WHAT HAS EDDY DONE THIS SUMMER

Video Analysis of Argument and Explanation in an Introductory Classroom

By Eduardo A. Velazquez

Mentored by: JT Laverty

THE BIG QUESTION?

How can we see when students are engaging in scientific practices?

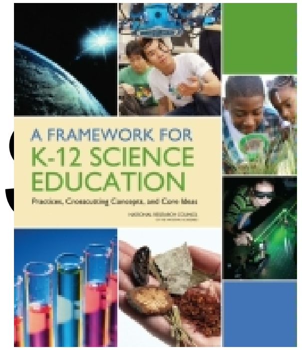
SCIENTIFIC PRACTICE

Recent efforts to transform science education have highlighted the importance of engaging students in scientific practices in order to develop their understanding of both the process and knowledge of science.

8 different practices from k-12

1. Asking questions
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. **Constructing explanations**
7. **Engaging in argument from evidence**
8. Obtaining, evaluating, and communicating information

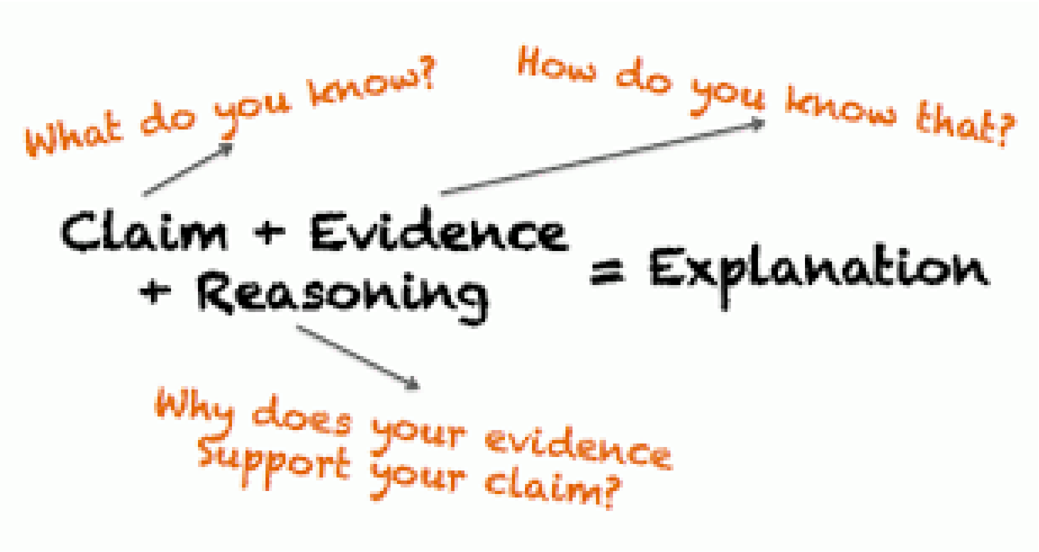
READINGS



- A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas
- Teaching Scientific Practices: Meeting the Challenge of Change Jonathan Osborn
- Scientific Argument and Explanation: A Necessary Distinction JONATHAN F. OSBORNE, ALEXIS PATTERSON
- For Whom Is Argument and Explanation a Necessary Distinction? A Response to Osborne and Patterson LEEMA K. BERLAND,1 KATHERINE L. McNEILL
- Authors' Response to "For Whom Is Argument and Explanation a Necessary Distinction? A Response to Osborne and Patterson" by Berland and McNeill JONATHAN OSBORNE, ALEXIS PATTERSON

CONSTRUCTING EXPLANATIONS

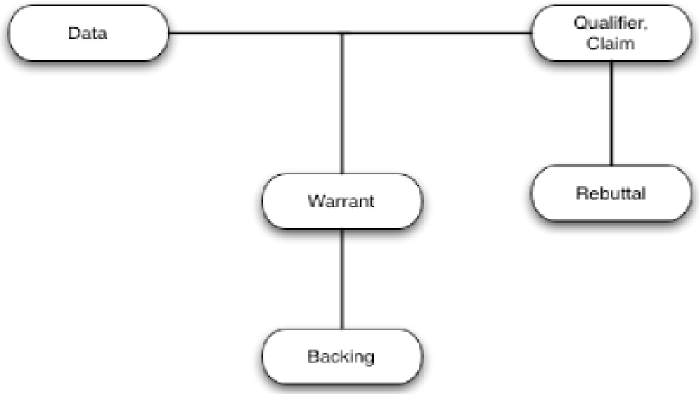
- A scientific explanation is an explanatory account that articulates how or why a natural phenomenon occurs that is supported by evidence and scientific ideas
- Explanations are ways to show your claim with evidence

