Misinformation Mondays: Navigating Scientific Information and Expertise in Physics Classrooms

Rachele Dominguez

CSAAPT Fall Meeting

October 10, 2026

Motivation

- Growing challenge of scientific misinformation in public discourse
- Large body of relevant scholarship
  - History - Naomi Oreskes
  - Sociology – Harry Collins
  - Philosophy – Douglas Allchin
  - Education – Jonathon Osborne
- Gap between scholarship and classroom practice
- Misinformation Mondays as practical response

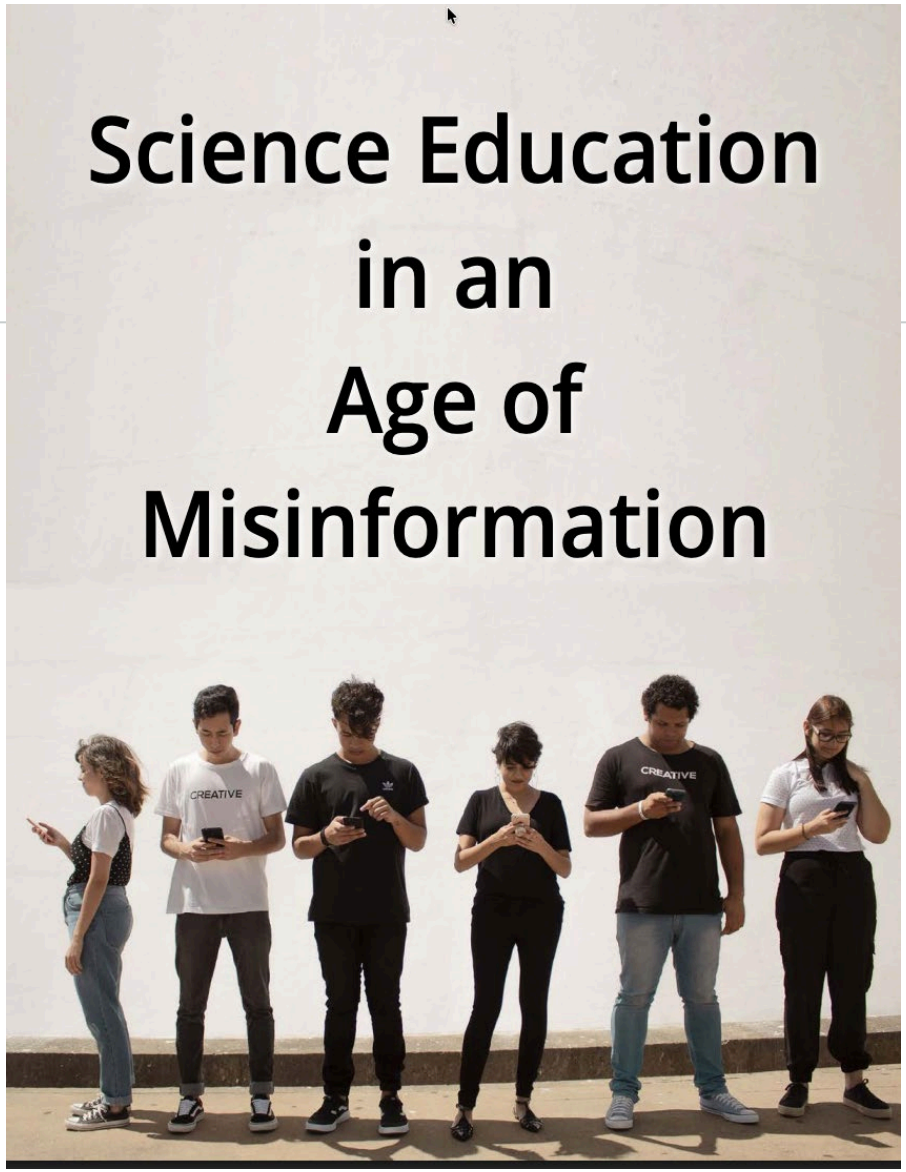


Image: Osborne et al. (2022), Science Education in an Age of Misinformation, https://sciedandmisinfo.stanford.edu/

Dan Kahan's Troubling Result

- We expect
  - More numeracy → Better evidence-based decision making
- Kahan found
  - More numeracy → More politically motivated decisions

(Kahan, 2017)



Kahan, D. (2018, February 5). Are smart people ruining democracy? [Video]. YouTube. TEDx Talks. https://youtu.be/1KFtQV7SiII?si=nPFETam40cymqPrd

How do we help students make better evidence-based decisions about science?

