Most STEM educators agree about the many benefits that result from students’ involvement in undergraduate research (UGR). However, on many campuses, there are more students who would benefit from UGR than there are opportunities in faculty labs. This is particularly a challenge for students in their first years of college, before they have completed many STEM courses. The irony is UGR might actually benefit these students the most, increasing retention in STEM and in college. Persistence in STEM is a particular concern for women and under-represented minorities. We propose that PATR resolves some of these issues.

**Introduction**

**Background:**
In the PATR method, 1st and 2nd year students learn about the key components of the research process by doing hands-on innovative exploration of interdisciplinary research topics. Teams of students complete a series of structured experiences to scaffold an understanding of the research process in a team setting. Under the supervision of trained peer research leaders, teams design and run their own studies, analyze their data and draw conclusions. Because the emphasis is on the research process and scientific reasoning, rather than on producing cutting-edge results, minimal equipment is needed for students to “feel like scientists”, an important component of STEM retention and choosing a STEM career.

**The components of a module are:**
- A real-world, cutting-edge, socially-relevant issue or topic described in the popular media
- A professional article on the same topic that students read using the C.R.E.A.T.E method that helps make the scientific article more approachable.
- A relatively-open ended set of experiments, requiring a set of clearly-defined research skills.
- A discussion component based on “3 steps forward”, encouraging consideration of broader applications or implications of the research in the real world.

**Results**

About 50 1st and 2nd year students have done PATR modules on a voluntary basis, similar to a science club. They report the modules are good training to build confidence and credentials for moving into a faculty research lab.

- **Understanding of the research**
  - After number of complete modules: 8 10 12

- **Experiment design confidence**
  - After number of complete modules: 25% 57% 70% 100%

- **Feeling like a scientist**
  - After number of complete modules: 25% 47% 74%

Academically-strong junior and senior peer leaders also report benefiting from PATR.

- **Reinforced my understanding of research**
  - After number of complete modules: 100%

- **Was a meaningful experience for me**
  - After number of complete modules: 100%

- **I felt qualified to be a peer leader**
  - After number of complete modules: 78%

**Next Steps:**
Our goal is to test PATR in more venues, such as research methods courses, discipline-specific courses and labs. We would like to investigate the effectiveness of PATR at other campuses, particularly at other CUNY 4- and 2-year schools.

**The PATR Model**

**Year One PATR Topics**

- **Endocrine Disruption** – Students study the effects of endocrine disruptors on the gonadosomatic index of guppies (p. reticulata).
- **Science of Junk Food** – Students quantify lipid, carbohydrate and salt contents of processed foods, determine error of reporting on food labels and design sweetens taste preference studies.
- **Blue Light & Sleep Patterns** – Students investigate how increases in blue and white light affect circadian rhythms, sleep patterns task focus.
- **Investigating Action Potentials** – Students investigate how neuronal activity in cockroaches is affected by stimuli such as different sounds, oxygen level, and MSG, a neurotransmitter.

**Year Two PATR Topics**

- **Caffeine and Energy Drinks** – Students design an experiment to quantify the caffeine in different energy drinks, compared with the amount on the labels and survey when and how college students ingest caffeine.
- **Experimental Multicellularity**
  - **Evolution** – Students design a study to encourage unicellular brewer’s yeast (s. cerevisiae) to evolve into multicellular snowflake yeast.
- **Power of Walking Behavior** – Students design psychometric studies to investigate how various walking styles affect cortisol and testosterone levels.
- **Cortisol/ Stress** – students investigate the effects of social stress on salivary cortisol levels.