The Longest Debate - Is Light a Particle or a Wave?

SOL PS.7a, PS. 6a,c

Objective: The students will research radiant energy and the history of scientists theorizing on if light was a particle or a wave. Each student will say at least one fact they learned or theory they came across during their research, with at least 95% of students participating in the class discussion.

Day One (approximately 3-4 days prior to class discussion)- Notes 6a (Reflection/Refraction) and Notes 6b (Mirrors/Lenses) will be completed in class as lecture and part of their available notes during research time.

Day Two (1 day prior to class discussion)- Students will watch the Veritasium video "The Original Double Slit Experiment" https://www.youtube.com/watch?v=Iuv6hY6zsd0 as part of the light lab day and participate in a short discussion about what was presented in the video.

Then, to see what true student discussion looks like, watch https://www.youtube.com/watch?v=8D-MA_I2_7U a socratic seminar with a high school class. Point out that these ARE high school students with LOTS of practice, but that doesn't mean we can't get there one day and it will take them forming their own ideas and opinions and being willing to share them!

Finally, students will be given at least 15 minutes to research online, guided by a list of keywords and names.[1]

Day Three (Discussion Day)- First, daily warm-up Journal question (5 minutes)

Students will be reminded of the basic discussion guidelines- speak clearly, with conviction but not emotion. No name-calling or insults will be tolerated. You can say "I disagree" but you cannot say "You're wrong." Everyone is expected to say at least one thing about what they found, and if it comes down to "they said what I was going to say" then that is okay, you can say it again. Students are challenged to try to listen carefully and be ready to respond without teacher prompting.[2] (5 minutes)

Students will then split into two groups - "wave" and "particle," and then, depending on class/group size, students will split into smaller groups of 3-4. They will share their findings with each other and begin forming ideas of what they will share with the opposing point of view to get their point across. They will work together to create one concept/story/fact/supporting argument/historical study for each person to share from their combined research that supports their view during class discussion. They will be given 10-15 minutes to talk in small groups and work out what each is going to share during class discussion, practice, and ask me for pronunciation as well as any clarifying questions. (15-20 minutes for explanation and small group discussion.) Basically I haven't changed what I am going to do here, just going to actually DO it/do it better!

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[1] I was super disappointed with the research portion from the great debate. It didn't help that I ended up having an emergency absence, so I wasn't there to guide/goad them into doing the work (and hitting submit). There were many, many students who did not submit their research at all, so I didn't have a lot of examples to choose from. I am hopeful that it will be completely different with me there and with more practice.

[2] Fingers crossed. Hopefully with the example video, prior practice, and encouragement in smaller groups, this will happen.

The Longest Debate- Students will split their “particle” or “wave” group in half, and form smaller groups with ~half on the particle side and ~half on the wave side of the debate. Students will take turns on each side of the debate (particle or wave), sharing the one fact/story/study that they agreed to share during the small group discussion when they were grouped with like thinkers. After everyone has shared their one fact/story/study, the floor is open to people sharing their opinions from each side, with a 2 minute limit (timer kept by teacher) for opinion sharing per person, again passing it back and forth between the two sides. Students are also encouraged to share what things came to their mind new and fresh that they hadn’t considered before due to the discussion. The teacher will move between groups to encourage staying on topic, and might interject a thought or name as needed to advance the discussion, but I’m hopeful by not having a whole-class discussion and breaking it into smaller groups will encourage more student-led discussion and moving from point to point without me.

If there is time, students will be allowed to switch sides if they had a change of heart to see where the class opinions lie now. Again, this didn’t change much from before as I feel that I didn’t completely do this well and can do it better with more practice. (30 minutes)

Day Four (Evaluation) - Students will answer survey questions in a google form about yesterday’s debate. What was their final decision? Did they feel that they got to say their peace? Can they understand why it is still such a debate for Scientists? What is their final opinion on the matter- is light a particle, a wave, or both? (5-10 minutes)