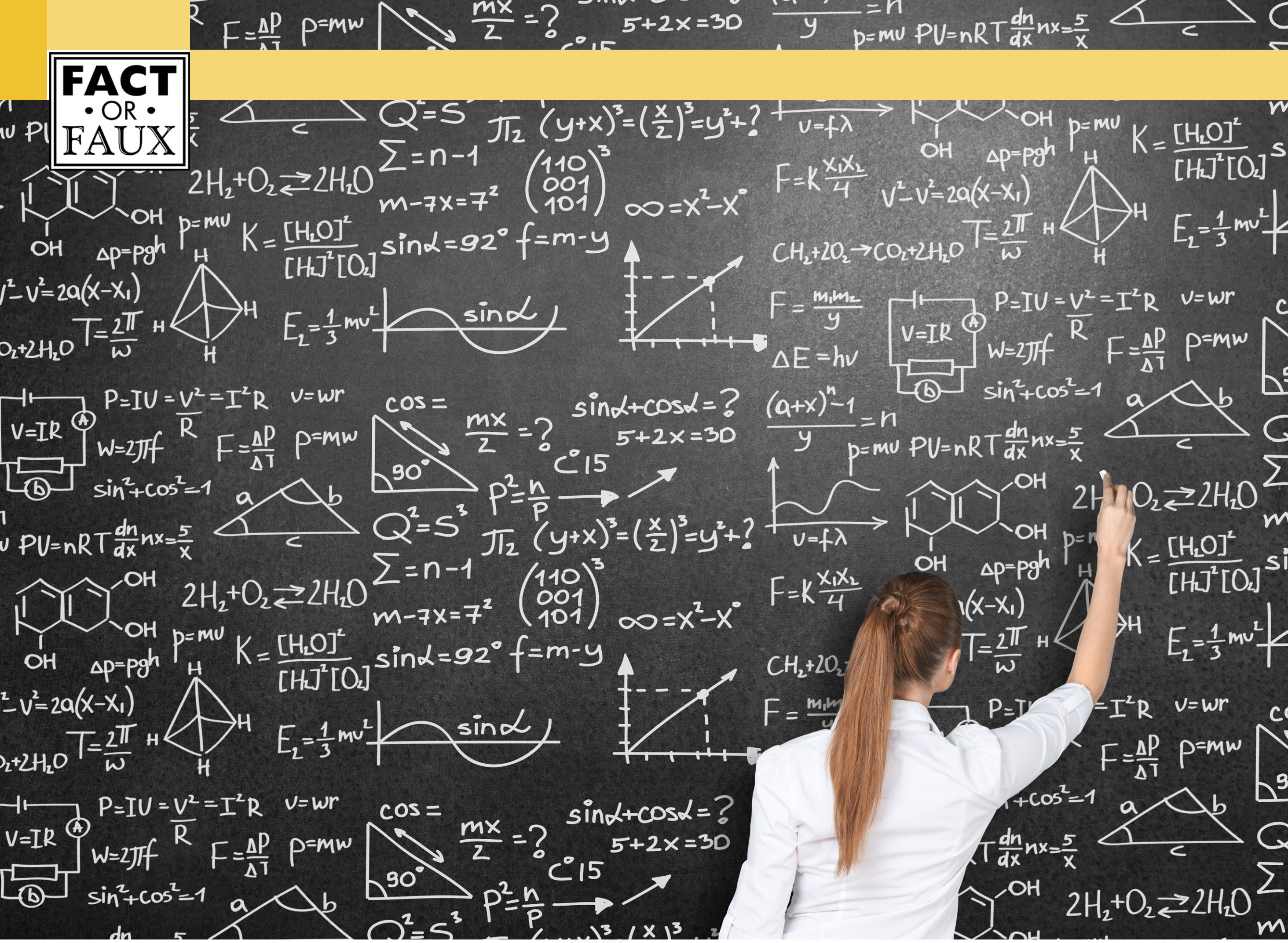
FACT OR FAUX



Inquiry into Expertise

GÁBOR ZEMPLÉN AND DOUGLAS ALLCHIN

ABSTRACT

Fact-or-Faux addresses misinformation and science media literacy. Here, we describe how students can build on their own experience to develop a concept of the social role of expertise, essential to respect for scientists' claims.

