The Impact of a Story-Based Lesson on Student Learning and Attitudes

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Abstract
Recent work by Stephen Klassen draws attention to specific structural elements that are thought to give stories their explanatory power in the context of physics. In this poster we report results of a study based on Klassen’s pioneering work but in the context of evolution. A mixed-method research study was conducted over two semesters at a Midwest university to determine if a story developed from the story of research on industrial melanism over the course of a three-day lesson would result in improved student understanding of the concept of natural selection. The study involved a direct comparison of two different versions of the unit: one presented the history of research on industrial melanism (IM) as a story, the other did not. The episode was chosen because it incorporates past scientists’ investigations on IM as a strategy to mitigate misconceptions. Learning gains were measured by means of the Concept Inventory of Natural Selection (CINS), used as a pre- and post-assessment. Semi-structured interviews were also conducted with a subset of the participants in an effort to understand their experiences with and attitudes toward the lesson. Results demonstrate that the story version yielded significant learning gains, and significant decreases in some misconceptions. In addition, participants expressed positive attitudes to the lesson’s format as a mystery in reference to inquiry teaching.

Teaching & Learning Evolution
- **National & State Science Education Standards**
  - Important to understand biology from evolutionary perspective
- **Evolution is Difficult for Students to Learn**
  - Alternative conceptions compound difficulties
- **Stories are a powerful form of communication**
  - Suggests a role for stories in teaching evolutionary biology

Research Background and Gap
- **Story construction**
  - Stephen Klassen’s work
- **Story structure**
  - 10 narrative elements
  - Not a formula
  - Identifying deficiencies
- **Provides**
  - Standard structure
  - Consistent way to evaluate findings
  - (Klassen, 2010)

Q1 Results: Learning Impacts
What differences in learning outcomes do the concept inventory (CINS) scores reveal in both approaches?

- **Quantitative**
  - None-experimental design
  - Instrument
  - Concept Inventory of Natural Selection (CINS)
  - Pre and post-test
  - Participant scores
  - Explanatory coherence
  - Misconceptions
  - Inferences
  - Descriptive statistics
  - Inferential statistics

- **Qualitative**
  - Semi-structured interviews
  - Costing
  - 1st round emergent costing
  - All questions
  - 2nd round prioritized codes
  - Context questions
  - Theme development
  - Inferences

Q2 Results: Misconceptions
What alternative explanations, as identified in the CINS and the interviews, are participants using in both approaches?

- **CINS**
  - Participants in both groups displayed the same misconceptions based on:
    - Lamarckian ideas
    - Origin of variation
    - Darwinian ideas
    - Origin of selection
    - Differential survival
    - Other ideas
    - Variation inherited
    - Change in population
    - Results align with other studies

- **Interviews**: 3 types of misconceptions
  - Same as CINS
  - Hybrid answers: correct statement w/ incorrect one
  - Variation example
  - C2 stated that variation was “different” between eye color, different skin
  - C3 also stated that variation happened between different species.

- **Concept of species**
  - Origin of example variation
  - C13: “two different species coming together and mating, successfully mating is what I was referring to”

Data Collection and Analysis
- **The Mystery**
  - Rapid increase of dark form of moth in areas downwind from manufacturing centers
  - Unique example of natural selection: reliable visual imagery and bird predation as agent of selection

Q3 Results: Mystery Phenomenon Lesson
What are the similarities and differences in participants’ experiences, as revealed in the interviews, in both approaches?

- **Mysteries equal inquiry**
  - Morality of each group
  - T4: “So I think it’s always helpful when you’re presented with a mystery or something you actually think about and go through the inquiry process, and use critical thinking…”

Q4 Results: Stories
What do the interviews reveal about the participants’ awareness of the story and its narrative elements in the story approach?

- **The story structure**
  - Klassen’s structural components (narrative elements)
  - All were described by the story group

Limitations and Implications
- **Q1 - Improved learning outcomes**: CINS scores, explanatory coherence gains
- **Q2 - Decline in common misconceptions explicitly discussed in lesson**
- **Q3 - Mysteries are considered inquiry**
- **Q4 - Mystery phenomenons considered a story: Basic structure & narrative elements recognized**

Conclusions
- Method for empirically testing efficacy of stories

References