The effect of interest on including life science contexts in introductory physics

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IPLS and Interest

Life science students may or may not come into introductory physics with pre-exiting interest in physics. This could negatively impact their attention, learning, and persistence (Hidi & Renninger, 2006; Sansone & Smith, 2005).

Interest is here conceptualized as an affective and cognitive motivational variable that develops over time (Hidi & Renninger, 2006). This work distinguishes between

1) interest that students may (or may not) bring to class, characterized as **individual interest** (which can be more- or less-developed), and
2) interest that develops as students engage with learning tasks in class, characterized as **situational interest**.

The process of interest development begins with an initial triggering of situational interest, may or may not be maintained, and can lead to the asking of curiosity questions, and more developed individual interest.

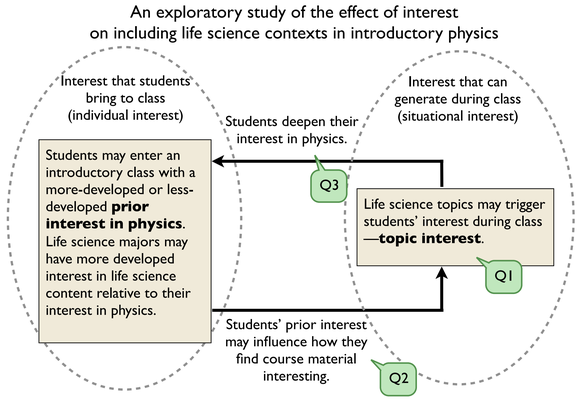
Introduction of interesting contexts in physics course materials for middle school students reduced the learning gap between genders (Hoffmann, 2002).

In an undergraduate introductory psychology class, situational interest that students experienced during class predicted performance, continued interest, and future engagement (number of courses taken and major). (Harackiewicz, et al., 2008).

Citation:
Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational psychologist*, 41(2), 111-127.
Hoffmann, L. (2002). Promoting girls' interest and achievement in physics classes for beginners. *Learning and Instruction*, 12(4), 447-465.
Harackiewicz, J. M., Durik, A. M., Barron, K. E., Linnenbrink-Garcia, L., & Tauer, J. M. (2008). The role of achievement goals in the development of interest: Reciprocal relations between achievement goals, interest, and performance. *Journal of Educational Psychology*, 100(1), 105.
Sansone, C., & Smith, J. L. (2000). Interest and self-regulation: The relation between having to and wanting to. In C. Sansone, & J. M. Harackiewicz (Eds.), *Intrinsic and extrinsic motivation: The search for optimal motivation and performance* (pp. 341-372). San Diego: Academic Press.

Study design

An exploratory study of the effect of interest on including life science contexts in introductory physics



Research Questions:

Q1: In which of the life science topics are students interested?
Q2: Does the interest in physics that students bring to the course (their prior interest) impact whether life science topics are interesting?
Q3: Does students' interest in physics change over the semester? Does topic interest influence change in students' interest in physics?
Q4: Do prior interest and topic interest influence performance on final exam?

Participants:

Students enrolled in reformed IPLS 2nd semester in 2012 (75 students: 47 females, 28 males) and 2013 (39 students: 26 females, 13 males)

Data collected:

- **Interest in physics** (pre and post)—Physics interest was identified using 12 items from CLASS that allowed identification of knowledge, value, and feelings about physics.
  - **Levels of prior interest**—Based on the distribution of 2012 pre responses to the CLASS items, the sample was partitioned into 3 groups: **low** prior interest (bottom quartile), **moderate** prior interest (middle 50%), and **high** prior interest (top quartile).
- **Topic interest**—At the end of each semester, students complete a course evaluation that included Likert ratings of the life science topics, asking to what extent did the given topic triggered their interest.
  - **Levels of topic interest**—Using the same method to partition the sample by prior interest, the sample was partitioned into **low**, **moderate**, and **high** groups for topic interest.
- **Course Performance**—Final exam scores served as a measure of course performance.

