

Investigating the Mechanisms of Peer Review

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Writing-to-Learn at Scale

Our Course - Physics 140

- Introduction to Mechanics.
- 600+ students each term.

Writing-to-Learn (WTL) Components

- Meaning-making writing tasks,
- **Interactive writing processes,**
- Clear writing expectations,
- Metacognition [1].

M-Write Project

- Campus wide, socio-technical system that works with courses to implement WTL activities [2].
- First draft, **peer review**, and revised draft.
- Writing Fellows.



The Writing Activity

Title: A Watershed Moment in Energy Storage

Scenario: The student is placed in the role of a consultant working at a renewable energy firm. Their boss is interested in the Ludington Pumped Storage Plant which uses pumped water that is held above a bluff on the coast of Lake Michigan to store energy. Their boss tasks the student with writing a memo describing the physics of the storage facility.

The Learning Goal: Understanding the importance of defining an energy system and how to choose the entities to include in it.

Our Definition of the System: We hoped that students would define the system as the water and the Earth. We still gave full points if the students also included any parts of the plant itself (e.g. turbines and/or pumps), as long as they still included the water and the Earth. The reason that we wanted students to define the system this way is because you need the water and the Earth in your system to talk about both the Kinetic Energy and Potential Energy.

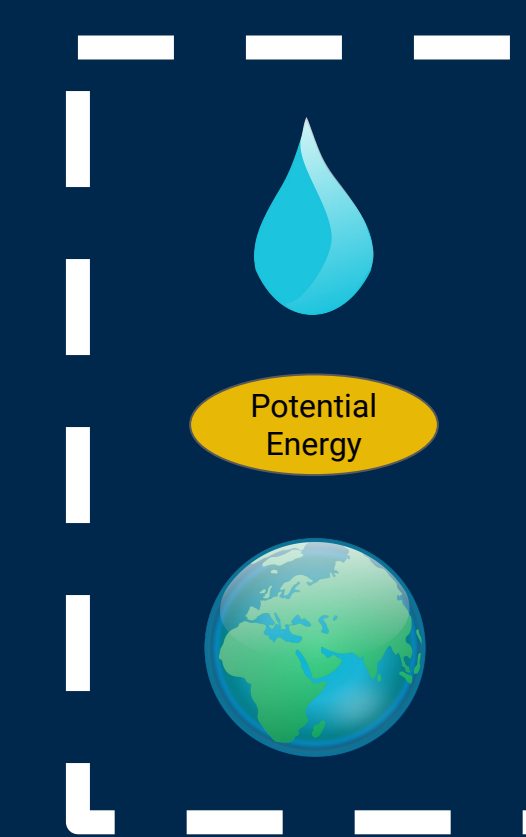


Aerial image of the Ludington Pumped Storage Facility [3].

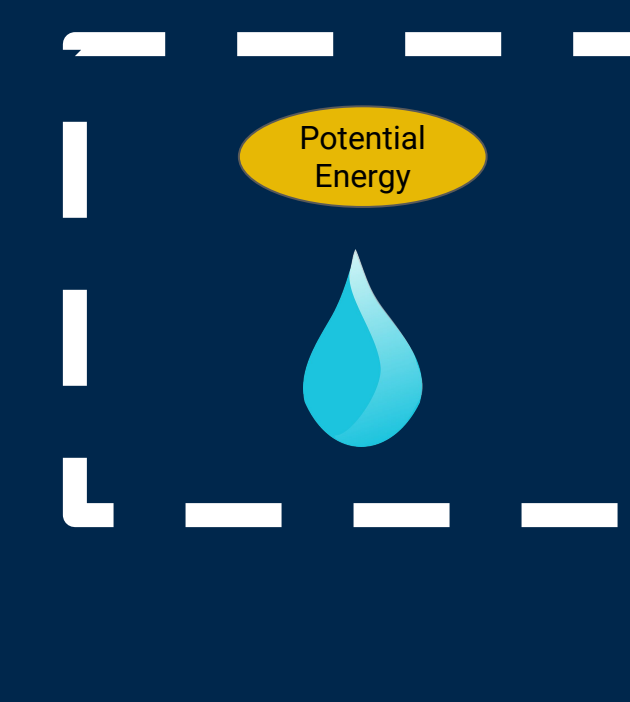
What elements of the Peer Review process impact student understanding?

We deductively categorized all of the first and revised drafts by the system in which energy was stored.