- Cultivate **scientific curiosity**
- Teach more **science literacy**
- Teach more **nature of science studies**
- Cultivate **informed trust** in science
- Learn how to be a **competent outsider**/ non-expert

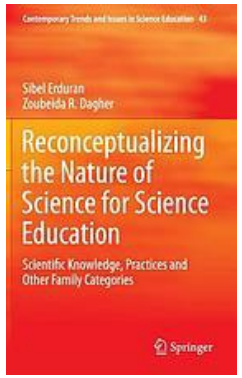
How to be a competent non-expert

1. Understand scientific foundations
    - “Producing reliable evidence is the core commitment of science.” J. Osborne

Source of quote: Jonathon Osborne - https://www.youtube.com/live/Ya5uEtXriKE?si=4P14um97owR3xetQ

How to be a competent non-expert

1. Understand scientific foundations
   - "Producing reliable evidence is the core commitment of science." J. Osborne
2. Understand the social structure of science
   - Consensus and convergence of evidence



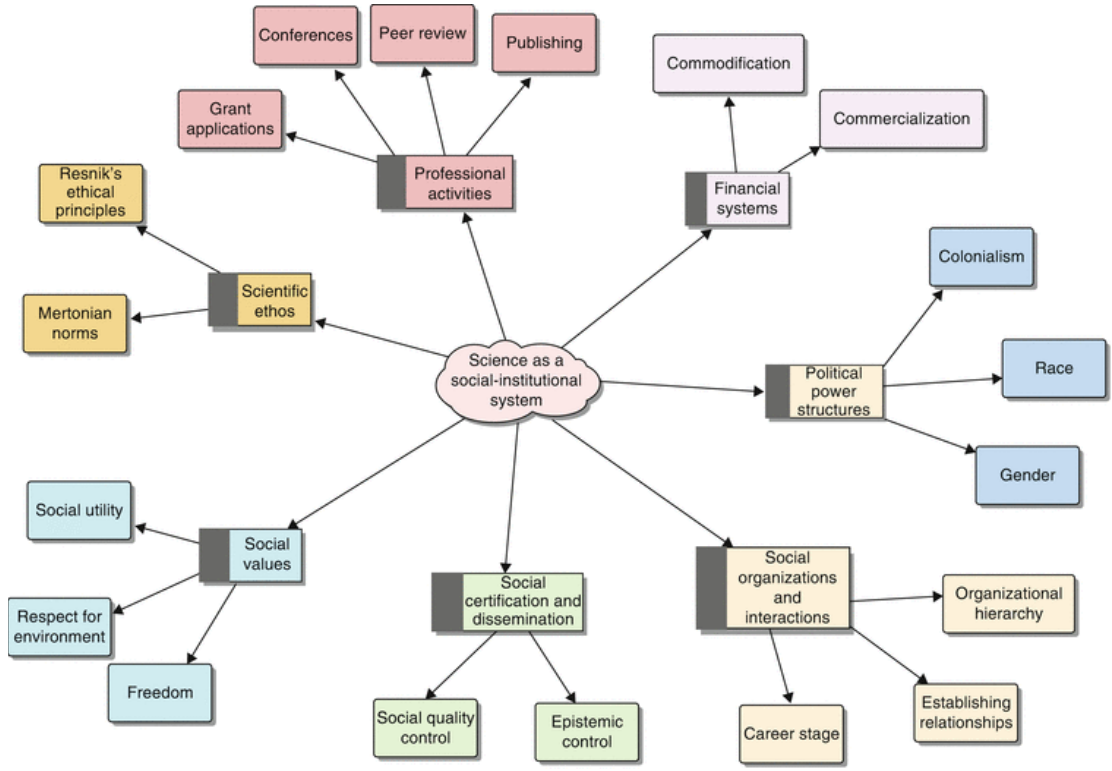


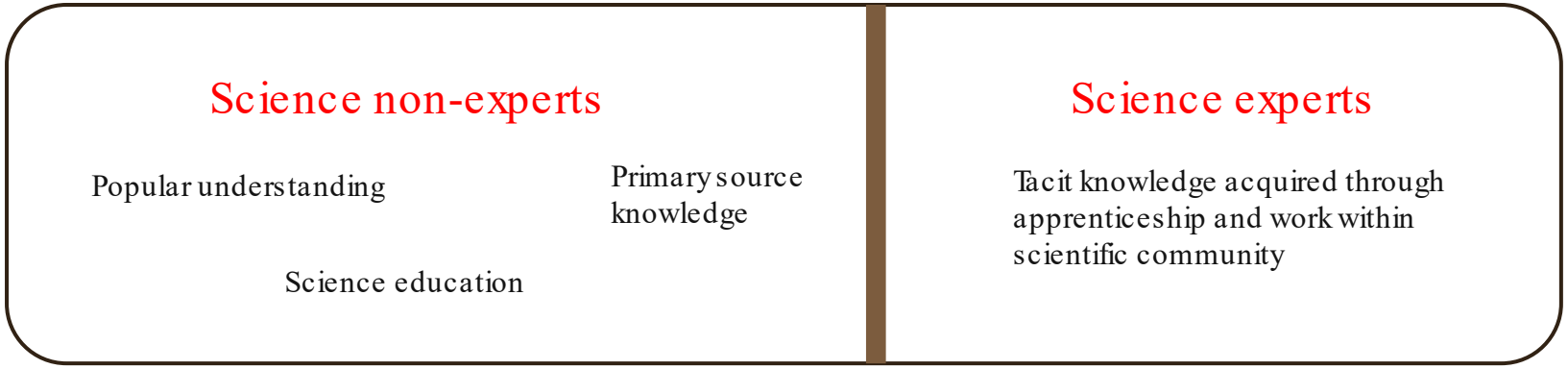
Image Source: Erduran & Duschl (2014).

