

Presence of Cognitive Construals in an Undergraduate Level Introduction to Biology Course Lecture

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Introduction

- Cognitive construals are informal intuitive ways of thinking about the world. These may not be true but they help facilitate our understanding of both biological concepts and the world as a greater whole.
- Coley & Tanner (2015) examined first year biology/non-biology students and found that construals have a lasting effect on students' thought processes, even at a college level; both groups demonstrated a tendency to use certain construals when reasoning about biology.
- This study analyzes biology transcripts from an introductory biology course at SFSU to identify the prevalence of three cognitive construals :
 - Teleological:** Causal based reasoning based on the assumption of a goal, purpose or function.
 - Essentialist:** Belief in core, underlying properties/features that determine category membership.
 - Anthropocentric:** Distortion of the place of humans in the natural world.
 - General:** seeing humans as unique from, or an example of the rest of the world.
 - Personification:** attributing human characteristics to biology.
 - Artifact:** using a man-made object to explain biology.

Materials

- 15 transcripts of classes in an introductory biology course.
- Transcripts are divided into separate timestamps, each approximately 30 seconds long. Each timestamp is called an 'utterance'
- In the 15 classes, there was a total of 1,233 utterances. Classes ranged from 18 utterances to 160 with a mean number of 82.2 utterances/class

Procedure

- 6 Trained coders independently coded each transcript utterance for the presence of construals
- All coders met as a team to reach a consensus about each utterance. A majority agreement of for or more coders was required to code an utterance.

Scoring

- Each utterance was scored as 0 or 1 (with 1 = a construal and 0 = no construal) for containing Essentialism, Teleology, Anthropocentrism: General, Anthropocentrism: Personification, Anthropocentrism: Artifact.
- Additionally, the tree types of Anthropocentrism were combined for an Anthropocentrism: Combined score .
- Scores were used to calculate prevalence of each construal per class and total course

Sample Text: Class 27, utterance times 27:12-28:09
Code: Essentialism Teleology Anthropocentrism

