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Record - 1

DIALOG(R)
Scaffolding the unbelievable: understanding light and vision.
Yang, Li-hsuan
Journal of College Science Teaching , v 38, n 6, p 54
Wednesday, July 1, 2009

Text:

Many of my students profess that they understand the law of reflection and can "prove" it by shining a light beam toward a mirror and demonstrating that the angle of incidence equals the angle of reflection (Meltzer and Espinoza 1997). My students also tell me that they understand vision: We see an object when some light reflected off the object reaches our eyes. However, they experience great difficulties when asked to apply their understanding of light and vision to make predictions and explain related phenomena in real-world contexts. In this article, I describe how I challenged my students with three intriguing questions and provided scaffolding to help them develop a deeper understanding of light and vision.

Materials
* A ruler, a protractor, duct tape, two worksheets (Figure 1 and Figure 2), and one or two small mirrors for each group of students. (The size of the mirror is not that critical as long as it is somewhat shorter than one-half the height of the "average" student in class. The ones I used were 10 cm x 10 cm.)

* One large mirror that is longer than one-half the height of the "average" student in the class.

* Numbers 1-9 cut out from construction paper

* A meter stick or a tape measure

* A dry erase marker

Procedure

The questions I used in this learning activity were modified versions of the questions discussed in a Private Universe Project workshop entitled "Vision: Can We Believe Our Own Eyes?" (Harvard-Smithsonian Center for Astrophysics 1995).

* If a mirror is mounted flat against a wall, how big must it be for you to see your whole body in it?

* Does distance affect how much of your body you would see in the mirror?

* Does distance affect how much of the surroundings you would see in the mirror?

I asked students to write down their ideas before sharing them with the class. Not all students were sure how big the mirror must be in order for them to see their whole body in it, but they were certain that the distance would affect what they saw. They all believed that the farther away you were from the mirror, the more of your body you would see, but they had different ideas regarding the surroundings. Some thought that the farther away you are from the mirror, the more of the background surroundings you would see "because of the wider angles" (Figure 3). Others thought that the distance would not make a difference because "the mirror captures half of its surroundings (the half that the mirror is facing) no matter where you stand" (Figure 4). What caught my attention was that none of the ideas indicated that they were applying their understanding of the law of reflection and the principle of vision they claimed to have.

[FIGURE 1 OMITTED]

To answer the question about the surroundings, I placed a large mirror in front of the classroom facing students, and taped numbers 1-9 across the back wall of the classroom to represent a range of the background surroundings. Each student stood in front of the mirror and then gradually backed up from the mirror, noticing what numbers he or she could see in the mirror. Again, students were really surprised that instead of seeing more and more of the background surroundings, as they had predicted, they saw a narrower and narrower range of the background surroundings as they backed away from the mirror.

After these two findings, the class explored the first question empirically. As a volunteer stood in front of the large mirror, I marked the places on the mirror he saw the top of his head and the bottom of his shoes. A student then measured the distance between the two marks, which represented how big the mirror must be in order for the volunteer to see his whole body in it. We then measured the height of the volunteer. This procedure was repeated with several more volunteers. The class soon noticed that the needed height of the mirror was half the height of the person.

After these discoveries, students really wanted to know why. Instead of

telling them the answers, I challenged them to figure out the explanations. Many of them said that they had no idea how to explain these findings or even where to start. Their comments made me realize that they needed some scaffolding in order to figure out the explanations. Thus, I provided two drawings (Figures 1 and 2) to support their effort. I also encouraged them to pay special attention to the edges of the mirror, because the edges of the mirror should affect the scope of the person's view.

[FIGURE 2 OMITTED]

[FIGURE 3 OMITTED]

[FIGURE 4 OMITTED]

When students tried to draw lines that represented the paths of the light beams, many of them started from the person's eyes. I asked them, "Does light come from the person's eyes and shine on the object or does light get reflected off the object and then reach the person's eyes?" After they remembered that light should travel from the light source to the object, reflect off the object, and then reach the person's eyes, they were able to successfully draw the paths of the light beams and explain their empirical findings. Their comments indicated that they could visualize that some light coming from number 1 and number 9 would reflect off the mirror and completely miss the person's eyes when the person was far away from the mirror, and that is why they did not see as wide a range of the background when they stood far away from the mirror (Figure 5). They were also able to explain why the mirror needs to be half of the person's height in order for the person to see his/her whole body in it (Figure 6) and why distance does not make a difference in the amount or portion of his/ her body the person would see in the mirror (Figure 7).