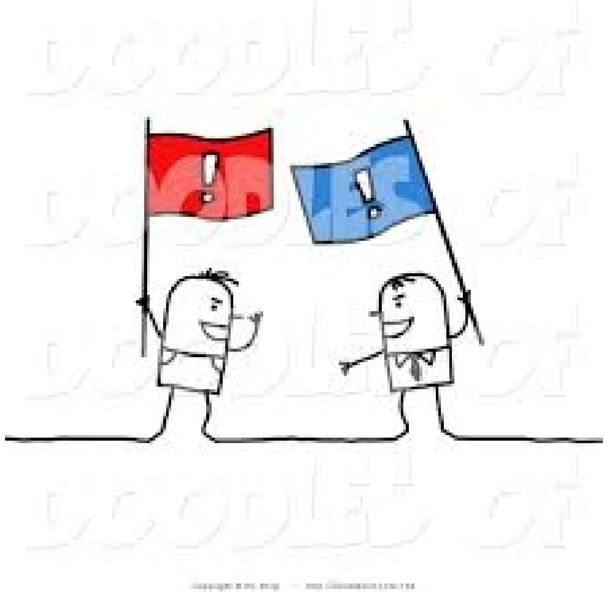


ENGAGING IN ARGUMENT FROM EVIDENCE

- Scientific argumentation is a process that occurs when there are multiple ideas or claims to discuss and reconcile. An argument includes a claim supported by evidence and reasoning, and students engage in debates to evaluate and critique competing arguments.
- Arguments are ways to validate your claim
- Toulmin method

Toulmin's diagram of arguments typically looks something like this example:



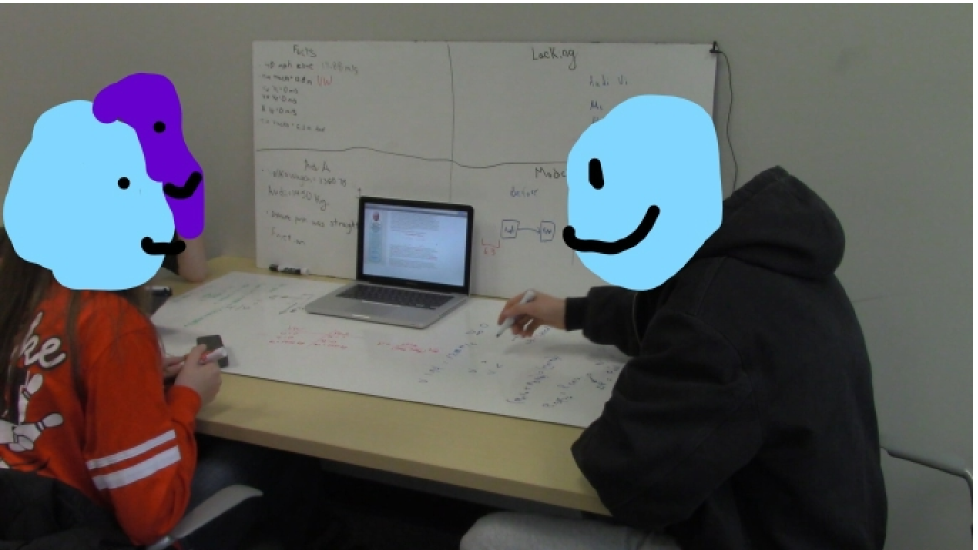


Data collection

INFORMATION GATHERING AND WHAT NOT

MSU VIDEO DATA

- Paul Irving and Danny Caballero from PERL @ Michigan State University shared videos with me
- P^3 program (half computing half intro to physics) course
- Group of 3-4
- 2 hour block
- Names: Wendy Yolanda Don



