

Checklist for video evaluation or creation

The checklist below is provided to help an individual seeking to use the framework to either evaluate an existing video or to help in the planning when creating a video on a specific chemistry topic. For video production suggestions, see Castillo, et al. (2021).

Johnstone's Triangle Elements

Identify which of the following relevant representations are present within the video. Suitable representations will need to be defined by the user as they may be content topic dependent.

- | | |
|--------------------------------------|--|
| ☐ Macroscopic | ☐ Symbolic |
| ☐ Particulate | ☐ Explicit connections between levels |

Core Ideas

Core ideas are content topic specific. This framework was developed around the chemistry core ideas outlined in the 3D-LAP (Lavery, et al, 2016) or adapted from the Framework (NRC, 2021). Ideally, a core idea is woven through the full explanation of a concept.

- | | |
|----------------------------------|--------------------------------------|
| ☐ Present | ☐ Not Present |
|----------------------------------|--------------------------------------|

Scientific Practices

Criteria for science practices have been defined in the 3D-LOP (Bain, et al., 2020) and are found at the end of this checklist. Ideally the science practice is connected to the core idea as recommended in the Framework (NRC, 2021).

- | | |
|----------------------------------|--------------------------------------|
| ☐ Present | ☐ Not Present |
|----------------------------------|--------------------------------------|

Causal Mechanistic Reasoning (CMR)

CMR is content topic specific. There must be a question (*what*) being addressed and include both *how* it happens (cause) and a scientific reasoning (mechanism) for *why* it happens. The mechanism will be at a level below the phenomenon. The “what” question, is typically related to the core ideas for the concept.

- | | |
|----------------------------------|--------------------------------------|
| ☐ Present | ☐ Not Present |
|----------------------------------|--------------------------------------|

Self-assessment

Does the video specifically encourage self-assessment by the viewer? This typically involves posing a question and then prompts the viewer to try and answer the question, giving wait time or prompting to pause the video. The video should then reveal the answer either explicitly or by providing data (often in the form of a demonstration) that would allow the viewer to understand if their assessment was correct.

- | | |
|----------------------------------|--------------------------------------|
| ☐ Present | ☐ Not Present |
|----------------------------------|--------------------------------------|

Analogies

Does the video use analogies? Are analogies presented visually (so that a viewer unfamiliar with the analogies may still understand) or only verbally (requiring the viewer to have some prior knowledge).

- | | | |
|--|---|--------------------------------------|
| ☐ Present verbally and visually | ☐ Present, verbally only | ☐ Not Present |
|--|---|--------------------------------------|

Captions

Does the video rely exclusively on auto-captioning? If so, the video may be lacking punctuation and capitalization. It is also more likely to have misspelled scientific words.

☐ Auto captioned

☐ Fully captioned

☐ No-captions/Other issues

Multimedia Principles

Following good multimedia principles for creating educational materials can help strongly support learning. Identify which statement best categorizes a video.

High	Low
Image usage	
☐ Video almost exclusively involves <u>meaningful and relevant</u> images and verbal components AND <u>images are explained for a novice learner</u>	☐ Large segments of video presented just verbally and not pictorially (ex. just the instructor talking, or just written words) OR images presented are not relevant to learning or explained. If images are clearly incorrect or misleading it should be low.
Text usage	
☐ Text on screen is minimal (ex. Only brief bullet points or keywords if text is used)	☐ Contains full sentences of written text that are also narrated (e.g., several bullet points or sentences on one screen OR full sentences of text on many screens)
Video Coherence	
☐ Content is all relevant to the topic and learning (no music, unhelpful animations, graphics, etc.)	☐ Contains extraneous content, music, graphics, animations, background changes, sounds, or just too much stuff on the screen at one time - anything that detracts attention from core content
Video Segmenting and Supports	
☐ Contains elements that meaningfully support student organizing content or identify key ideas (introductory organizer, section heading, summary, guiding questions/topic (for short, focused video only) Key Question: Could a novice learner clearly understand what they should take away from the video? Yes=high.	☐ Does not contain any elements that meaningfully help learners organize content or identify key ideas (e.g., no introductory organizer, section headings, video segments, summary, guiding question/topic (for short focused videos only)

Scientific Practices

We expect that the most common practices will be the following so we have listed those first. ***Must have all elements present to be considered as meeting that science practice.***

- SP 2: Developing & Using Models (e.g. simulation showing how changing variables affects equilibrium)
- SP 4: Analyzing and Interpreting Data (e.g. specific data about equilibrium systems and explaining it)
- SP 5: Using Mathematical & Computational Thinking (e.g. using K & Q to explain changes in equilibrium systems)
- SP 6: Constructing explanations and engaging in argumentation from evidence