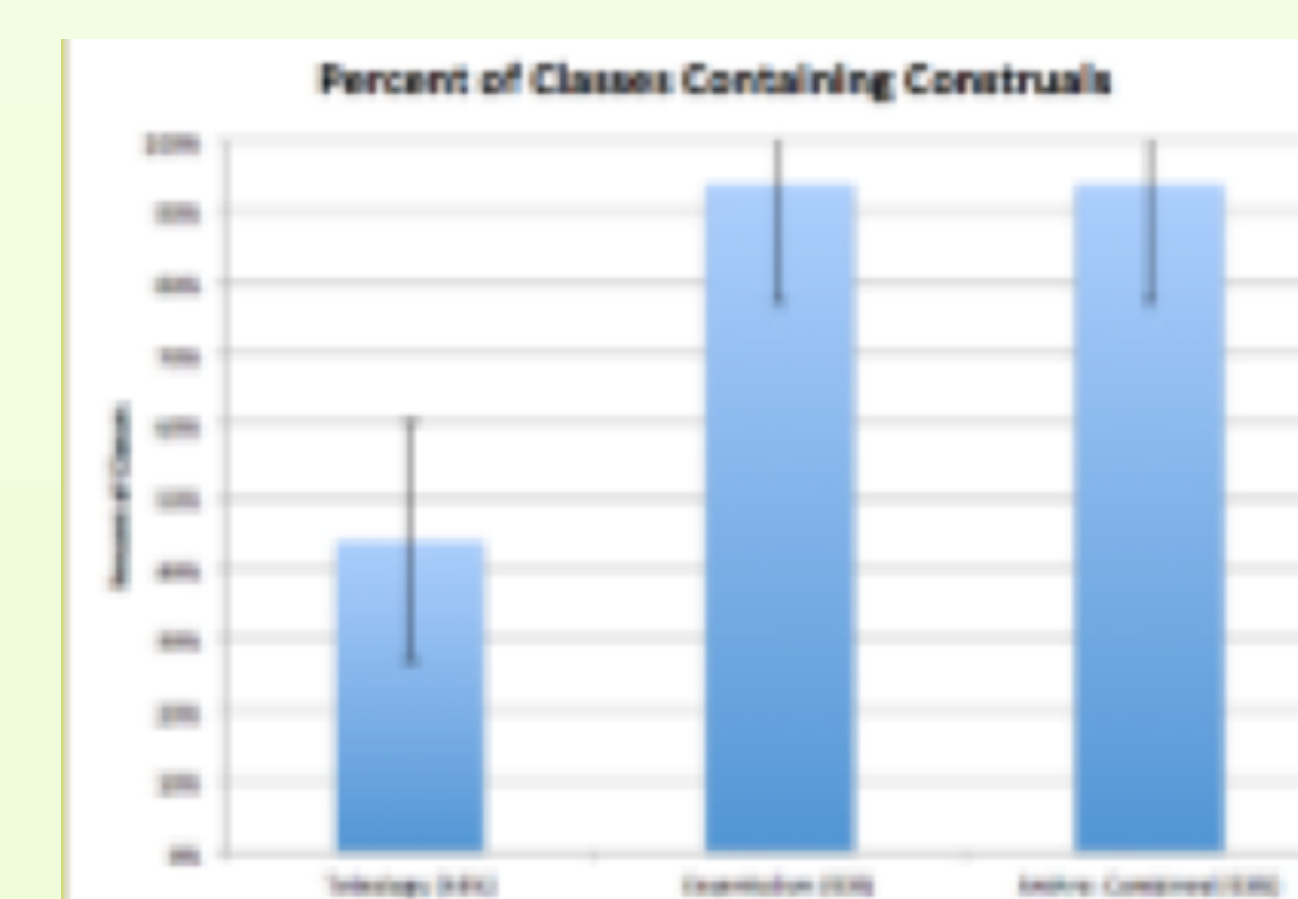
The purpose of photosynthesis is to capture sunlight energy... and store it as chemical energy in the bonds of sugar. [Photosynthesis] makes food for every living thing – everything; not just plants, everything that's alive is getting its mass in terms of most of its molecules – and energy – the bonds in those molecules that came from singlight energy originally – they-re getting it from photosynthesis. That means everybody in this room is getting enery and their mass from this process. Third, so these processes go hand in hand, photosynthesis and cellular respiration... The purpose of cellular respiration is to transform energy from the chemical bonds of food into energy in the bonds of the small molecule