How to be a competent non-expert

1. Understand scientific foundations
   - "Producing reliable evidence is the core commitment of science." J. Osborne
2. Understand the social structure of science
   - Consensus and convergence of evidence
3. Understand scientific expertise
   - Science is for everyone! But not everyone is a scientific expert.



Collins, H. (2014).



How to be a competent non-expert

1. Understand scientific foundations
   - "Producing reliable evidence is the core commitment of science." J. Osborne
2. Understand the social structure of science
   - Consensus and convergence of evidence
3. Understand scientific expertise
   - Science is for everyone! But not everyone is a scientific expert.
4. Navigating Scientific Information
   - Evaluate the source of a scientific claim

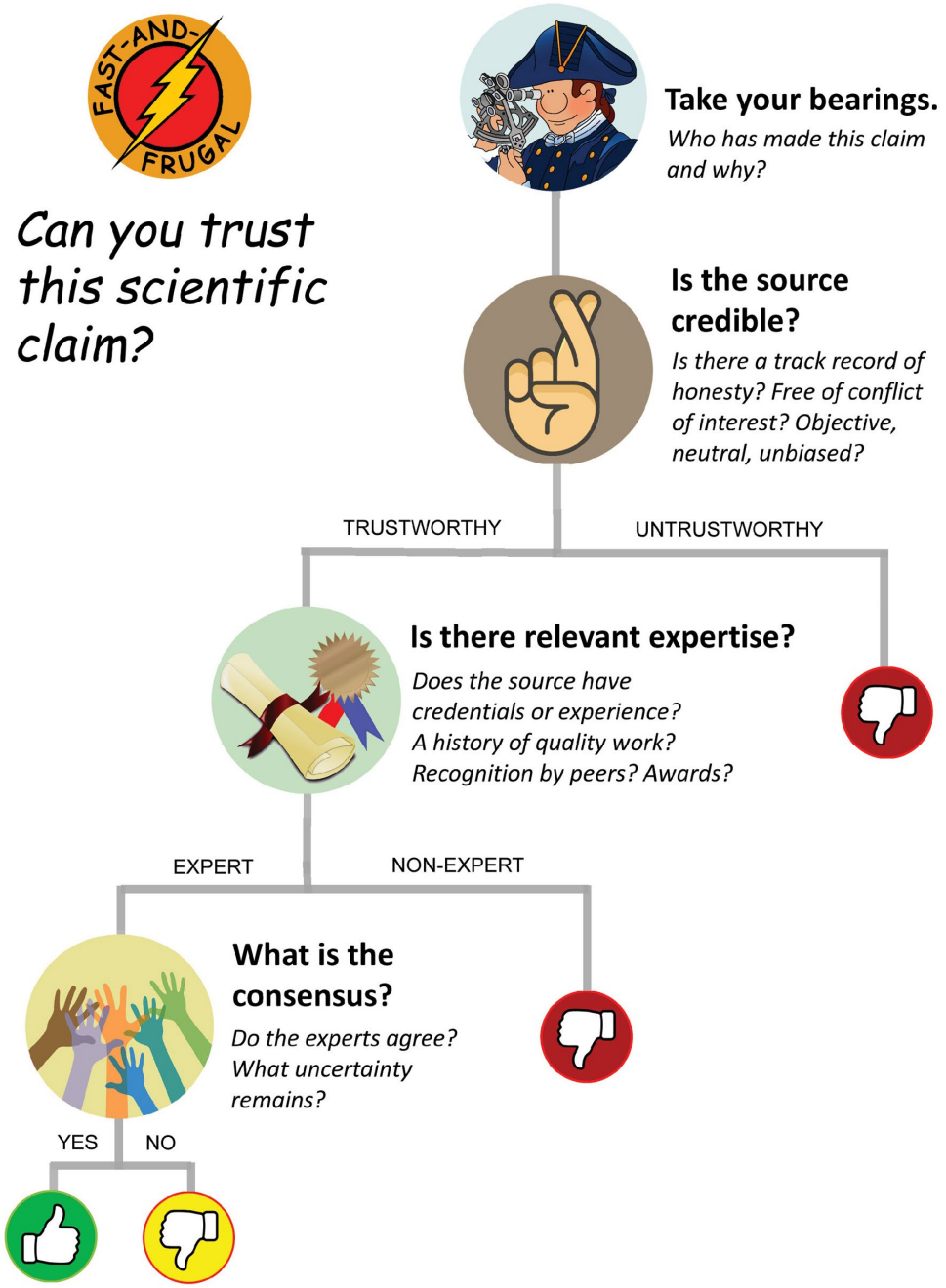


Image from https://www.nsta.org/science-teacher/science-teacher-mayjune-2023/marginalizing-misinformation

How to be a competent non-expert

1. Understand scientific foundations
   - "Producing reliable evidence is the core commitment of science." J. Osborne
2. Understand the social structure of science
   - Consensus and convergence of evidence
3. Understand scientific expertise
   - Science is for everyone! But not everyone is a scientific expert.
4. Navigating Scientific Information
   - Evaluate the source of a scientific claim