Keywords: Expertise; epistemic dependence; epistemic trust; credibility

Scientific claims—both fact and faux—stream across the internet, social media, and other information networks. Which claims are trustworthy, and which are not? This is a pressing yet challenging question for both students and teachers. Simple classroom activities can link ordinary encounters to the concept of expertise and trust in science.

One of the chief features of the exercises we describe here is to highlight the relevance of science in social and personal decision making, hence stressing the value of reliable knowledge and trustworthy (scientific) experts. Recognizing our reliance on experts helps us appreciate the importance of the question of *who* has the expertise to be a credible source of information. As our societies increase in complexity, the question becomes relevant for everyone. The ultimate objective of these exercises is to help decipher the concept of *reliable media*, referenced repeatedly in *Next Generation Science Standards* Science and Engineering Practice 8, Obtaining, Evaluating, and Communicating Information.

You might feel like you do not know enough to teach about the nature of

expertise. But trust the process used by this activity! We all have intuitions, and by mutual discussion with students we can extract a robust understanding of how we ascertain expertise in the media and distinguish it from its would-be imitators.

Begin with the students' perspective

The most effective education is student-centered. It taps directly into student motivations. It is also interactive, engaging students in their own learning (Chi 2009; Zemplén 2009). That is where this activity begins.

Open, perhaps, with a casual comment about our widespread need for reliable knowledge: where do we get essential pieces of information? Usually, we turn to our friends, family and other acquaintances. So, ask students in your class to list people (from among the classmates?) who can:

- help them with their science homework,
- find parties on the weekend,
- negotiate the latest new app on their phone, or
- help in an emotional crisis.

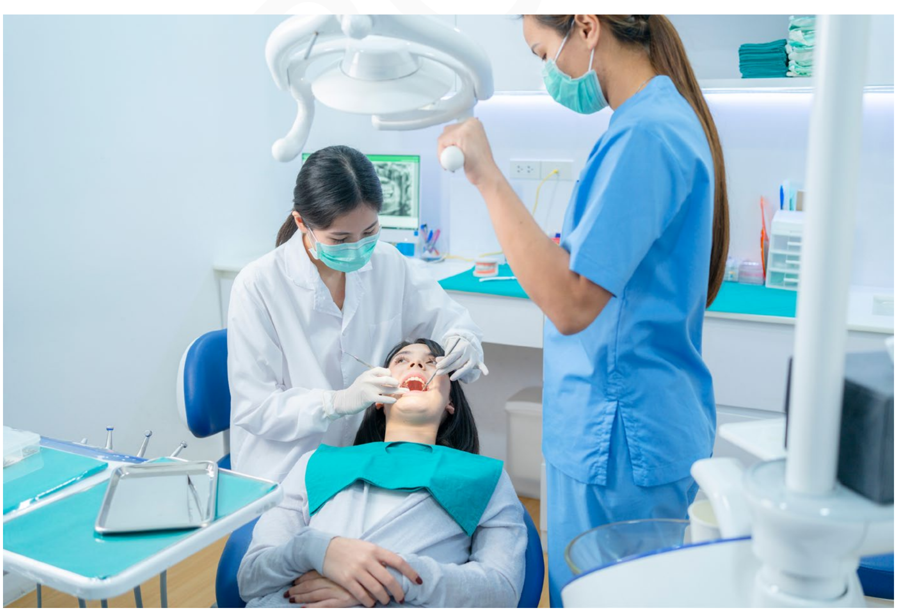
Students quickly appreciate that they rank individuals on the quality of their knowledge. Even in a school setting, they regard certain individuals as "experts" on specific topics.