Conclusions

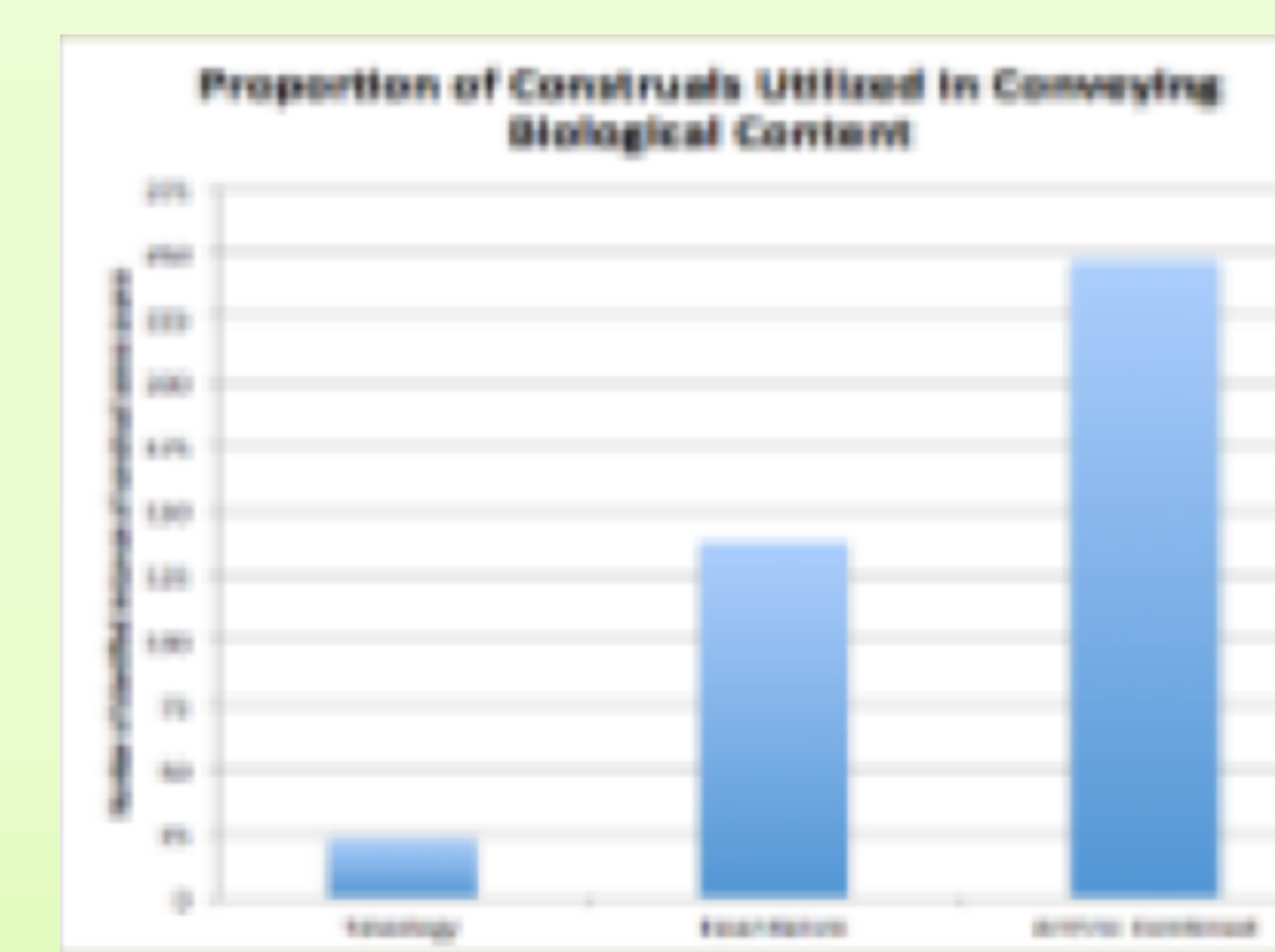
- Except for one shortened logistics class, all classes had at least one instance of a construal.
- Anthropocentrism: Personification may have been the most common type of anthropocentrism due to the coding of technical terms (such as "daughter cell") because they endorse anthropocentric thinking
- Because these construals are significantly prevalent, future research should investigate a potential correlation with students' use of construals in their biological thinking. If this correlation is found to be present, it could have important implications for the discourse used in teaching biology to undergraduates