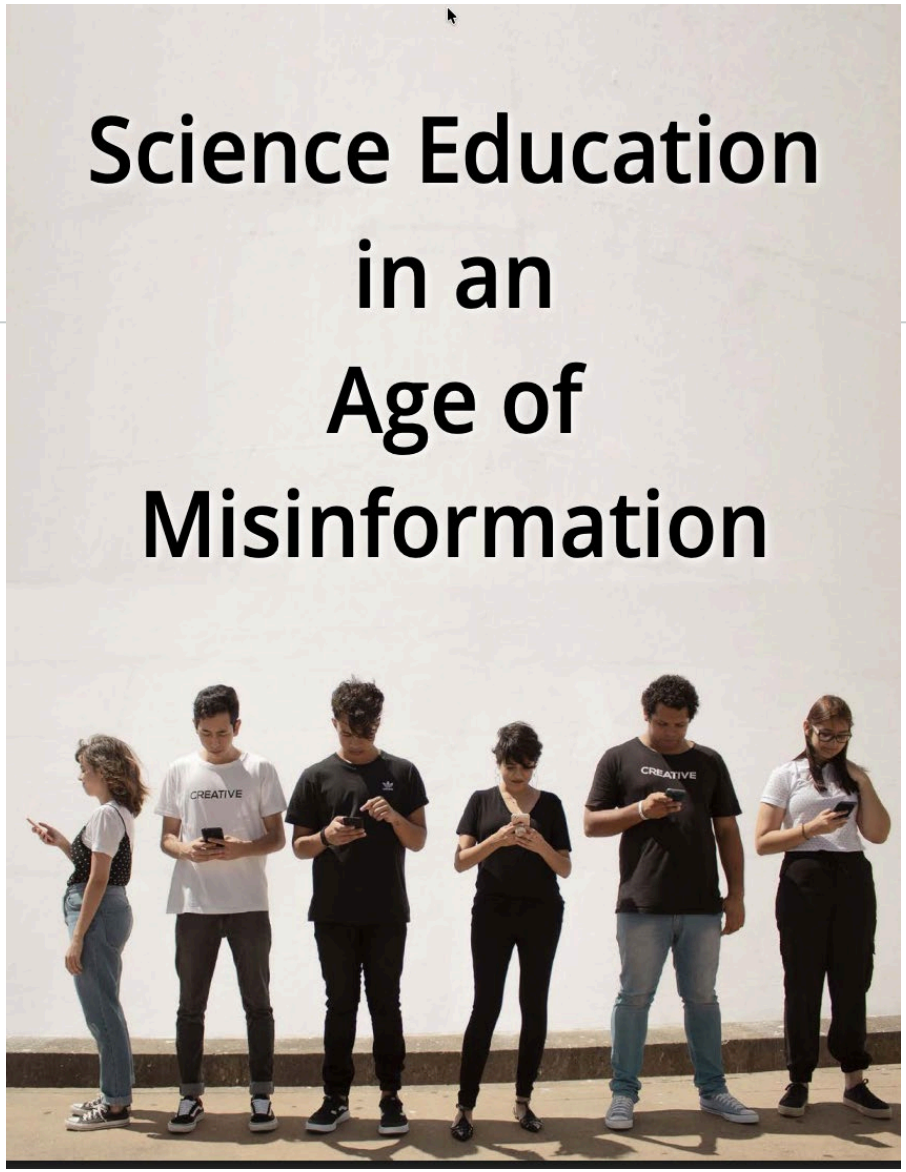


Image: Osborne et al. (2022), Science Education in an Age of Misinformation, https://sciedandmisinfo.stanford.edu/

Misinformation Monday – Personal Barriers and Strategies

- Time constraints
  - Start small (<15 mins, some Mondays)
  - Physics tie-ins
- Expertise
  - Rely on expertise of other scientists
- Confidence
  - Lean into physics; keep it curiosity-based
  - Choose specific claims, not broad controversies

- Teaching, not debunking
  - Start with what is true.
  - Critically evaluate a claim
  - Explicitly identify skills of competent non-expert

Example Claim – N95 Masks

"The COVID-19 virus size is 0.125 microns. N95 masks filter down to 0.3 microns. Therefore, N95 masks cannot block the virus."

– based on a Viral Facebook Post, 2020



Politifact article: https://politifact.com/factchecks/2020/jun/15/facebook-posts/claim-n95-masks-cant-stop-covid-19-particles-due-s/

Example Claim – N95 Masks

"The COVID-19 virus size is 0.125 microns. N95 masks filter down to 0.3 microns. Therefore, N95 masks cannot block the virus."

Claim contains a grain of truth.

Missing important context!



Journal of Cellular and Molecular Medicine Open Access

J Cell Mol Med. 2021 Dec 14;26(1):25–34. doi: 10.1111/jcmm.17103

The atomic portrait of SARS-CoV-2 as captured by cryo-electron microscopy

Tudor Emanuel Fertig [1,2,✉], Leona Chitoiu [1], George Terinte-Balcan [1], Victor-Eduard Peteu [1], Daciana Marta [1], Mihaela Gherghiceanu [1,2]



https://www.visualcapitalist.com/visualizing-relative-size-of-particles/

Example Claim – N95 Masks

"The COVID-19 virus size is 0.125 microns. N95 masks filter down to 0.3 microns. Therefore, N95 masks cannot block the virus."