Scientific Practices Criteria (must satisfy all criteria) From Bain, et al, (2020)	
SP 2: Developing and Using Models	
☐	Instruction presents an event, observation, or phenomenon for instructor/students to explain or make a prediction about.
☐	Instruction presents a representation or asks instructor/students to construct a representation.
☐	Instruction has instructor/students explain or make a prediction about the event, observation, or phenomenon.
☐	Instruction has instructor/students provide the reasoning that links the representation to their explanation or prediction.
SP 4: Analyzing and Interpreting Data	
☐	Instruction presents a scientific question, claim, or hypothesis to be investigated.
☐	Instruction provides a representation of data (table, graph, or list of observations) used to answer the question or test the claim or hypothesis.
☐	Instruction provides an analysis of the data or asks instructor/students to analyze the data.
☐	Instruction has instructor/students interpret the results or assess the validity of the conclusions in the context of the scientific question, claim, or hypothesis.
SP 5: Using Mathematics and Computational Thinking	
☐	Instruction presents an event, observation, or phenomenon.
☐	Instruction has instructor/students perform a calculation or statistical test, generate a mathematical representation, or demonstrate a relationship between parameters.
☐	Instruction has instructor/students give a consequence or an interpretation in words, diagrams, symbols, or graphs of their mathematical results while demonstrating reasoning in the context of the given event, observation, or phenomenon.
SP 6: Constructing Explanations and Engaging in Argument from Evidence	
☐	Instruction presents an event, observation, or phenomenon.
☐	Instruction presents or asks instructor/students to make a claim based on the given event, observation, or phenomenon.
☐	Instruction has instructor/students provide scientific principles or evidence (data or observations) to support the claim.
☐	Instruction has instructor/students provide reasoning about why the scientific principles or evidence support the claim.

SP 1: Asking Questions

- ☐ Instruction presents an event, observation, phenomenon, data, scenario, or model.
- ☐ Instruction has instructor/students *generate* an empirically testable question about the given event, observation, phenomenon, data, scenario, or model. (Question cannot be rhetorical or simply a part of instruction; rather it must be a *process of generating* a testable question.)

SP 3: Planning Investigations

- ☐ Instruction poses a scientific question, claim, or hypothesis to be investigated.
- ☐ Instruction has instructor/students describe or design an investigation, or identify the observations required to answer the question or test the claim or hypothesis.
- ☐ Instruction has instructor/students justify how their description, design, or observations can be used to answer the question or test the claim or hypothesis.

SP 7: Evaluating Information

- ☐ Instruction provides an excerpt from a conversation, article, student solution, or other communication that makes one or more assertions.
- ☐ Instruction presents a conclusion about the validity of the assertion(s) made or asks instructor/students to make a conclusion about the validity of the assertion(s), or reconcile multiple assertions with each other.
- ☐ Instruction has instructor/students provide reasoning to support their conclusion(s) about the validity of the assertion(s) or reconciliation with data, observations, or scientific principles.

References

Bain, K.; Bender, L.; Bergeron, P.; Caballero, M. D.; Carmel, J. H.; Duffy, E. M.; Ebert-May, D.;

Fata-Hartley, C. L.; Herrington, D. G.; Lavery, J. T.; Matz, R. L.; Nelson, P. C.; Posey, L. A.; Stoltzfus, J. R.; Stowe, R. L.; Sweeder, R. D.; Tessmer, S. H.; Underwood, S. M.; Urban-Lurain, M.; Cooper, M. M. Characterizing College Science Instruction: The Three-Dimensional Learning Observation Protocol. *PLOS ONE* **2020**, *15* (6), e0234640. <https://doi.org/10.1371/journal.pone.0234640>.

Castillo, S.; Calvitti, K.; Shoup, J.; Rice, M.; Lubbock, H.; Oliver, K.H. Production Processes for Creating Educational Videos. *CBE Life Sciences Education* **2021**, *20* (2), 10:es71-12. <https://doi.org/10.1187/cbe.20-06-0120>.

Lavery, J. T.; Underwood, S. M.; Matz, R. L.; Posey, L. A.; Carmel, J. H.; Caballero, M. D.; Fata-Hartley, C. L.; Ebert-May, D.; Jardeleza, S. E.; Cooper, M. M. Characterizing College Science Assessments: The Three-Dimensional Learning Assessment Protocol. *PLoS ONE* **2016**, *11*, e0162333. <https://doi.org/10.1371/journal.pone.0162333>.

National Research Council. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*; The National Academies Press: Washington, DC, 2012.