

Assessment of Scientific Argumentation in the Classroom (ASAC) Observation Protocol

Time	Description of Event

COGNITIVE ASPECTS OF SCIENTIFIC ARGUMENTATION

HOW THE GROUP ATTEMPTS TO NEGOTIATE MEANING OR DEVELOP A BETTER UNDERSTANDING

(THESE ITEMS TARGET HOW THE GROUP INTERACTS WITH IDEAS)

1. The talk of the group was focused on solving a problem or advancing understanding.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> The emphasis on advancing understanding indicates that there were some significant claims or explanations at the heart of discussion. Groups that score high on this item maintain the focus of their talk and efforts on understanding or solving the problem rather than the best way to finish their work quickly or with the least amount of effort. <i>Note:</i> Groups that stay on topic but never go engage in an in-depth discussion about what is happening should be scored low on this item.			
2. The participants sought out and discussed alternative claims or explanations.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> Divergent thinking is an important part of argumentation. A group that meets this criterion would talk about more than one claim, explanation, or solution. Individuals that valued alternative modes of thinking would respect and actively solicit new or alternative claims, explanations, or solutions from the other participants. <i>Note:</i> Groups that discuss multiple types of grounds or support for a claim, explanation, or solution but only one claim, explanation, or solution should be scored low on this item.			
3. The participants modified their explanation or claim when they noticed an inconsistency or discovered anomalous information.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> Inconsistencies between claims or explanation and the phenomenon under investigation are common. A group that modified their claim or explanation when they noticed inconsistencies or anomalies would not ignore “things that do not fit” or attempt to discount them once they are noticed by one of the participants. Groups that score high on this item try to modify their claim or explanation (not just their reasons) in order to account for an inconsistency or an anomaly rather than attempting to “explain them away.”			
4. The participants were skeptical of ideas and information.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> During scientific argumentation, allowing a variety of ideas to be presented, but insisting that challenge and negotiation also occur would indicate that group members were skeptical. Accepting ideas without accompanying reasons would result in a low score because it is a sign of credulous thinking. In other words, students must be willing to ask, “how do you know?” or “Are you sure?” Groups that respond to the ideas of others with comments such as “ok”, “that sounds good to me”, or “whatever you think is right” would score low on this item.			
5. The participants provided reasons when supporting or challenging an idea.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> Providing reasons to support or challenge a claim, conclusion, or explanation is a crucial characteristic of argumentation. Claims must have some support provided for them beyond simply restating the claim itself. Making claims without support would result in a low score on this item and including any reason like “that’s what I think”, “it doesn’t make sense”, “the data suggests...” or “but that doesn’t fit with...” would result in a higher score. <i>Note:</i> Personal or past experiences count as a reason for this item.			
6. The participants attempted to evaluate the merits of each alternative claim or explanation in a systematic manner.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> This addresses the tentative or responsive nature of science. The idea that there is often more than one way to interpret data or evidence and that only through careful analysis can an idea be accepted or eliminated. This gets at the “gut” response factor. Conclusions are not based on opinion or inference.			

COGNITIVE SUBSCORE: _____/12

EPISTEMIC ASPECTS OF SCIENTIFIC ARGUMENTATION

HOW CONSISTENT THE PROCESS IS WITH THE CULTURE OF SCIENCE

(THESE ITEMS TARGET HOW THE GROUP DETERMINES WHAT COUNTS AS VALID OR ACCEPTABLE)

