

Modified color frames for analyzing group interactions during an online quantum tutorial

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Research Goals: Analyze the behaviors of online group tutorials to better understand the effectiveness of online group work.

Methods: Modify the Color Frames [1] by adding behaviors to each frame seen in the online format. Redefine each frame to account for these additional behaviors and test usefulness by analyzing a single QM tutorial.

Modified Color Frames

Previously "Worksheet" Frame

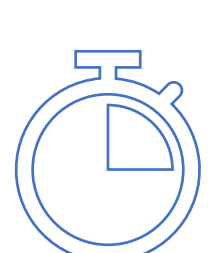
We renamed this frame due to the limitations of our virtual environments. We cannot verify if students are truly working on tutorial, especially while attention is offscreen.

We included echo-back talk in this frame as it is important to distinguish loose/limited collaboration from fully engaged discussion.

Blue Frame can be quickly identified by...



Prolonged Silence



Brief Exchanges



Lack of Full-Group Participation

Previously "Joking" Frame

Frame was modified due to observation of casual/friendly behavior beyond what "Joking" encompassed.

We observed that Yellow Frame was able to overlap with all other frames. Specifically, Yellow Frame does not only appear in off-topic discussions.

Yellow Frame can be quickly identified by...



Laugh/Smile

Blue "Individual" Frame

Eyes on paper, screen, or downward. Brief glances to peers or screen.

Muttering, trail-off sentences, vague language

"Echo-back" talk without disagreement or substantial modification

Hands quiet, face neutral

Red "Authority" Frame

Sit up straight, attention on authority figure.

Acceptance of authority's claim with minimal modification or disagreement.

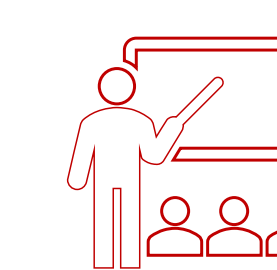
Reduced gestures.

Previously "TA" Frame

We renamed this frame after two observations. First, Instructor/TA presence did not always result in a shifted Frame for students. Second, some students took on an informal authority role in absence of Instructor/TA presence.

Red Frame can now be triggered by any authority figure, formal or informal, and is not automatically triggered in presence of Instructor/TA.

Red Frame can be quickly identified by...



Presence of Authority Figure



Clarification-Based Exchanges



Knowledge Imparted to Group

Yellow "Friendly" Frame

Giggle, smile, self-touch, fidget, unsettled gaze, glance away from screen, shielding/dismissive gestures.

Laughter, casual language, friendly/familiar demeanor

Green "Discussion" Frame

Prolific gesturing.

Animated tone, face, clarity of speech.

Sit up straight, focus on screen

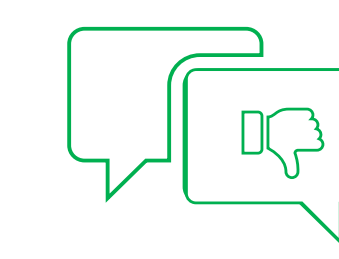
Disagreement between students not immediately resolved with clarification.

Substantial modification of ideas exchanged.

Previously "Discussion" Frame

We constructed a more rigorous definition of Discussion in order to clearly delineate between Green Frame exchanges and Red Frame or Blue Frame Exchanges (which often briefly mimic Discussion).

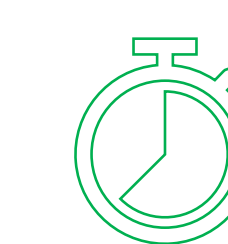
Green Frame can be quickly identified by...