[FIGURE 5 OMITTED]

[FIGURE 6 OMITTED]

[FIGURE 7 OMITTED]

Safety

It is safer to use framed mirrors. If mirrors are not framed, their edges should be covered with duct tape. A mirror that is not too heavy can be taped to the wall. It is recommended that multiple pieces of tape are used on each side of the mirror to lower the chance of having a mirror fall and break. The mirrors taped on the wall should be taken off once the experiment is completed.

Conclusion

Through these surprising empirical experiences, the scaffolding, and the exchange of ideas, my students have developed a much richer and more useful understanding about light and vision, which is very different from "understanding" the law of reflection and the principle of vision as isolated pieces of knowledge that cannot be applied to real-world contexts (Duckworth 1991).

Acknowledgments

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Record - 2

DIALOG(R)
Wong's silent treatment clouds emissions credibility,
Bob Carter, David Evans, Stewart Franks, Bill Kininmonth,
The Australian, 1 - All-round Country ed , p 12
Friday, June 19, 2009

Text:

Why won't the government answer Steve Fielding's questions, wonder Bob Carter, David Evans, Stewart Franks and Bill Kininmonth STEVE Fielding recently attended a climate change conference in Washington, DC. Listening to the papers presented, the Family First senator became puzzled that the scientific analyses they provided directly contradicted the reasons the Australian government had been giving as the justification for its emissions trading legislation
Fielding heard leading atmospheric physicist Dick Lindzen, of the Massachusetts Institute of Technology, describe evidence that the warming effect of carbon dioxide was much overestimated by computer climate models and remark: "What we see, then, is that the very foundation of the issue of global warming is wrong
"In a normal field, these results would pretty much wrap things up, but global warming-climate change has developed so much momentum that it has a life of its own quite removed from science." Another scientist, astrophysicist Willie Soon, from the Harvard-Smithsonian Centre for Astrophysics, commented: "A magical CO2 knob for controlling weather and climate simply does not exist." Think about that for a moment with respect to our government's climate policy

On his return to Canberra Fielding asked Climate Change Minister Penny Wong

to answer three simple questions about the relationship between human carbon dioxide emissions and alleged dangerous global warming

Fielding was seeking evidence, as opposed to unvalidated computer model projections, that human carbon dioxide emissions are driving dangerous global warming, to help him, and the public, assess whether cutting emissions would be a cost-effective environmental measure

After all, the cost to Australian taxpayers of the planned emissions trading bill is about $4000 a family a year for a carbon dioxide tax of $30 a tonne. The estimated benefit of such a large tax increase is that it may perhaps prevent an unmeasurable one-ten-thousandth of a degree of global warming from occurring. Next year? No, by 2100

The questions posed were: * Is it the case that CO2 increased by 5percent since 1998 while global temperature cooled during the same period? If so, why did the temperature not increase, and how can human emissions be to blame for dangerous levels of warming? * Is it the case that the rate and magnitude of warming between 1979 and 1998 (the late 20th-century phase of global warming) were not unusual as compared with warmings that have occurred earlier in the Earth's history? If the warming was not unusual, why is it perceived to have been caused by human CO2 emissions and, in any event, why is warming a problem if the Earth has experienced similar warmings in the past? * Is it the case that all computer models projected a steady increase in temperature for the period 1990 to 2008, whereas in fact there were only eight years of warming followed by 10years of stasis and cooling? If so, why is it assumed that long-term climate projections by the same models are suitable as a basis for public policy-making? As independent scientists attending the meeting, we found the minister's advisers unable, indeed in some part unwilling, to answer the questions

We were told that the first question needed rephrasing because it did not take account of the global thermal balance and the fact much of the heat that drives the climate system is lodged in the ocean

Que? What is it about "carbon dioxide has increased and temperature has decreased" that the minister's science advisers don't understand? The second question was dismissed with the comment that climatic events that occurred in the distant geological past were not relevant to policy concerned with contemporary climate change. Try telling that to geologist Ian Plimer

