

The Potential Role of Learning Physics on Paranormal Beliefs

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Abstract. Studies in science education and learning psychology have shown that student misconceptions and paranormal beliefs may have caused by a same mechanism, intuitive thinking. Since the coordination of theory and evidence, and being reflective about the epistemic practice are effective approaches to change student alternative conceptions, they may also influence paranormal beliefs, we wondered. We accompanied NGPET physics curriculum with an online learning community emphasizing the reflective aspect of physics learning. The results of pre- and post-survey and the post-assessment on paranormal beliefs suggest statistically significant changes. We hypothesized these changes may be influenced by being reflective about epistemic practice.

Introduction

NGPET curriculum [1] aims to help students to develop physical models and use those models to explain daily life phenomena. Students regularly collect data and build evidence to support/reject their intuitive ideas. This focus on building models and collecting evidence may transform student intuitive thinking towards scientific practices. Evidently, providing opportunities for students to reflect on their epistemic practices, improve their science learning [2]. In our physics course, we accompanied the NGPET curriculum with an online community of learners where students have weekly opportunities to practice the coordination of theory and evidence, and reflect on their practices. In this study, we examine how these learning environments influence student intuitive thinking.

Theoretical Framework

Comparing the epistemic practice of scientists and students, in a nutshell, we can see the following similarities and differences. Scientists intuitively draw from their scientific background to develop hypotheses; the process that is called abductive reasoning [3]. Then, scientists hold themselves accountable for testing the hypotheses and building empirical evidence to support/reject those hypotheses. Similarly, students also intuitively draw from their background knowledge and experiences to develop an explanation for the observed phenomenon [4] with some differences. First, during the intuitive thinking, students are more likely draw from knowledge they have gained in their daily life experiences rather than scientific knowledge. Second, contrary to scientists, students do not commit to test the ideas they develop and simply consider the results of their intuitive thinking as final products. We consider these two issues in student epistemic practices as the lack of coordination of theory and evidence [5]. Comparable to physics alternative conceptions, paranormal beliefs about psychokinesis and astrology are the product of intuitive thinking [6], and in conflict with scientific theories and empirical evidence. We wondered how the reflective physics learning environments emphasizing the coordination of theory and evidence affect paranormal beliefs.

Methods and Founding

Information on participants' beliefs measured with the Paranormal Belief Scale (PBS) [7]. We specifically focused on two categories of the PBS related to psychokinesis and

astrology. Among 41 members of the two sections of the physics course, we chose 13 students (the believer group) who had an average score of 4 (out of 7) or higher in psychokinesis category. This group logically had most potential to change.

Pre- and post-results of PBS survey

Based on the results of PBS survey, the score for the believer group is as follows. Initially, the average score in psychokinesis and precognitions category was 4.0 ± 0.1 and 3.7 ± 0.3 respectively. The comparison between the results of the pre- and post-survey suggests that believers have a statistically significant changes in their ideas in both mentioned categories. The score in psychokinesis category decreased from 4.0 ± 0.1 to 3.0 ± 0.3 and the score in precognitions changed from 3.7 ± 0.3 to 2.8 ± 0.3 .

Post-assessment

In a post-assessment, students watched a video of a monk claiming for self-levitation. Then, either they agreed or disagreed with the claim, they used the physical models that they have learned during the semester to explain how this self-levitation is possible or not. Then, they provided some empirical evidence to support their argument. The average score of being agree or disagree with the monk's claim is 3.2 ± 0.4 out of 7 for the believer group, which is consistent with the results of the post-survey. Analysis of student writing is in progress. As an example, to see how students used the language of physics in their intuitive thinking and writing, one student in the believer group wrote:

“Gravity is constant, so there would have to be some force present to overcome gravity. He is not creating an anti-gravity field because all his clothes and jewellery are still being drawn towards the earth.”

Conclusion

The theory of intuitive core knowledge may provide mechanisms to explain the mentioned changes in paranormal beliefs. This theory asserts that children develop intuitive physical, biological, and psychological core knowledge, such as objects has volume [8]. Psychological studies suggest that intuitive thinking causes paranormal beliefs as people draw from the conflated intuitive core knowledge [6]. We hypothesize two mechanisms for the mentioned changes: first, during intuitive thinking, participants may have more often use science models as an alternative to blended core knowledge. Second, participants may have implicitly learned that intuitive thinking can produce great ideas; however, those ideas need to be supported/rejected by empirical evidence. We can test these hypotheses in follow-up studies.

References

- [1] Goldberg, F., et al. *Next generation physical science and everyday thinking*. Greenwich, CT: Activate Learning (2018).
- [2] Sandoval WA. Conceptual and epistemic aspects of students' scientific explanations. *The journal of the learning sciences*. 2003 Jan 1;12(1):5-1.
- [3] Lawson AE. The nature and development of scientific reasoning: A synthetic view. *International Journal of Science and Mathematics Education*. 2004 Sep;2(3):307-38.
- [4] Coley JD, Tanner K. Relations between intuitive biological thinking and biological misconceptions in biology majors and nonmajors. *CBE—Life Sciences Education*. 2015 Mar 2;14(1):ar8.
- [5] Kuhn D, Pearsall S. Developmental origins of scientific thinking. *Journal of cognition and Development*. 2000 Feb 1;1(1):113-29.
- [6] Lindeman M, Aarnio K. Superstitious, magical, and paranormal beliefs: An integrative model. *Journal of research in Personality*. 2007 Aug 1;41(4):731-44.
- [7] Tobacyk JJ. A revised paranormal belief scale. *The International Journal of Transpersonal Studies*. 2004;23(23):94-8.
- [8] Spelke ES. Core knowledge. *American psychologist*. 2000 Nov;55(11):1233.