishing marginal returns

2. The rule of 80/20



A rule of thumb that states that 80% of outcomes can be attributed to 20% of all causes for a given event.

Most assignments covered in Flipgrid belong to those 80% part, which has the higher marginal returns.

Experiments' Outcomes

Future Work