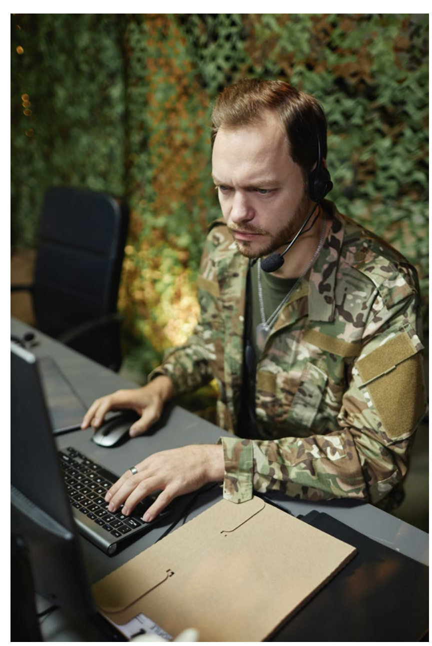
Next, expand the focus slightly by asking who they would seek information from on other issues, beyond what their peers might typically provide, and ask them to come up with the last few questions (in total around 8–12 questions):

- Whom might they trust to repair their cell phone?
- Who might help with diagnosing a possible pregnancy or sexually transmitted disease?
- Who could help a friend with suicidal thoughts or anxieties about gun violence?
- Who might fix a Wi-Fi network or internet connection at home?

Acknowledge, perhaps, that we all face challenges in identifying or finding people with specialized knowledge. (Here, you are preparing the way for assessing misinformation.)

Finally, invite students to list other experts in our culture. Their list might include (as pictures here suggest):





- doctors, dentists
- lawyers
- accountants
- airplane pilots
- military intelligence
- car/truck mechanics
- plumbers, electricians, carpenters
- appliance repairers
- farmers
- bridge welders

If the students do not spontaneously mention scientists, you can ask whether they belong on the list. You might ask them to name some of the forms of scientific expertise. Here, you might participate, proposing some roles and (in the spirit of collaboration) seeking concurrence from the class: for example, meteorologists, immunologists, chemists, astronomers, oceanographers, virologists, paleoclimatologists, biotech engineers, nuclear physicists, epidemiologists? You might ask: "When do these science experts provide us with knowledge that is better and more reliable than everyday assumptions?" The answers may be incomplete, at this point. That's okay.

This exercise helps, in part, to contextualize science in the students' everyday lives, as an important source of specialized knowledge (akin to others), built on particular forms of expertise.

Articulating expertise

Now, with an extensive list of types of experts in many contexts, students are prepared to think more deeply about what makes an expert an expert. What differentiates someone with true expert knowledge from some self-professed, would-be know-it-all on YouTube? Let students discuss this, first in small groups (~10–12 min) and then as a full class. Compile their ideas on the board. Their list might include:

- specialized knowledge or skills
- professional training
- extensive relevant experience
- good memory (for their topic)
- able to detect possible errors
- keen perception (able to discern fine differences)
- recognizes patterns in apparent chaos
- efficient reasoning and judgment
- avoids big mistakes

Again, you can help invite consideration of important items they might miss but could easily imagine with a small prompt.

In some classrooms, the social dimension of distributed expertise may emerge naturally. If not, you can ask (naïvely, perhaps): "Well, if we know now what constitutes expertise, can't we all be experts in everything? Can't we all become airplane pilots and chess masters and doctors and lawyers and pandemic experts, all at once?" This helps to highlight (or introduce) the notion that not everyone knows everything. Nor can they, even in an ideal world. We all, ultimately, depend on each other's knowledge.

To help engage students further, you might invite them each to reflect on what types of expertise they may offer to others now and what expertise they may hope to develop in the future. You can help the visualization if you start with some commonalities: we all have expertise in some simple tasks, like lacing shoes, or even complex ones, like speaking our native language. But some abilities are special: some of us are adept at second or third languages; or perhaps it is some sport, musical instrument, or art; or some school subject? Drawing bubbles around the concepts, students can continue individually or in pairs to list specialized assets they already have. Can you handle dogs well? Are you good at human relations? What tools and repairs have you mastered? Continue the diagram by adding aspirations for the future: forms of expertise that you might strive for.

Finally, use this list for personal reflection: What are you good at? What are areas where others know more than you do? Where does science fit?

The purpose of these last two activities is to develop an awareness of the distribution of expertise (or the "division of cognitive labor") in our modern society. This is a critical lesson about the social structure of knowledge in our culture and helps to situate science. It also helps nurture a sense of personal pride, as well as informed intellectual *humility*—knowing about our strengths but equally where our knowledge ends and where we rely on others. As such, it helps to find the balance between overconfidence (when students overvalue their skills) and lack of self-respect (where they may feel crippled by some limitation).