And regarding the accuracy of the Intergovernmental Panel on Climate Change's computer models, we were assured that better models were in the pipeline. So the minister's advisers apparently concede that the models that have guided preparation of the emissions trading scheme legislation are inadequate

These are not adequate responses

It was reported in the Business Age last July that the ministry of climate change's green paper on climate change, which was issued as a prelude to carbon dioxide taxation legislation, contained scientific errors and over-simplifications. Almost 12 months on, our experience confirms that the scientific advice Wong is receiving is inadequate to justify the exorbitantly costly upheaval of our society's energy usage that will be

driven by the government's ETS legislation
All Australians owe Fielding a vote of thanks for having had the political courage to ask in parliament where the climate empress's clothes have gone. Together with the senator, and the public, we await with interest any further answers to his questions that Wong's advisers may yet provide

Geologist Bob Carter, carbon modeller David Evans, hydrologist-climatologist Stewart Franks and meteorologist-climatologist Bill Kininmonth attended the meeting between Steve Fielding, Penny Wong, Chief Scientist Penny Sackett and ANU Climate Change Institute executive director Will Steffen. Sackett has so far declined to answer Fielding's questions on this page.

Record - 3

DIALOG(R)
MIT's unscientific, catastrophic climate forecast,
Kesten C. Green And J. Scott Armstrong,
National Post (Canada), National ed, p FP15,
Wednesday, June 17, 2009
Text:

When we drive on a long bridge over a river or fly in a passenger aircraft, we expect the bridge and the plane to have been designed and built in ways that are consistent with proven scientific principles. Should we expect similar standards to apply to forecasts that are intended to help policymakers make important decisions that will affect people's jobs and even their lives? Of course we should. Such standards exist. But are they being followed?
The Financial Post asked us to look at a report last month from the Massachusetts Institute of Technology (MIT) Joint Program on the Science and Policy of Global Change, titled 'Probabilistic Forecast for 21st Century Climate based on uncertainties in emissions (without policy) and climate parameters.'
The MIT report authors predicted that, without massive government action, global warming could be twice as severe as previously forecast, and more severe than the official projections of the United Nations' Intergovernmental Panel on Climate Change (IPCC). The MIT authors said their report is based in part on 400 runs of a computer model of the global climate and economic activity.

While the MIT group espouses lofty-sounding objectives to provide leadership with 'independent policy analysis and public education in global environmental change,' we found their procedures inconsistent with important forecasting principles. No more than 30% of forecasting principles were properly applied by the MIT modellers and 49 principles were violated. For an important problem such as this, we do not think it is defensible to violate a single principle.

For example, MIT forecasters should have shrunk forecasts of change in the

face of uncertainty about predictions of the explanatory variables; in this case the variables postulated to influence temperatures. More generally, they should also have been conservative in this situation of high uncertainty and instability. They were not.

We recognize that judgement is required in rating forecasting procedures. Evidence for our principles, however, is in the form of findings from scientific experiments comparing reasonable alternative methods, and accepted practice (see link below).

So what's really wrong with the MIT report? The phrase "global environmental change' provides a clue. The group's objective implicitly rejects the possibility of no or unimportant change or, despite mention of uncertainties, the possibility of unpredictable change. People who do research on forecasting know that a forecast of 'no change' can be hard, if not impossible, to beat in many circumstances. A forecast of no change does not mean that one should necessarily expect things not to vary. Such a forecast can be appropriate even when a great deal of change is possible but the direction, extent or duration is uncertain.

When one looks at long series of Earth's temperatures, one finds that they have gone up and down irregularly, over long and short periods, on all time scales from years to millennia. Moreover, science has not been able to tell us why. There is much uncertainty about past climate changes and about the strength and even direction of causal relationships. To wit, do warming temperatures result in more carbon dioxide in the atmosphere or is it the other way round -- or maybe a bit of both? Does warming of the atmosphere result in negative or positive feedback from clouds? There are many more such questions without answers. All this strongly suggests that a no-change forecast is the appropriate benchmark long-term forecast.

