Transformative Experiences and Biological Evolution: Facilitating Deep Engagement

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Abstract: The goal of this study was to explore the effectiveness of the Teaching for Transformative Experiences in Science (TTES) model for facilitating deep learning as compared to a typical teaching method implemented in science class when learning about evolution. We then wanted to explore what these experiences look like. Both quantitative and qualitative methods were used to explore participant experiences. This study seeks to improve teaching by exploring how to facilitate out-of-school engagement.

Theoretical Framework
Dewey believed that the educational experience should expand the perception of the students’ experiences above and beyond the classroom (Dewey, 1938). So how can we create a learning environment that can expand a student’s perception of experiences outside the classroom? Pugh (2002) developed the concept of transformative experience which occurs when students use concepts to experience their world in a meaningful way. Transformative experience can be defined using three qualities: 1) active use of the concept, 2) an expansion of perception, and 3) an expansion of value with the concept (Pugh, 2002) and is considered a continuum from in-school engagement to high out-of-school engagement. Teaching for Transformative Experience in Science model or the TTES model has three general methods: (a) framing content in terms of its experiential value, (b) scaffolding re-seeing, and (c) modeling transformative experiences (Pugh & Linnenbrink, 2007). TTES was found to be an effective teaching method for facilitating conceptual change and positive affect in previous work (Author & Author, 2011; Pugh, Linnenbrink-Garcia, Koskey, Stewart, and Manzey, 2010). The goal of the current research was to provide a closer examination of the experiences that students have with biological evolution concepts when implementing the TTES model.

Evolution is typically seen by students as something not relevant to their everyday lives. TTES should encourage students to engage with biological evolution ideas out-of-school. But what do these experiences look like? How do these experiences influence learning about evolution? These are the questions that drive this research.

Method
Participants
Participants were recruited from an educational psychology participant pool at a large southwestern university in the United States. Participants ranged from age 18 to 50, (mean = 27). Participants were 70.9% female. The ethnicities were 58.2% Caucasian. There were 28 participants in the treatment and 27 in the comparison.

Procedures
The treatment group was taught about evolution using the TTES model. The comparison group was taught by implementing a typical college biology lecture, reading, and discussion method. On Day 1, both conditions received the same lecture about evolution, with an added emphasis on the instructors’ own transformative experiences with the concepts and the value of the material for the treatment condition. On Day 2 the comparison group read a text about evolution and then had a whole group discussion, whereas the instructor for treatment condition modeled transformative experiences, scaffolded student experiences, and discussed value. On Day 3, both groups received instruction similar to Day 2 before completing the Transformative Experience Scale after instruction.

The transformative experience scale contained 20 Likert scale items and three open-ended questions. For the presentation, there will be a focus on the open-ended questions. The first question addressed active use and asked students to give an example of how they used the evolution ideas they learned. The second question assessed expansion of perception and asked participants to give an example of how their experiences changed due to learning the evolution ideas. The final question assessed experiential value and asked participants to give an example of how they valued the evolution ideas they learned. Answers were coded and analyzed for degrees of engagements. The coding scheme was as follows: a “0” was given for no answer, an incoherent answer, or statements that participants did not use or value the concepts. A “1” was given for stating the concepts were used only in class. A “2” was given when students claimed that they used the concepts outside of class but did not elaborate. Finally, a “3” was given when participants stated they used the concepts outside of class and
provided an elaborated example. The scores were analyzed for all three dimensions and summed for an overall degree of engagement score. Conceptual knowledge of evolution was assessed using the Evolutionary Reasoning Scale (Shtulman, 2006). This survey contained 14 closed-ended and open-ended questions and was implemented as pre-test and post-test measure.

**Results**

The treatment condition scored significantly higher in degree of engagement when the coded open-ended scores where subjected to an ANOVA, F (1, 53) = 21.85, p < .0005, η² = .29 (these findings are consistent with those for the Likert-item analysis). These finding suggests that the treatment condition engaged in significantly higher levels of transformative experience and deeper out-of-school engagement than the comparison condition. The treatment condition also scored significantly higher on the active use dimension F (1, 53) = 19.49, p < .0005, η² = .27, the expansion of perception dimension F (1, 53) = 8.66, p = .005, η² = .14 and the experiential value dimension F (1, 53) = 7.847, p = .007, η² = .13.

Examples of students’ out-of-school engagement with evolution concepts will be shared. As an example of active use, one participant stated, “When I was at the zoo, I thought about variation when I looked at elephants. African elephants are taller and have larger ears.” Expansion of perception is seen in this statement, “I think I will pay more attention to a species and see why it looks different and what are the chances of survival. Also, I never thought I was related to a plant!” Experiential value, is evident in this statement, “It (learning about evolution) was an excellent reminder to stop and reflect on what is going on around me. It makes my life more meaningful and answers questions about existence while creating new ones.”

Engagement and learning data were submitted to a multivariate repeated measures ANOVA. Results showed a significant interaction between time and condition, F(1, 53) = 13.47, p =.001, η² = .20. Follow-up univariate analysis showed a significant gain in learning at at posttest for the treatment condition F(1, 53) = 21.27, p < .0005, η² = .29.

**Discussion**

The TTES model was effective for facilitating transformative experience with evolution concepts and also predicted higher learning. This may be due to the high levels of engagement and personal relevance facilitated by the TTES model. These findings have implications for teaching science and evolution. Science concepts and specifically evolution are typically not viewed as influencing a student’s everyday experience in a personally meaningful manner and being deeply engaging manner. The TTES model may foster engagement in evolution ideas which could facilitate deep learning. Engaging in transformative experiences allows students to realize the personal relevance of evolution ideas. Innovative teaching methods such as TTES may facilitate deep understanding and engagement with evolution concepts.

**References**


