Citizens must be able to argue from evidence

- Complex global issues, like climate change and fake news, require citizens who can make decisions and argue from scientific evidence.¹
- Students need opportunities to develop these skills.² Instructors need methods to assess the structure and content of students’ arguments.³,⁴
- We propose a framework that characterizes student arguments in three dimensions: reasoning, granularity, and comparisons.

Phase 1: identifying concepts, links, and comparisons

**What concepts are discussed?**

The equilibrium will favor the products...

...NaH’s conjugate acid is H₂, which has a pKₐ of 36...

...indicates the side with the weaker acid.

**Which concepts are linked?**

The equilibrium will favor the products... because

...NaH’s conjugate acid is H₂, which has a pKₐ of 36...

this is relevant because

...it indicates the side with the weaker acid.

**Which concepts are used to compare?**

The equilibrium will favor the products because NaH’s conjugate acid is H₂, which has a pKₐ of 36. This is relevant because it indicates the side with the weaker acid. To compare, both H₂O and ‘NH₄ have pKₐ values lower than H₂.

Phase 2: identifying the argument’s level of granularity, reasoning, and comparison

**Level of granularity**

- pKₐ values
- Direction of equilibrium
- Conjugate acid strength
- Reaction
- Molecular
- Atomic

Concepts in the argument reach a molecular level of granularity

**Mode of reasoning**

- Direction of equilibrium
- pKₐ values
- Conjugate acid strength
- Descriptive
- Relational
- Linear-causal
- Multi-component

Argument connects concepts in a linear-causal mode of reasoning

**Level of comparison**

- Conjugate acid strength
- Direction of equilibrium
- pKₐ values
- Discussed in isolation
- Compared against other claims

Argument uses some (not all) concepts to partially compare between claims.

Learn more: FlynnResearchGroup.com

---