Claim contains a grain of truth.

Missing important context! Viruses never travel alone.

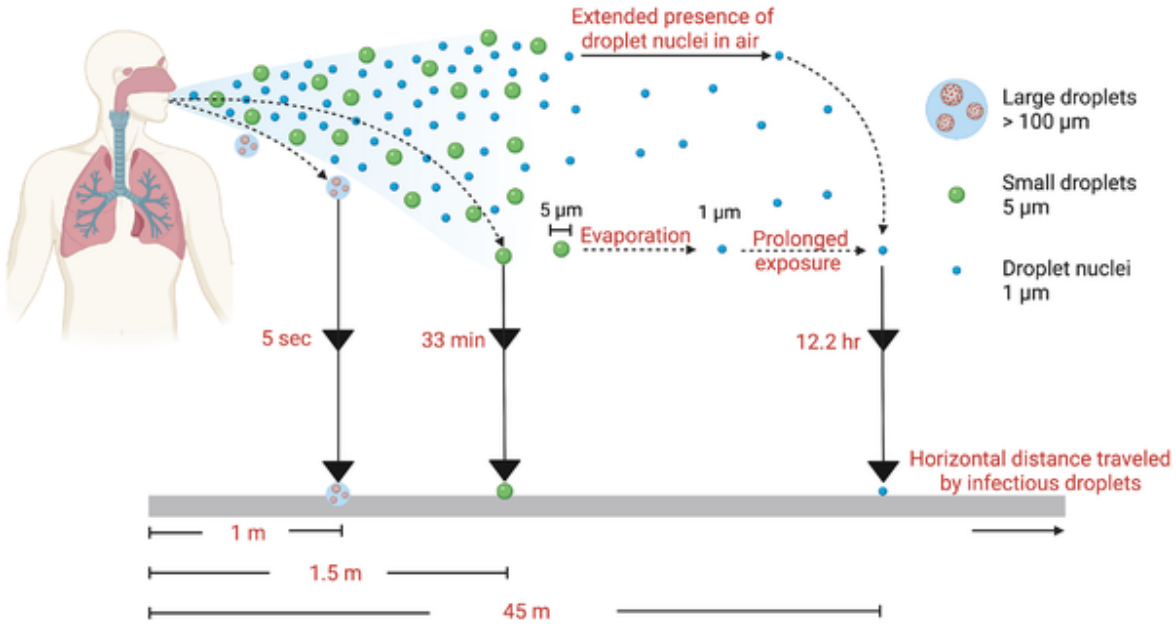


Image source: Joseph, et. Al, 2022.

Example Claim – N95 Masks

"The COVID-19 virus size is 0.125 microns. N95 masks filter down to 0.3 microns. Therefore, N95 masks cannot block the virus."

Wrong model N95 masks – not a sieve!

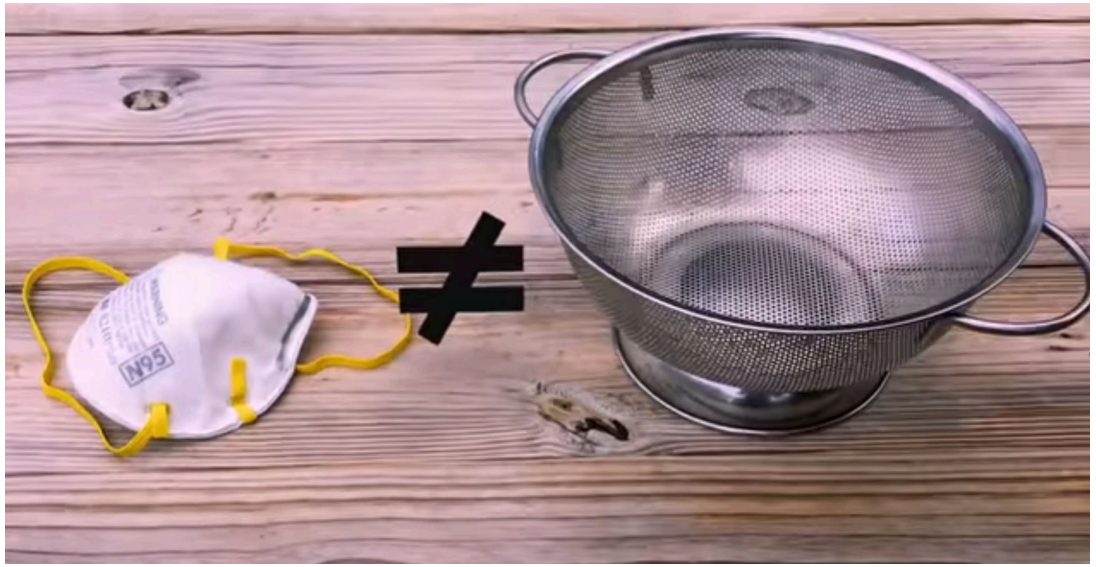
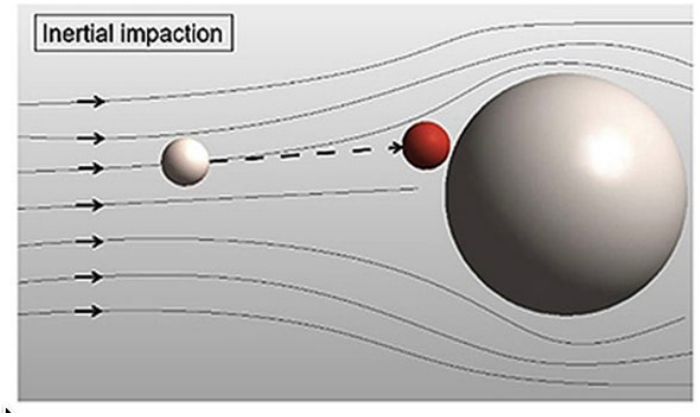
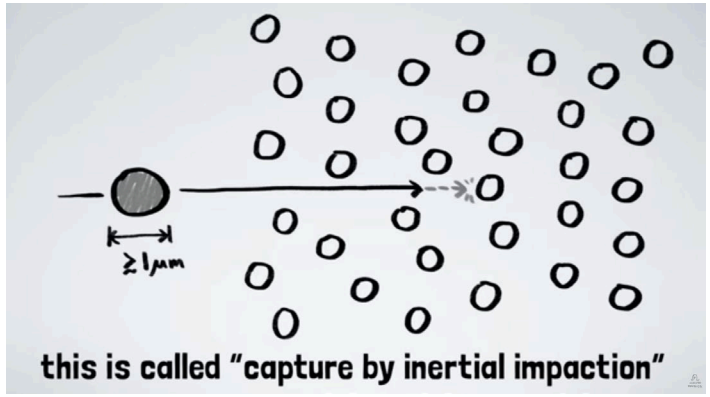