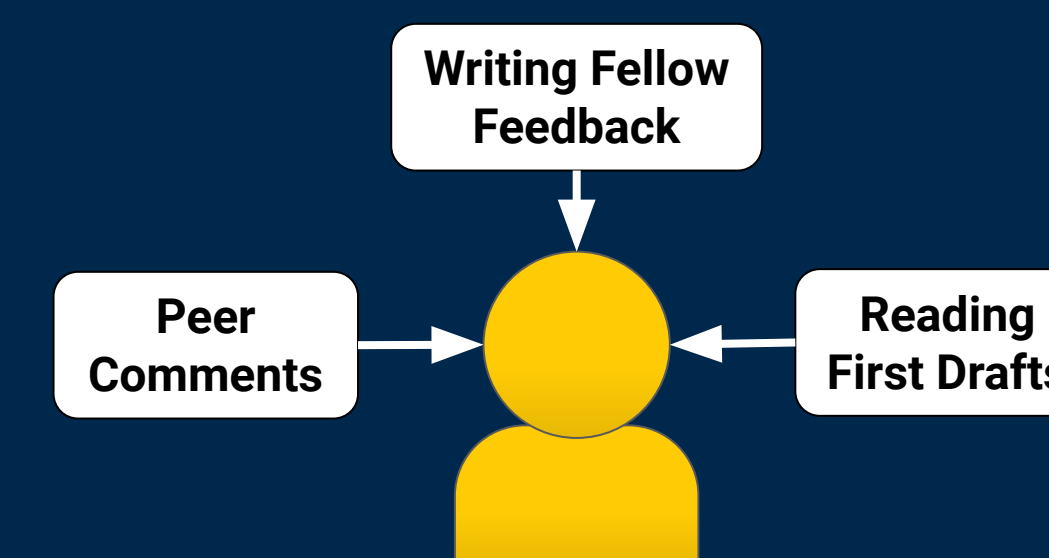
Earth and Water



Water



We Identified measurable peer review inputs and generated measures for each individual student.



The peer comments a student received were significantly correlated to if the student revised their written energy system.

The specific writing fellow feedback a student received was significantly correlated to if a student added the Earth in their revised system.



Student Writing Data

First Draft	Revised Draft	N
Fall 2018		
N = 620		
Earth	Remain	47
	Earth	16
	No Earth	16
No Earth	Remain	186
	Earth	152
	No Earth	203
Winter 2019		
N = 514		
Earth	Remain	97
	Earth	9
	No Earth	8
No Earth	Remain	99
	Earth	215
	No Earth	86

This table shows the populations of students who included Earth (or not) in their system between their first and revised drafts for each semester.

Input Type	Revised	Remained	p-value
Fall 2018			
(N = 355) (N = 186)			
PR-S = 0	52	74	<0.001***
PR-S = 1	95	68	0.018*
PR-S = 2	115	27	<0.001***
PR-S = 3	93	17	<0.001***
Read-S = 0	5	8	0.037*
Read-S = 1	41	32	0.068
Read-S = 2	121	74	0.19
Read-S = 3	188	72	0.0016**
WF-S = 1	319	156	0.043*
Winter 2019			
(N = 301) (N = 99)			
PR-S = 0	50	20	0.42
PR-S = 1	93	36	0.31
PR-S = 2	98	30	0.68
PR-S = 3	60	13	0.13
Read-S = 0	8	6	0.11
Read-S = 1	39	18	0.19
Read-S = 2	96	31	0.91
Read-S = 3	158	44	0.17
WF-S = 1	286	90	0.14

This table presents the number of students who experienced different inputs during the peer review process. These students included in this table did not have the Earth in their first draft system.

	PR-S = 0			PR-S = 1		
	Revised	Remained	p-value	Revised	Remained	p-value
Read-S = 0	1	4	0.031*	2	4	0.094
Read-S = 1	11	18	0.0012**	15	10	0.55
Read-S = 2	21	31	<0.001***	32	28	0.034*
Read-S = 3	19	21	0.012*	46	26	0.74
	PR-S = 2			PR-S = 3		
	Revised	Remained	p-value	Revised	Remained	p-value
Read-S = 0	1	0	0.47	1	0	0.47
Read-S = 1	11	4	0.52	4	0	0.15
Read-S = 2	36	8	0.018*	32	7	0.025*
Read-S = 3	67	15	<0.001***	56	10	<0.001***

The population of students in this table are those who did not have the Earth in their first draft system in Fall 2018. Moving horizontally represents the number of peer reviews that a student received advising them to revise their system. Moving down the table represents the number of different systems that students read in the first drafts. Each cell holds the number of students who Revised or Remained and the p-value when comparing the two groups.

Acknowledgements

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References

- [1] A.R. Gere, N. Limlamai, E. Wilson, and S. MacDougall, K. Saylor, and R. Pugh, *Writing and Conceptual Learning in Science: An Analysis of Assignments*, in *Written Communication* **36**, 1 (2019).
- [2] M-Write. See more at <https://lsa.umich.edu/sweetland/m-write.html>
- [3] Consumers Energy, *Ludington Pumped Storage Facility* (2016).