The gulf between knowledge-holder and knowledge-user opens possible discussion about the role of trust. Not ordinary trust, based on loyalty, or moral integrity, or promise-keeping. Rather: *epistemic trust*—trust specifically based on knowledge: whether it is valid and shared faithfully. Thus, as an extension activity, you may wish to invite students to discuss the commonplace notion that it is always wisest to make decisions based on your own knowledge and intuitions. When might it be more reasonable—paradoxically, perhaps—to trust someone else's judgment instead, even against your own instincts? That's tough to swallow but sometimes the wiser option!

The social dimensions of expertise

The focus so far has been mostly on the individual. But having established that we all rely to some degree on others for their expertise, including scientists sometimes, the next step is to explore the social dimension, where we are challenged to distinguish authentic experts from would-be experts, a skill integral to sorting fact from faux.

Here, you might draw a lone figure on a small desert island. In the classic case, the stranded voyager (Robinson Crusoe, perhaps, or an astronaut in a science fiction film, abandoned on some distant planet) is challenged to rely on their own wits and ingenuity. Next, you can draw lots of other islands, inhabited by classmates and others, each with their own expertise. (Be sure to include a few scientists—experts in pandemics, energy technology, or environmental sustainability, perhaps.)

Pose the new problem. How should we share or exchange expertise? How much do we rely on the media and communication? In particular, how do we evaluate someone's expertise—not abstractly, but in practice? (If we are not experts ourselves, how do we gauge whether someone else's performance or claimed expertise is genuine?) Whom should we trust, and why? Can we invent a social system that might help us (another activity to be presented later)? This, too, is not so unfamiliar to students, as they are well-aware of braggarts and bloated egos—even among their peers.

Again, facilitate small group discussion and whole class sharing to organize the informal ideas that already exist. Various criteria might include the following:

- a documented track record, or portfolio
- advanced degree/training
- certification (testing)
- licensing (accountability)
- peer recommendations
- professional awards or prizes
- positions of leadership
- (valid) user reviews

Again, as the facilitator of the inquiry, you can help gently solicit additions or extend the list through suggestive questioning. Next, entertain reflection: Which criteria are most important? Which can be gamed or easily faked? Note that most of these are all indirect indicators, not actual measures of trustworthiness. Caution is needed, even here! The list is an important product. It may serve as a guideline for students to apply to media messages. And because students (in each class) developed it, they will own it and tend to remember it (one of the key elements of inquiry learning and constructivist pedagogy). Perhaps students can jigger their names or labels and develop a handy acronym or mnemonic?

Here, you may elect to note that expertise in science differs somewhat from other professions. In any area, individual experts may sometimes differ in their professional judgments. (Sometimes, one seeks a second opinion.) In science, however, we are concerned with the reconciliation of their different views. The basis for trust is the consensus of the relevant experts. This understanding is developed in another activity, "When Experts Disagree" (forthcoming).

Expertise and misinformation

A conceptual understanding of the social structure of expertise is critical when it comes to scientific claims in the media—on websites, in social media feeds, and elsewhere. The media themselves are rarely or weakly regulated. Anyone can say anything and can even call it science. We need help sorting the reliable from the spurious—fact from faux. The ready availability of information on the internet easily fosters the illusion that we can be instant experts on anything we choose. But we can't. That's why we regularly turn to others who are more knowledgeable than us. Expertise matters (our opening exercise).

For example, many purveyors of misinformation will invite you to "Do You Own Research" (DYOR is their popular call-sign). They will tempt the unwary user into trying to be an expert themselves. They will feed them cherry-picked evidence and plausible (but incomplete and misleading) arguments, hoping to gain traction (Allchin 2024). However, someone schooled on the nature of expertise will recognize this as a persuasive ploy. What matters is the foundational expertise, not the superficial (and possibly manipulated) argument. Only the scientific experts can recognize the flaws in the evidence. An informed consumer will acknowledge, with intellectual humility, their dependence on experts. They will withhold judgment until they have been able to establish the views of verified experts. *Scientific* expertise matters (second activity above).

