

Sixth Graders' Use of Evidence in the Written Arguments about Socioscientific Issue

Nannan Fan, Troy D Sadler

University of North Carolina at Chapel Hill

March 30, 2022

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1. Introduction and research questions

- Engaging in evidence-based argumentation has been recognized as a key component of scientific literacy, which requires students to be able to obtain, understand, evaluate, and integrate evidence.
- Despite the consensus on the primacy of evidence in argumentation, it is still hard to have a universal understanding of what could be counted as evidence.
- Complexity of “evidence“ that makes students’ use of evidence more difficult to explore.
- ❖ How do 6th graders use available evidence in their written arguments about *de-extinction*?



2. What is evidence?

- Toulmin concluded that a complete set of arguments should include data, claim, warrant, qualifier, rebuttal, and backing.
- Evidence, often mixed with data, that is used to support a claim through reasoning.
- Evidence as all kinds of information that are directly or indirectly connected to a claim. In this study, evidence mainly refers to experts' opinions, scientific theory and predictive diversity data presented to students before their writing task.

3. Method

Video-taped class

Science content instruction about endangered and extinct animals was recorded.

Open-ended questionnaires

45 6th graders were invited to fill the questionnaire about *de-extinction* after they finished class about endangered animals.

Data collection

- **Data Analysis**

- Presented eight arguments which either came from the adapted article on social media or science lesson about endangered and extinct animals (recorded video).
- Analyzed 45 students' written responses when they mentioned these eight arguments and further explored nuanced ways that they referred to them.



3. Method

Table 1 The Information provided to 6th grade students

Excerpts	Argument	Type	Content in Detail
Debate about de-extinction on social media	For	Experts' opinion	The 7 minutes lifespan of the cloned Pyrenean goat symbolizes the first successful step of “reviving” extinct species. It’s human’s duty to revive extinct animals because most animals disappear in the process of human domination of the earth. Reviving extinct animals will help enrich the biodiversity of the earth and restore damaged natural environments.
	Against	Experts' opinion	Cloning an extinct animal does not mean that humans could “revive” the entire species population. Even if extinct animals could be resurrected in groups, the suitable environment for them may have disappeared. According to a relevant report, the resurrection of recently extinct species may cause the disappearance of up to 3 times as many existing species.
Science lesson about endangered animals' protection	Neutral	Science theory	The creatures living in the same environment do not live alone, they depend on each other, such as the relationship between Dodo and Dodo’s tree.
	Neutral	Predictive diversity data	An estimated 17,500 species are lost every year and the major destruction is caused by human activity (<u>DiSilvestro, 1993</u>)

4. Results and discussion

(1) Students' use of evidence

- Paraphrasing: Paraphrasing the given reading or science teaching content;
- Interpreting: Further interpreting the given opinions from the reading article or science teaching content with some new claims;
- Refuting: Directly refusing the arguments from given article with self-justifications;
- Presupposing: Integrating the opposing justifications as a presupposition of their later stated claims;

For Example

“More importantly, even if extinct animals can be resurrected in groups, the environment suitable for their growth may have already disappeared”

Presupposing: “I think that we should choose some animals that are useful to nature or humans and can find a suitable living environment in nature”.



4. Results and discussion

(2) The distribution of students' use of evidence

Sources	Type of evidence /use of evidence	Paraphrasing (32.1%)	Interpreting (39.3%)	Refuting (23.2%)	Presupposing (5.4%)
Adapted News	Experts' opinion	17	8	13	3
Science Lesson	Science theory	1	2	0	0
	Predictive diversity data	0	12	0	0
Personal Experience	Sci-fi movies: <i>Jurassic Park</i> , <i>Resident Evil</i>	11			

- 39.3 % and 32.1% students' arguments are built on interpreting and paraphrasing information presented by the adapted article and science lesson, rather than refuting opposite ones.
- Compared to scientists' claims and scientific theory, 6th graders tended to interpret arguments with predictive diversity number which describe the negative impact of reviving extinct animals and the status quo of endangered animals.
- Emerging finding: the prominent effect of personal experience with Sci-fi movies (*Jurassic park*, *Resident Evil*)



5. Implications

- Students' written arguments reveal their personal experience and their influence on students' decision making. It is necessary and interesting for science teachers to know students' prior beliefs and address them in the classroom.
- Science teachers need expose students to conflicting information and cultivate students' critical thinking ability, such as how to evaluate different claims and judge the merit of different kinds of evidence.