THE QUESTION ITSELF

You are a group of scientists who are a member of an elite crime scene investigation unit who focus on traffic accidents. You have been called to the scene of an accident between two cars. Your initial assessment allows you to come to the conclusion that one of the cars has obviously run into the back of the other. Your team finds brake marks on the road. After examining the scene of the accident you conclude that one of the cars, a Volkswagen New Beetle was parked with its handbrake on and only the driver in it before the accident, while the other car, an Audi tt had a single male occupant (33 years old) who crashed into the back of the Beetle. Both cars were empty except for their drivers. The point on the road where the impact took place is indicated and you notice brake marks leading up to the impact and brake marks after the impact. After the impact, the cars were stuck together. The accident took place in a 40 mph zone and the road was dry. It is your task to determine if the person driving the Audi was speeding. There is a technical expert at the scene of the accident who will make any measurements you ask for

Conservation of momentum
and inelastic collision

MEETINGS

- Both for feedback and helping out presentations
- Wednesday two different ones
- One with MSU
- One with the PER group

Analysis

WHAT DID I DO WITH ALL THIS DATA

TIME STAMP

- Made a “time stamp ” to help me organize and take notes on clips
- Color coded
- Needed evidence and confidence

13:00	13:30	explaining 1-d conservation of momentum	3	explanation
14;11	15;00	don askes about the equation	4	explanation
15;10	17:13	don asks again to get farther euation	4	argument
32;15	1:12	getting help from the TA with the questions they learn to explain	3	none
3:00	7:30	figuring out where the items in the equation come from ft.	3	argument
10:30	13:40	"I'm confused"- "I think were on to something"	3	explanation
16:40	23:32	till 17:38 worked on problem before TA then asks why they chose the eqn.	1	none
22:31	23:03	is momentum conserved when they collide?	3	explanation
23:28	24;30	reexplaining the difference from equations and making it work	4	argument
24;46	25;55	explain about before and after. And how momentum is conserved	4	explanation
26;07	28;24	once confused they try to figure out calculate the velocity	3	explanation
28;41	31;13	using prior equations they find a threshold of higher or lower then 40	2	argument
32;22	0:17	arguing of the question (using different frames) and misinformation	4	argument
0:26	2:00	showing TA that they found a way to understand the question	3	explanation
3:21	3:44	what if they use after to find the before speed?	1	explanation
5:00	7:00	what is the acceleration and where it comes from? Ft. TA	2	argument
9:48	11:08	coefficient of friction	3	explination
11:08	13:16	needs to see it in different frames	3	explanation
13:53	18:49	dose the mass matter in the exudation ?	4	argument
19:14	20:41	one of them need another example to understand	2	argument
22:50	24;09	explaining TA how far they've come and get feed back	1	explination
25;17	26;31	how do the different accelerations are different	3	argument
33;40	0:48	who wants to explain it? TA asks them to explain there resoning	4	explination
1:00	6:15	questions prior to leaving	1	??
	video 1			
	video 2			
	video 3			
	video 4			

DEFINITIONS

- Tried making definitions for the two scientific practices
- Didn't work out and had to take a different approach
- Its so bad that I don't want to show it

RUBRIC

- Ended up making a rubric to make watching and identifying the practice
- Found out that they have similarities
- there are two parts to it
- First watch- since both have this claim evidence reasoning
- Second watch - deducing whether it is argument, explanation or neither

RUBRIC

Both / 1st step **(This is necessary to follow to the next two)**	In the clip, I am looking for 1. One student instructor/anyone has to make a tentative statement (claim) directed towards either another student, the group as a whole, or the instructor about the physics in the problem. (*tentative statement is one in which the student expresses some uncertainty) 2. The student/s uses scientific principles or other physics equations that they have at their disposal in order to make their statement valid (evidence). 3. The student/s then uses both items (claim and evidence) to form a concise, valid scientific statement that would further someone else's understanding of the original.
Explanation **(The claim is not in question / the fight of differing evidence)**	1. If a student does not understand what the rest of the group is doing they may need an explanation of this. ("What does this equation mean?") 2. Another student or an instructor can intervene and try to answer their question using evidence from scientific principles or an equation they have. 3. The original student should have a better understanding after this explanation. 4. The explanation should be understood and accepted globally.
Argument **(The claim is in question/ the fight of differing explanations)**	1. The claim that one student makes has to be questioned. 2. There must be a reason for doubt in the claim and not the evidence. 3. "Not all arguments have a rebuttal, but when a conversation has a rebuttal it is an argument." (A rebuttal is a statement indicating circumstances when the general argument does not hold true.) 4. A competition of explanations. 5. If the students know the outcome of the question, the argument is figuring out "how." (Example: Here is where the cars hit. One was stationary and the other was not. The students state that they know that the cars will continue their path. The question here is how.)