7. The participants used evidence to support and challenge ideas or to make sense of the phenomenon under investigation.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> A goal of scientific argumentation is the use of data that has been collected, analyzed, and interpreted as evidence to defend a claim, conclusion, or explanation. This item implies that students were attempting to use evidence in their arguments. This should more than an opinion; they must discuss data that was collected, how the data was analyzed, or what the results of an analysis means. Statements like “that’s what I think” or “it doesn’t make sense” would result in a low score. Statements like “the data we found suggests that ...” or “our evidence indicates...” would result in a higher score.			
8. The participants examined the relevance, coherence, and sufficiency of the evidence.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> This item draws attention to the amount and kinds of evidence used to support a claim or explanation. Groups that attempt to (a) determine the value of a piece of evidences (e.g., “does that matter?”), (b) look at links or the relationship between multiple pieces of evidence (e.g., “This supports X and Y but this only supports X”), or (c) attempt to determine if there is enough evidence to support an idea (e.g., “We do not have any evidence to support that”) would score higher on this item.			
9. The participants evaluated how the data was gathered, analyzed or interpreted.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> The evidence provided for a claim or explanation should be evaluated based on how well the data was gathered, analyzed, and interpreted. A question such as “Why is that evidence included?” or “How did they gather their data?” or “Where did that data come from?” indicates that the participants are assessing methods or an interpretation of data and would result in a higher score.			
10. The participants used scientific theories, laws, or models to support and challenge ideas or to help make sense of the phenomenon under investigation.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> Science is theory-laden. In other words, scientists rely on broad, well-supported organizing ideas to frame their arguments and claims. Students should also employ these paradigmatic ideas in providing warrants for the evidence and claims they make or use to refute others’ claims. Explicit reference to these “big ideas” will result in a higher score on this item.			
11. The participants made distinctions and connections between inferences and observations explicit to others.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> The structure of scientific arguments includes evidence involving both empirical (such as quantitative measurements and systematic observations) and inferential (noting of trends and logical connections among observations) aspects. Making these distinctions and their connections explicit to others enhances the quality of the argumentation and thus results in a higher score.			
12. The participants used the language of science to communicate ideas.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> This item stresses the importance of the accurate use of scientific language by students. The adoption and use appropriate terms (e.g., condensation, force, etc.), phrases (e.g., “it supports” rather than “it proves”) or ways of describing information is a characteristic of argumentation that is scientific. <i>Note:</i> Ideas may be explicated before being labeled with the correct terminology.			

EPISTEMIC SUBSCORE: _____/12

SOCIAL ASPECTS OF SCIENTIFIC ARGUMENTATION

HOW THE PARTICIPANTS INTERACT WITH EACH OTHER

(THESE ITEMS TARGET GROUP DYNAMICS)

13. The participants were reflective about what they know and how they know.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> It is important for members of the group to agree on what they know and to be specific about how they know. Statements such as, “do we all agree?” or “is there anything else we need to figure out?” or “can we be sure?” indicate that participants are monitoring their progress and have an end goal in mind.			
14. The participants respected what each other had to say.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> Respecting what others have to say is more than listening politely or giving tacit agreement. Respect also indicates that what others had to say was actually heard and considered (e.g., “that is a good point”, interesting idea”, or “I hadn’t thought of that”). A group that scored high on this would allow everyone to present their ideas and express their opinions without censure or ridicule.			
15. The participants discussed an idea when it was introduced into the conversation.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> To be a participating and contributing member of the group, it is important to feel valued. Ideas and opinions need to be critically acknowledged. This means they are considered and given weight by the group. Groups that ignore ideas when they are proposed (results in the same idea being mentioned over and over) would earn a low score on this item.			
16. The participants encouraged or invited others to share or critique ideas.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> Good argumentation comes from considering and comparing competing ideas from multiple individuals to construct the most robust explanation of the phenomenon under study. Groups that consist of individuals that invite others to share (e.g., “what do you think”), critique (e.g., “do you agree” or “it is ok to disagree with me”), or discuss an idea (e.g., “let’s talk about this some more”) would score higher than a group with an alienating leader that dominates the conversation and the work of the group.			
17. The participants restated or summarized comments and asked each other to clarify or elaborate on their comments.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> The depth of discussion will be enhanced by not making implicit judgments or assumptions about another person’s ideas or views, and it demonstrates that their point of view is valued and is furthering the discussion. Communication provides students with opportunities to identify the strengths and weaknesses of their understanding.			
18. There was equal participation from all members of the group.	0	1	2
	Not at all	Somewhat	Yes
<i>Description:</i> The degree to which in member contributed to the argumentation impacts the depth and breadth of the discourse. Also, one or two high performers may result in a high score on some items, but not be representative of the actual argumentation event. Groups where some members are not engaged would score low on this item.			

SOCIAL SUBSCORE: _____/12

TOTAL SCORE: _____/36