With Dr. Willie Soon of the Harvard-Smithsonian Center for Astrophysics, we found that simply predicting that global mean temperatures will not change results in quite small forecast errors. In our validation study that covered the period 1851 to 2007, we compared the no-change forecast with the IPCC global warming forecast that temperatures will climb at a rate of 0.03C per year. We compared the IPCC projection of 0.03C per year with what actually happened after 1850. The errors from the IPCC projection were 12 times larger than no-change benchmark. Consider the accuracy of the no-change model: On average the 50-years ahead forecasts differed by only 0.24C from the global mean temperature as measured by the Hadley Centre in the U. K.

Based on our analysis, we expect the annual global mean temperature for every year for the rest of the 21st Century to be within plus-or-minus 0.5C of the 2008 mean.

The MIT approach to forecasting is in substance the same as the approach adopted by the IPCC. Our forecasting audit of the IPCC approach and its conclusion therefore applies as well to the MIT forecasting effort: The forecasting procedures were not valid and there is no reason for policymakers to take their forecasts seriously. It also leads to the conclusion that the MIT forecast errors will be much larger even than the IPCC's forecast errors.

Policymakers and the public should be made aware that the forecasts from

the MIT modellers, as well as those used by the IPCC, are merely the opinions of some scientists and computer modellers. It is not proper to claim that these are truly scientific forecasts. - Dr. Kesten C. Green is a senior research fellow of the Business and Economic Forecasting Unit at Monash University in Australia. Dr. J. Scott Armstrong is Professor of Marketing at The Wharton School, University of Pennsylvania. Armstrong and Green are co-directors of the public service Web site forecastingprinciples.comsponsored by the International Institute of Forecasters.

Record - 4

DIALOG(R)
Peculiar, junior-sized supernova discovered by New York teen.,
PTI - The Press Trust of India Ltd.,
Thursday, June 11, 2009

Text:

Peculiar, junior-sized supernova discovered by New York teen

New York, Jun 11 (PTI) A 14-year-old student from New York has apparently become the youngest person in the world to discover a supernova, the weakest-ever found in a nearby galaxy.
Astronomers have confirmed that the supernova discovered in November last year by Caroline Moore -- called SN 2008ha -- is a new type of stellar explosion, 1000 times more powerful than a nova but 1000 times less powerful than a supernova.

Astronomers say that it may be the weakest supernova ever seen.

Even though this explosion was a weakling compared to most supernovae, for a short time SN 2008ha was 25 million times brighter than the sun. However, since it is 70 million light years away, it appeared very faint viewed from Earth.

Caroline was able to discover the object using a relatively small telescope, but some of the most advanced telescopes in the world were needed to determine the nature of the explosion.

The data has been verified by Magellan telescopes in Chile, the MMT telescope in Arizona, the Gemini and Keck telescopes in Hawaii, and NASA's Swift satellite.

"Coincidentally, the youngest person to ever discover a supernova found one of the most peculiar and interesting supernovae ever," said Alex Filippenko, the leader of the University of California, Berkeley supernova group. The paper in this regard is due to appear in next issue of the Astronomical Journal.

"This shows that no matter what your age, anyone can make a significant contribution to our understanding of the Universe," Filippenko said. The peculiar object effectively bridged the gap between a nova (a nuclear explosion on the surface of an old, compact star called a white dwarf) and a type Ia supernova (the destructive death of a white dwarf caused by a runaway nuclear reaction starting deep in the star).

SN 2008ha likely was a failed supernova where the explosion was unable to destroy the entire star.

"If a normal supernova is a nuclear bomb, then SN 2008ha is a bunker buster," said team leader Ryan Foley, Clay fellow at the Harvard-Smithsonian Center for Astrophysics and first author on the paper reporting the findings.

In typical supernova explosions, light from different chemical elements (such as calcium or iron) is smeared out across the electromagnetic spectrum by the Doppler effect (the same principle that makes a police siren change pitch as it passes).

Because the ejected bits of the star were "only" moving at 4.5 million miles per hour (compared to 22 million miles per hour for a typical supernova), the light was not as smeared out, allowing the team to analyse the composition of the explosion to a new precision.

One reason astronomers haven't seen this type of explosion before might be because they are so faint. "SN 2008ha was a really wimpy explosion," said Filippenko.