Image source: MinutePhysics (2020)

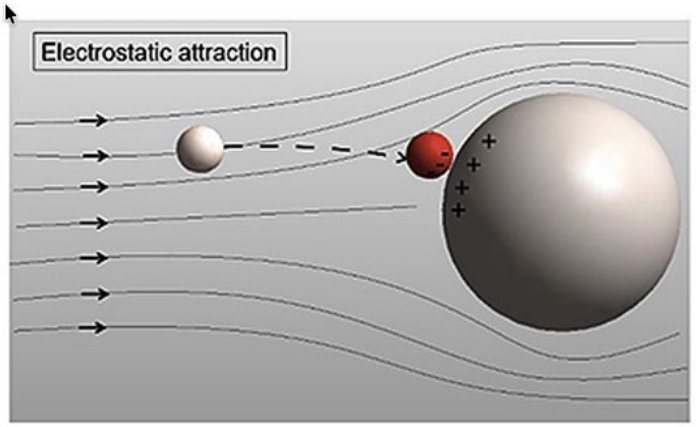
How masks capture droplets of many sizes and transport methods

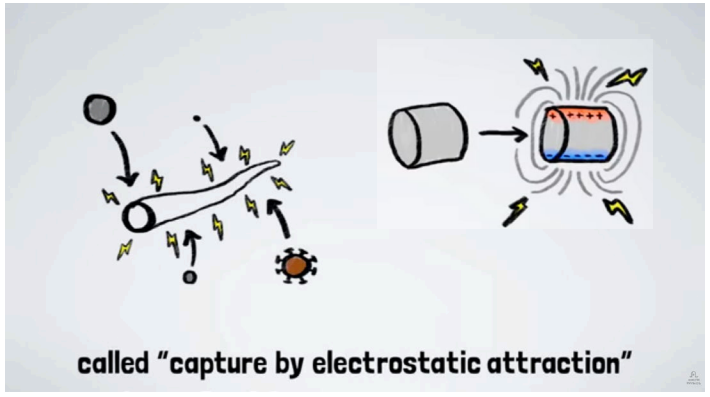
Larger high inertia droplets



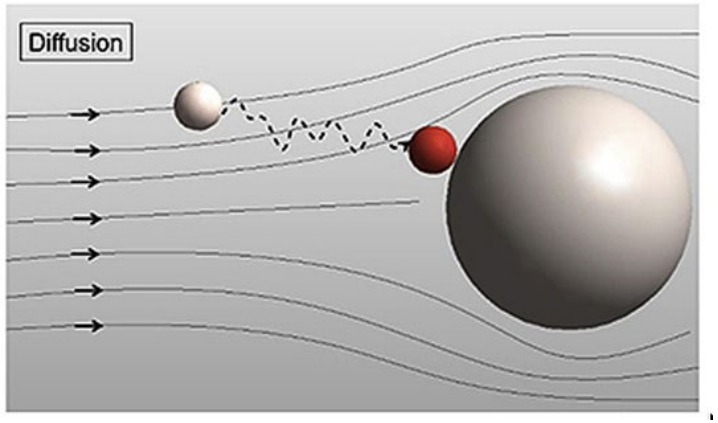


Medium ($\sim .3\mu m$)