Results

Summary of selected results (analyses by gender, goal, prior level of mathematics, and prior physics content knowledge were also conducted)

- Overall, students found the life science topics interesting. Nerve signaling, optics of vision and cell membrane potential were particularly interesting.
- Students who had higher prior interest in physics at the start of the course tended to report higher topic interest.
- Topic interest appears to influence change in students' physics interest.
- Students who reported higher topic interest performed better in the final exam, especially students whose interest in physics was initially low.

Question 1: In which of the life science topics are students interested?

All life science topics were highly rated, however nerve signaling, optics of vision, and cell membrane potential were rated significantly higher (p<.001). These findings were replicated in 2013.

Table 1: Mean ratings of integrated life science topics by phase of interest (Physics 4L, Spring 2012)

	Nerve signaling	Optics of vision	Cell membrane potential	ECG	Pacemaker safety	Magnetic sensing	Optics of microscopy	Dielectric constant of water
Mean ratings*	4.2	4.1	4.1	3.6	3.5	3.5	3.4	3.3

* Standard error of the mean is ±0.1 for every topic.

Question 2: Does the interest in physics that students bring to the course (their prior interest) impact whether the life science topics are interesting?

Students with high prior physics interest tend to report higher topic interest than do those with only low prior physics interest.

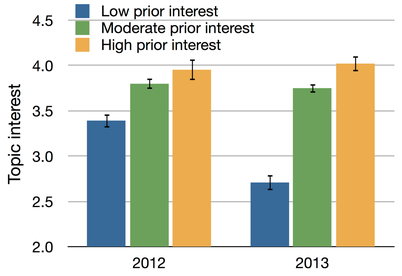


Figure 1: Mean ratings of whether topics triggered interest by level of prior interest (The difference between the low and high interest groups were significant, p<.05, for both 2012 and 2013.)

Question 3: Does students' interest in physics change over the semester? Does topic interest influence change in students' physics interest?

In 2012, those who entered with low physics interest had positive change (p<.01), whereas those with high interest showed a tendency to decrease in interest (p<.07) and those with moderate interest did not change. These findings were only partially replicated in 2013.

Topic interest appears to influence change in students' physics interest, as shown by univariate ANOVA (p<.01).

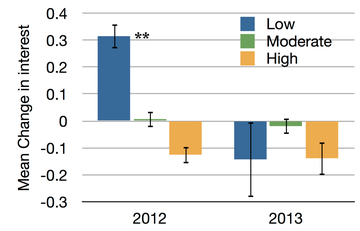


Figure 2: Mean change in physics interest for each class; ** denotes p<.01.

Question 4: Do prior interest and topic interest influence performance on final exam?

Topic interest predicted the final exam score (p<.05); however prior interest did not.

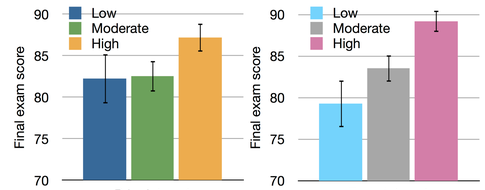


Figure 3: Final exam score by level of prior interest and topic interest

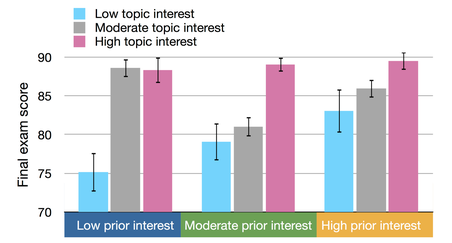


Figure 4: Final exam score by level of topic interest for each level of prior interest

Next steps

- Develop better understanding of the tendency for the decline in interest of students with high prior interest and for the lack of change among students with moderate interest.
- Explore why some topics were more interesting than others, and whether the level of topic interest influences performance specific to that topic (i.e. whether the impact is more local or global).

Acknowledgement: We thank Ann Ruether for assistance with data. Partial support provided by a grant to Swarthmore from the Howard Hughes Medical Institute through the Precollege/Undergraduate Science Education program.