Results

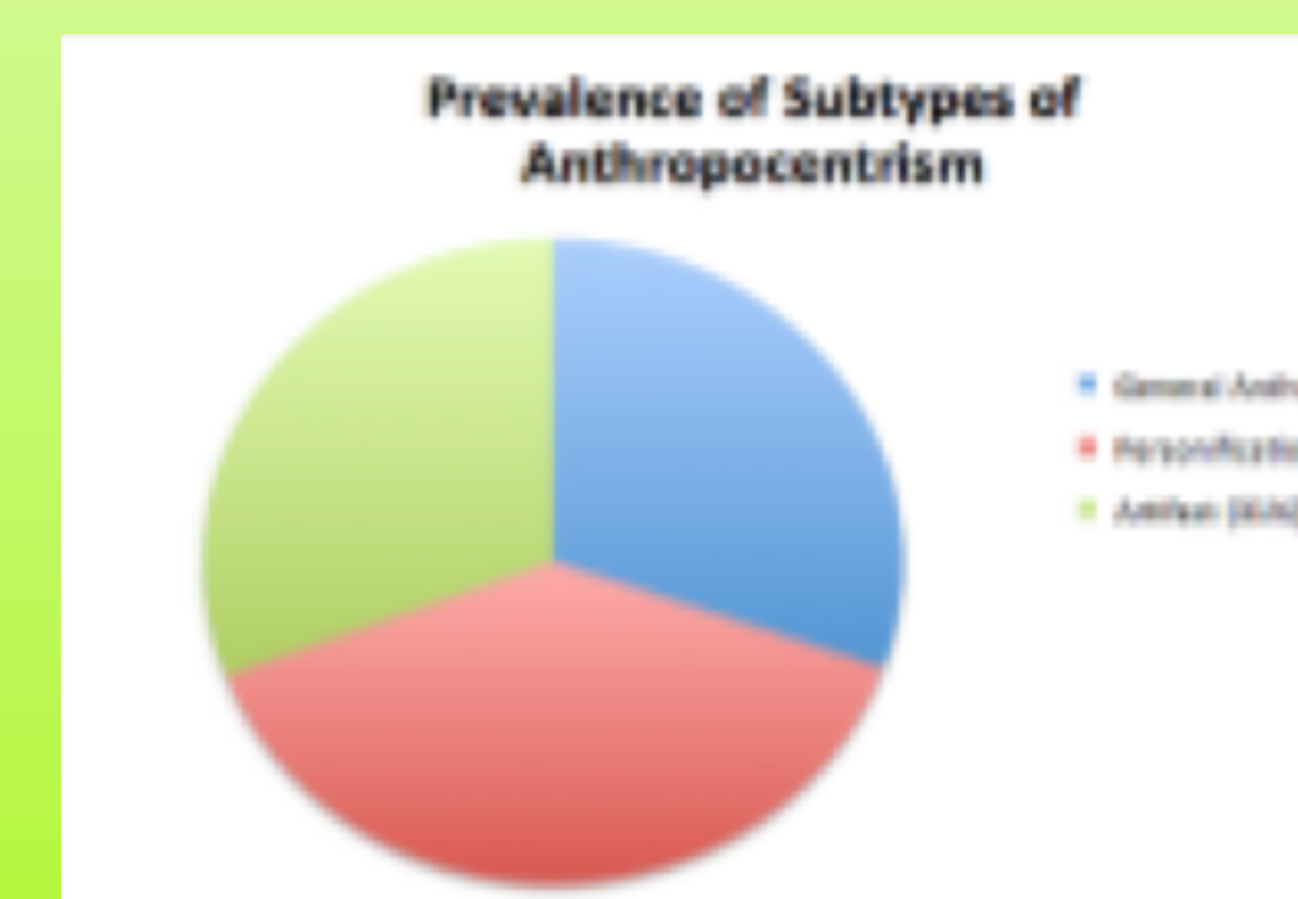
Total Classes Containing Cognitive Construals: Essentialist and Anthropocentric Combined statements were present in significantly more classes than teleological statements. There was no significant difference between prevalence of Essentialism and Anthropocentric: Combined.



Overall Prevalence of Construals: For all utterances, the prevalence each construal is as follows: Anthropocentrism: Combined (20%), Essentialism (11%), Teleological (2%).



Breakdown of Anthropocentrism: Combined: When Anthropocentrism: Combined is separated into three subtypes, the prevalence is as follows: Personification (39%), Artifact (31%) and General (30%).



References:

Coley, J. D., & Tanner K. (2015) Relations between Intuitive Biological Thinking and Biological Misconceptions in Biology Majors and Nonmajors. CBE-Life Sciences Education 14(1)