Even so, a consumer needs to be wary of misleading claims of expertise. For example, a nuclear physicist is not qualified to pontificate about second-hand smoke or global warming (Oreskes and Conway 2010). A chemist—even a Nobel Prize winner—has no credible place predicting how long a viral pandemic will last (Boodman 2021). It does not matter how many scientists sign a declaration against climate change if their expertise is not in climate change (Angliss 2010). The savvy consumer knows that expertise resides in specific fields, not in "science" generically. *Relevant* scientific expertise matters (next exercise).

Someone may simply purport to be an expert when they are not. It is thus valuable to know a bit about the criteria for expertise—to sort through their bogus pretensions. *Authentic* expertise matters (third inquiry).

Another tactic in scientific disinformation is to recruit dissenting experts. They are experts, yes, but they do not represent the consensus. They should be promptly discounted (for example, the anti-climate-change websites ClimateAudit.org or WattsUpWithThat.com). If the dissenters cannot convince their peers, why should we listen to them? Unfortunately, these contrarian voices are often amplified on social media, unchecked by the professional discourse (e.g., Efstratiou and Caulfield 2021; see also Allchin 2024, Fact-or-Faux, May 2024 on "the Galileo Gambit"). The *consensus* of relevant experts is what matters (lesson on social dimensions of science).

The *Next Generation Science Standards* state (on 12 separate occasions) that students should learn to consult *reliable* media—by which they mean credible sources. The evidence that the source of information is trustworthy is what matters—not the evidence itself, because we do not have the expertise to evaluate it. Are the sources under scrutiny truly qualified to speak on behalf of science? Where the risk of misinformation is concerned, understanding expertise and its social dimensions matters.

DISCLOSURE STATEMENT

No potential conflict of interest was reported by the authors.

REFERENCES

Allchin, D. 2024. "Science L.I.A.R.S.: A Game to Combat Misinformation." *The Science Teacher* 91 (1): 8–11. https://doi.org/10.1080/00368555.2023.2297469.

Allchin, D. 2024. "The Galileo Gambit." *The Science Teacher* 91 (3): 8–12. https://doi.org/10.1080/00368555.2024.2336861.

Angliss, B. 2010. "Scrutinising the 31,000 Scientists in the OISM Petition Project." Skeptical Science [website]. http://www.skepticalscience.com/scrutinising-31000-scientists-in-the-OISM-Petition-Project.html.

Boodman, E. 2021. "He's a Stanford Professor and a Nobel Laureate. Critics Say He Was Dangerously Misleading on Covid." *STAT News*. https://www.statnews.com/2021/05/24/stanford-professor-and-nobel-laureate-critics-say-he-was-dangerously-misleading-on-covid/.

Chi, M. 2009. "Active-Constructive-Interactive: A Conceptual Framework for Differentiating Learning Activities." *Topics in Cognitive Science* 1 (1): 73–105. https://doi.org/10.1111/j.1756-8765.2008.01005.x.

Efstratiou, A., and T. Caulfield. 2021. "Misrepresenting Scientific Consensus on COVID-19: The Amplification of Dissenting Scientists on Twitter." arXiv:2111.10594.

Oreskes, N., and E. Conway. 2010. *Merchants of Doubt*. New York: Bloomsbury Books.

Osborne, J. 2024. "Just Because It's Plausble, Does Not Mean It Is Right." *The Science Teacher* 91 (2): 8–13. https://doi.org/10.1080/00368555.2024.2309696.

Zemplén, G. Á. 2009. "Putting Sociology First—Reconsidering the Role of the Social in 'Nature of Science' Education." *Science & Education* 18 (5): 525–559. https://doi.org/10.1007/s11191-007-9125-3.

Gábor Á. Zemplén (*zemplen@gtk.elte.hu*) (ORCID: 0000-0001-7017-4661) is a professor and Vice Dean for International Affairs at Eötvös Loránd University in Budapest, Hungary. **Douglas Allchin** (*allchindouglas@gmail.com*) (ORCID: 0000-0003-4038-5155) is a science educator and Resident Fellow at the Minnesota Center for the Philosophy of Science at the University of Minnesota.