RUBRIC IN ACTION!! (EXPLANATION)

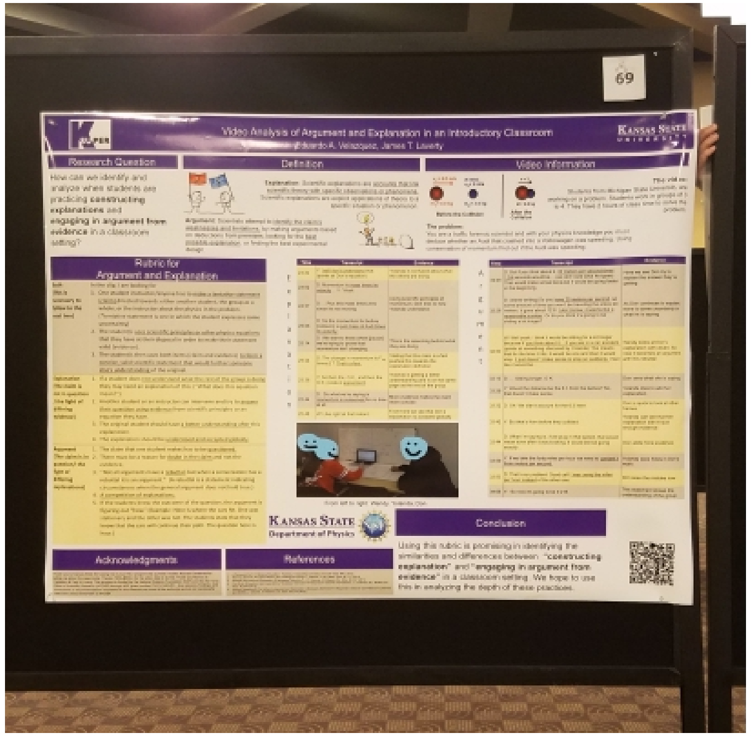
Time	Transcript	Evidence
24:42	Y: I still don't understand that. (points at Don's equation)	Yolanda is confused about what the others are doing.
24:52	D: Momentum is mass times its velocity… Y: "Yeah.	
24:57	D: …Plus this mass times zero since it's not moving.	Using scientific principles of momentum, Don tries to help Yolanda understand.
25:06	D: So the momentum for before [collision] is just mass of Audi times its velocity.	
25:14	D: We want to know when [*pause*] we're trying to prove that momentum isn't changing.	This is the reasoning behind what they are doing.
25:24	D: The change in momentum is F_{net} times Δ T. That's a fact.	Stating that this claim is a fact pushes this towards the explanation definition.
25:36	Y: So then the, O.K., and then the O.K. (nods in agreement)	Yolanda is getting a better understanding and is on the same page as the rest of the group.
25:44	D: So what we're saying is momentum is conserved for no time at all.	More evidence makes the claim more concise.
25:48	W: Like right at that instant.	From here we see that Don's explanation is accepted globally.

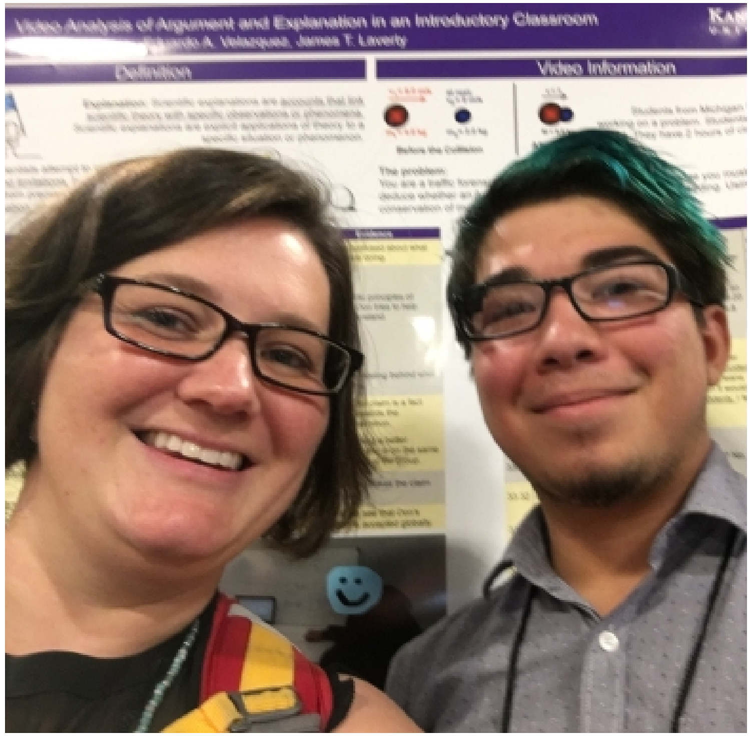
RUBRIC IN ACTION!! (ARGUMENT)