Debate/Disagreement



Full-Group Participation



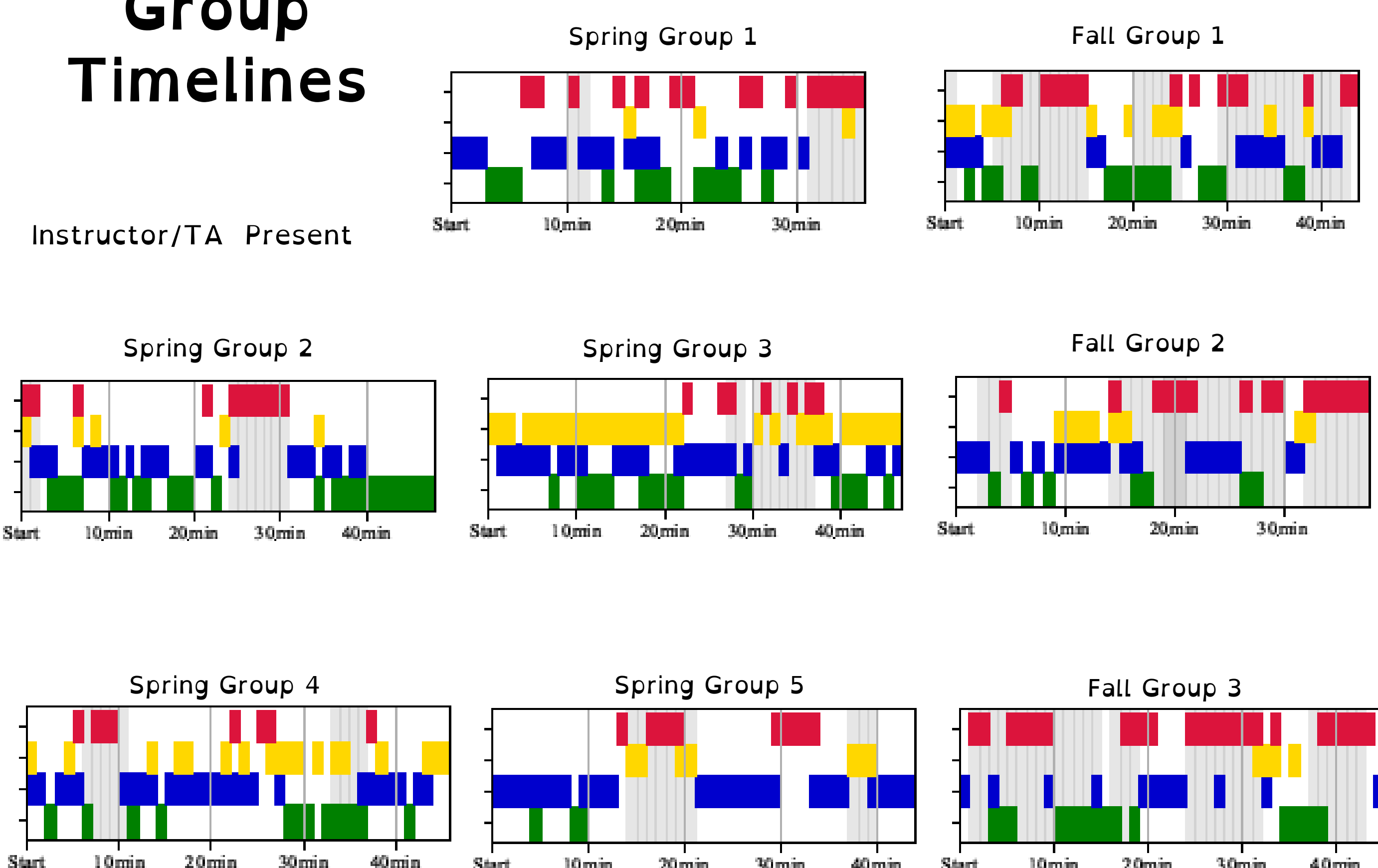
Lengthy Duration of Exchanges

Tutorial Results Using Updated Color Frames

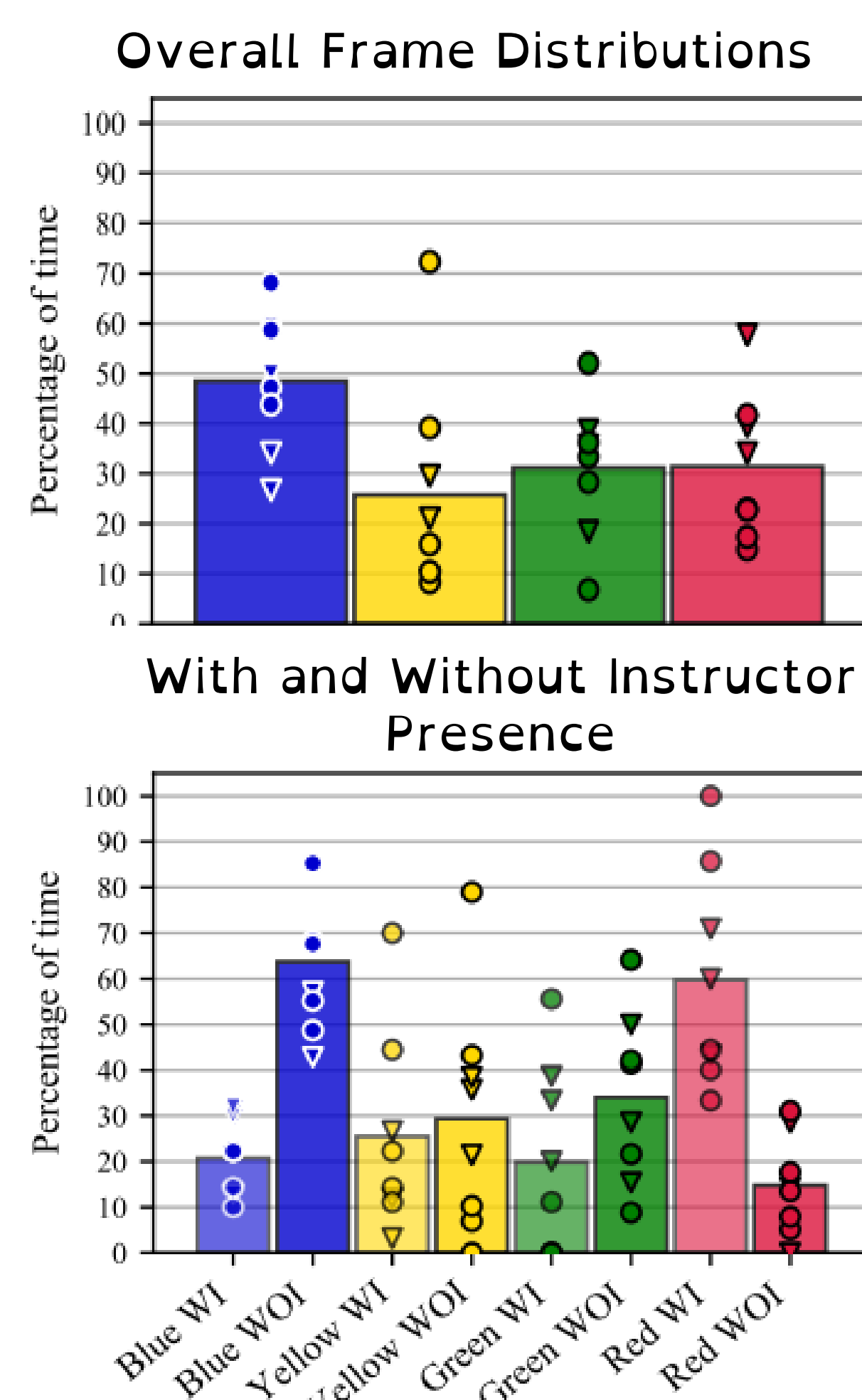
Analysis Methods: Groups complete tutorial using Zoom Breakout Rooms

Zoom Recordings reviewed and group behaviors analyzed

Group Timelines



Findings:



- ① No such thing as a "typical" group!
- ② **Yellow Frame** can overlap with all other frames
- ③ All frames are present in every group
- ④ Instructor presence does not always shift group to Authority Frame
- ⑤ Students can activate Authority Frame



Scan me for accessible versions of the poster & paper!

Acknowledgements:

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References:

- [1] Rachel E. Scherr & David Hammer (2009) Student Behavior and Epistemological Framing: Examples from collaborative active-learning activities in physics <https://www.physics.tutoringcenter.org/>
- [2] <https://acephysics.net/tutorials/epr>