Smaller diffusing droplets



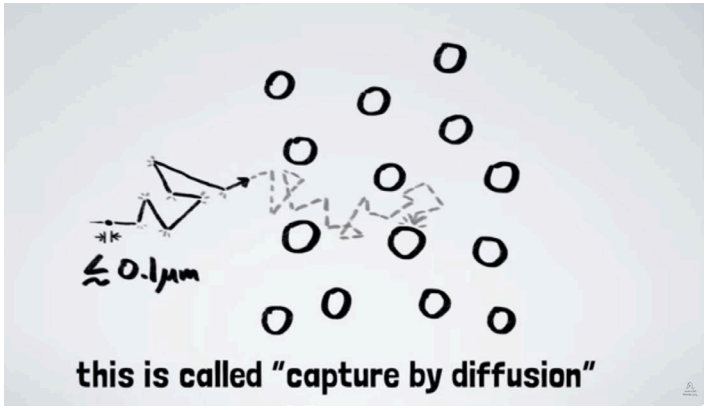


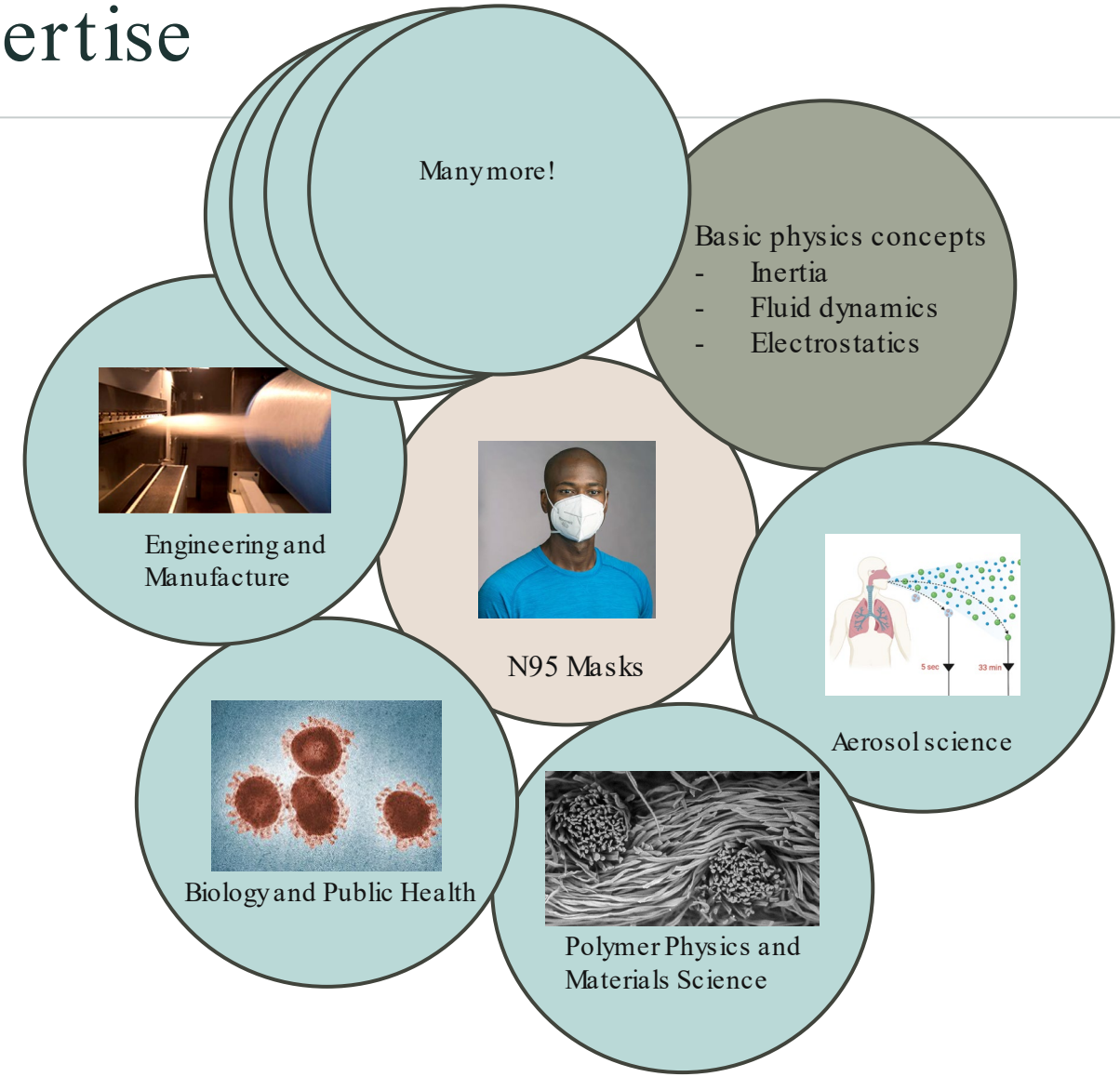
Image sources: Tcharkhtchi, et. Al, and Minute Physics, 2020.