Time	Transcript	Evidence
32:09	D: But if you think about it, 20 meters per second times 1.24 seconds would be… (we don't see what he types) That would make sense because it would be going faster in the beginning.	Here we see Don try to explain the answer they're getting.
32:28	D: (starts writing) So you have 20 meters per second, so some amount of time you won't be traveling the entire 20 meters, it goes about 12.8. I don't know, it seems like a reasonable number. Or do you think it's going to be sliding a lot longer?	As Don continues to explain, there is some uncertainty in what he is saying.
32:53	W: Well yeah, I think it would be sliding for a lot longer because if you think about it… If you are in a car accident. (points at something obscured by Yolanda) This means that for the time it hits, it would be one and then it would stop. It just doesn't make sense to stop so suddenly. I feel like it would be...	Wendy looks at Don's explanation with doubt. So now it becomes an argument with this rebuttal.
33:13	D: … Sliding longer. O.K.	Don sees what she is saying.
33:20	Y: Would the distance be the 6.3 from the before? No, that doesn't make sense.	Yolanda tries to add her explanation.
33:32	D: Oh. We didn't account for the 6.3 here.	Don is quick to look at other frames.
33:42	Y: But that's from before they collided.	Yolanda can see that her explanation didn't have enough evidence.
33:44	D: What I'm saying is, if we plug in that speed, that would mean even after it was braking, it would still be going exactly...	Don adds more evidence.
33:50	Y: If we take the forty miles per hour we need to convert it from meters per second.	Yolanda sees holes in Don's math.
33:53	D: That's our problem! Good call! I was using the miles per hour instead of the other one.	Don sees the mistake now .
34:06	Y: "So now it's going to be 9.216.	This statement shows the understanding of the group.

POSTER

- AAPT & PERC meeting
- Had to finish research early
- Had to present my data and method and what not
- Enjoyed my time there by the way
- Also used the poster yesterday at SUROP





PICTURES OF POSTER AND I

Conclusion

NOW WHAT

WHAT HAPPENS WITH MY FINDINGS?

- Give my data,
- Add more to the rubric to make it about the quality of the practice
- Use my experience here to be a better teacher one day
- Met some cool people in this program

CITATIONS

- Osborne, Jonathan F., and Alexis Patterson. "Scientific Argument and Explanation: A Necessary Distinction?" Science Education, Wiley Subscription Services, Inc., A Wiley Company, 23 May 2011, onlinelibrary.wiley.com/doi/10.1002/sce.20438/abstract.
- Berland, Leema K., and Katherine L. McNeill. "For Whom Is Argument and Explanation a Necessary Distinction? A Response to Osborne and Patterson." Science Education, Wiley Subscription Services, Inc., A Wiley Company, 9 Aug. 2012, onlinelibrary.wiley.com/doi/10.1002/sce.21000/abstract
- Osborne, Jonathan, and Alexis Patterson. "Authors' Response to 'For Whom Is Argument and Explanation a Necessary Distinction? A Response to Osborne and Patterson' by Berland and McNeill." Science Education, Wiley Subscription Services, Inc., A Wiley Company, 9 Aug. 2012, onlinelibrary.wiley.com/doi/10.1002/sce.21034/full.
- Osborne, Jonathan. "Teaching Scientific Practices: Meeting the Challenge of Change." SpringerLink, Springer Netherlands, 25 Mar. 2014, link.springer.com/article/10.1007/s10972-014-9384-1.
- National Research Council; Division of Behavioral and Social Sciences and Education; Board on Science Education; Committee on a Conceptual Framework for New K-12 Science Education Standards. "A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas." The National Academies Press, 19 July 2011, www.nap.edu/catalog/13165/a-framework-for-k-12-science-education-practices-crosscutting-concepts.

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AND LAST BUT NOT LEAST!!!!!




CUTENESSS OVERLOAD!!!!!!!!!