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 paper, 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 Biology of Life by the authors for teaching evolutionary biology 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 monitored 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 experience 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 this lesson’s format as a mystery in reference to inquiry teaching.

Teaching & Learning Evolution
- **National & State Science Education Standards**

- **Evolution is Difficult for Students to Learn**

- **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

- **Provides**
  - Standard structure
  - Consistent way to evaluate

No empirical studies evaluating Klassen’s approach
This study fills gap
Purpose: to test efficacy of story approach
  - Two versions of the Mystery Phenomenon Lesson
    - Traditional approach
    - Story approach
  - Both use Klassen’s 10-narrative elements
  - Evaluate learning outcomes and student experiences

Data Collection and Analysis
- **Quantitative**
  - Pre-post test results
  - Student performance

- **Qualitative**
  - Semi-structured interviews
  - **Grounding**
    - Emergent coding

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

- **Graph One**
  - Total score: 14.22 vs. 16.65
  - Graph Two: The story approach group had statistically significant gain from pre to post-test and the difference in gains between traditional approach and story approach groups was statistically significant.

- **Graph Three**: The story approach group had more questions display positive gains, including statistically significant gains.

- **Graph Four**: The story approach group had a statistically significant amount of participants move from a failing to a transferable score.

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

- Interviews: 3 types of misconceptions
  - Same as CINS
  - **Hybrid answers**: correct statement w/ incorrect one
  - Variation example

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:
- **Mystery 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…”

- **Mystery as future teachers**
  - T1: “I think the advantage there is the inquiry part of it… with young children, you can’t just give them facts and expect them to understand something, … but if you let them explore why things are happening, I think it will help them learn because they’ll come to it on their own…”

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

Conclusions
- **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 phenomenon considered a story: Basic construct & narrative elements recognized

Method for empirically testing efficacy of stories

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

What is the story approach group agreement? Stories show specific structure: beginning — middle — end Other components: human agency, resolution to problem

Limitations: CINS instrument 2 alternative conceptions Semi-structured interviews Only treatment group were asked about stories Long-term retention of gains Not considered due to time constraints Quasi-experimental design Generalizability limited

Implications: Improvement of MP lesson Explicitly discuss other common misconceptions Review ideas of random mutation and species Future Research: New part of lessons No/minimum narrative elements vs. All Mysteries vs. stories

Future Research
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