Example Claim – N95 Masks

"The COVID-19 virus size is 0.125 microns. N95 masks filter down to 0.3 microns. Therefore, N95 masks cannot block the virus."

Conclusion is a false scientific claim.

Relevant expertise



Confidence in the effectiveness of the N95 mask comes from the convergence of evidence.

Final Thoughts

- Reconsider goals for science education
  - Teach science reasoning and methods
  - Prepare future scientists
  - Cultivate curiosity and appreciation of science
  - Prepare citizens to use scientific information to make good decisions
- Are we doing enough to teach students how to navigate a world shaped by science?

Link to Misinformation Mondays Folder with N95 References

Thank you!
My email: racheledominguez@rmc.edu

Thank you! Questions?

References

- Allchin, D., Bergstrom, C. T., &Osborne, J. (2024). Transforming Science Education in an Age of Misinformation. Journal of College Science Teaching, 53(1), 40–43. (175141248). https://doi.org/10.1080/0047231X.2023.2292409
- Collins, H. (2014). Are We All Scientific Experts Now? Cambridge, UK: Polity Press. https://www.wiley.com/en-us/shop/general-sociology/are-we-all-scientific-experts-now-p-9780745682747
- Erduran, S., &Duschl, R. A. (Eds.). (2014). Reconceptualizing the Nature of Science for Science Education: Scientific Knowledge, Practices and Other Family Categories. Springer. https://doi.org/10.1007/978-94-017-9057-4
- Kahan, D. (2018, February 5). Are smart people ruining democracy? [Video]. YouTube. TEDx Talks. https://youtu.be/1KFtQV7SiII?si=nPFETam40cymqPrd
- Kahan, D. M., Peters, E., Dawson, E. C., &Slovic, P. (2017). Motivated numeracy and enlightened self-government. **Behavioural Public Policy,** 1(1), 54–86. https://doi.org/10.1017/bpp.2016.2
- Oreskes, N. (2019). Why Trust Science? Princeton, NJ: Princeton University Press. ISBN 9780691179001. https://press.princeton.edu/books/hardcover/9780691179001/why-trust-science
- Osborne, J. &Allchin, D (2025) Science literacy in the twenty-first century: informed trust and the competent outsider, International Journal of Science Education, 47:15-16, 2134-2155, DOI: 10.1080/09500693.2024.2331980, https://doi.org/10.1080/09500693.2024.2331980
- Osborne et al. (2022). Science Education in an Age of Misinformation. Stanford University. https://sciedandmisinfo.stanford.edu/

N-95 References

- MinutePhysics. “The Astounding Physics of N95 Masks.” YouTube video, August 4, 2020. https://www.youtube.com/watch?v=eAdanPfQdCA.
- New Mind. “How N95 Masks Stop Viruses.” YouTube video, March 30, 2022. https://www.youtube.com/watch?v=nQmZou7TaVc.
- **Litke, Eric.** “Claim That N95 Masks Can’t Stop COVID-19 Particles Due to Size Is Nonsense.” PolitiFact, June 15, 2020. https://www.politifact.com/factchecks/2020/jun/15/facebook-posts/claim-n95-masks-cant-stop-covid-19-particles-due-s/.
- National Institute for Occupational Safety and Health. “N95 Respirators and Surgical Masks.” Centers for Disease Control and Prevention. October 14, 2009. https://www.cdc.gov/niosh/bulletin/2009/respirators-and-masks.html.
- Fertig, Thomas E., Liviu Chitoiu, Gabriela Terinte-Balcan, Viorica-Elena Peteu, Denisa Marta, and Mariana Gherghiceanu. “The Atomic Portrait of SARS-CoV-2 as Captured by Cryo-Electron Microscopy.” Journal of Cellular and Molecular Medicine 26, no. 1 (2022): 25-34. https://doi.org/10.1111/jcmm.17103.
- Joseph, John, Helna Baby, Spencer Zhao, Xiang-Ling Li, Krisco-Cheuk Cheung, Kabir Swain, Eli Agus, Sruthi Ranganathan, Jingjing Gao, James Luo, and Nitin Joshi. “Role of Bioaerosol in Virus Transmission and Material-Based Countermeasures.” Exploration 2 (2022): 20210038. https://doi.org/10.1002/EXP.20210038.
- Tcharkhtchi, Abbas, Nafiseh Abbasnezhad, Mohammad Zarbini, Neda Seydani, Saeed Zirak, Mohammad Farzaneh, and Mehrdad Shirinbayan. “An Overview of Filtration Efficiency through the Masks: Mechanisms of the Aerosols Penetration.” Bioactive Materials 6, no. 1 (2021): 106-122. https://doi.org/10.1016/j.bioactmat.2020.08.002.

Choosing Lessons

GUIDELINES

- Scientific claim
- Physics tie-ins
- Small and specific
- Science literacy theme

IDEAS FOR MORE MISINFORMATION MONDAYS

- Cloud seeding is real; hurricane steering is not
- Chemtrails
- Vaccine efficacy in Israel and Simpson's paradox
- Do microwaves destroy nutrients?
- Do cell phones cause cancer?
- Partisanship and numeracy