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COMMENTARY

Twenty-Five Years of the *Canadian Journal of Science, Mathematics and Technology Education*: Past, Present, Future

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Abstract It has been 25 years since the *Canadian Journal of Science, Mathematics and Technology Education* first appeared. In this article, I first look back at the year 2001, both in general terms and in terms of science education; I then consider the current state of science education; finally, I spend most of the article looking at what school science might (should, in my view) be like in the future. I examine issues to do with the motivation of school students and teachers, the content of school science, how school science is taught, and where and when teaching about science might take place.

Résumé Cela fait 25 ans que la Revue canadienne de l'enseignement des sciences, des mathématiques et de la technologie a vu le jour. Dans cet article, je commence par revenir sur l'année 2001, tant d'un point de vue général que sur le plan de l'enseignement des sciences; j'examine ensuite la situation actuelle de l'enseignement des sciences; enfin, je consacre la majeure partie de l'article à ce à quoi pourrait (et devrait, à mon avis) ressembler le programme des sciences à l'école dans le futur. Je me penche sur des enjeux liés à la motivation des élèves et des enseignants, au contenu du volet des sciences à l'école, à la manière dont il est abordé, ainsi qu'au lieu et au moment où il pourrait être enseigné.

Keywords *Canadian Journal of Science, Mathematics and Technology Education* · Science education · 2001 · Science curriculum · Pedagogy

While everyone celebrated the start of the Millennium on 1 January 2000, technically it started on 1 January 2001. That date seems, therefore, a good occasion on which to have launched a new journal, and the first issue of *Canadian Journal of Science, Mathematics and Technology Education* (hereafter, *CJSMTE*) appeared in January 2001. Now it celebrates its 25th anniversary — a silver jubilee. In this article, I first look back at the year 2001, both in general terms and in terms of science education; I then consider the state of science education at present; finally, I look at what school science might be like in the future.

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The Past: 2001

2001: A Space Odyssey

For many people, 2001 is associated — rather like George Orwell's *1984* —not with events that actually occurred in that year, but with a work of fiction. I was too young to see *2001: A Space Odyssey* when it came out in 1968, but I remember seeing it in the early 1970 s as a young teenager. Stanley Kubrick's film (he produced it, directed it, and wrote the screenplay with Arthur C. Clarke) had a transformative effect on many who subsequently worked in the film industry, including Wally Pfister (director of *Transcendence*), Jan Harlan (producer of *A.I. Artificial Intelligence* which, co-incidentally, came out in 2001), John Gaeta (visual effects supervisor, *The Matrix*), Andrew Niccol (director of *Gattaca*), and Peter Suschitzky (cinematographer, *The Empire Strikes Back* and *Mars Attacks!*) (Hoad, 2018). HAL (the onboard supercomputer in *2001*) can also be seen as a harbinger of Artificial Intelligence (AI) and is widely credited with, to this day, affecting how some people see AI, even though AI did not exist at the time of the film's development (Fuge, 2018).

Interpretations of *2001* vary greatly. For some, it sits firmly within the genre of dystopian films; for others, it is seen as hopeful. For me, it is mainly simply a great film — arguably, the finest science fiction film ever made (apologies to aficionados of *Blade Runner* or other contenders). But it can also serve as a metaphor for science and scientists. Bowman (spoiler alert), the surviving crewmember, is on a mission to discover the truth about the origin of humans. He is an astronaut, a scientist with a doctorate, brave and very resourceful (notably, the scene where he regains entry to *Discovery One*, thwarting HAL).

The Year 2001 for Me

2001 was a good year for me professionally. In the same month that *CJSMTE* was launched, I took up my present post, as the holder of the Chair of Science Education, at what was then an independent higher education institution, The Institute of Education, and is now part of University College London. I had been very happy at my previous place of employment, Homerton College, Cambridge, where I had gratefully moved in 1994 after a 6-year series of temporary, short-term contracts in the University of Cambridge Department of Education finally came to an end and my attempt to become a full-time vicar came to naught. Initially, I think late in 1993 (though I have no e-mail records that survive from then), I had been encouraged to apply when the job was advertised after the previous post-holder moved to another position. I was perfectly happy at Homerton College, so I declined to apply — I also thought I had no chance of being appointed. In the event, The Institute of Education didn't appoint that time round and advertised again. I again said I wasn't interested in applying, but woke up the next morning at 6 a.m., thinking about the possibility and decided to apply. In the event, and somewhat to my surprise given the identities of the other two who were interviewed for the post, I was appointed and am still here, 25 years later.

2001 for *CJSMTE*

There will be others who know better than I the story of how *CJSMTE* was conceived and came to be launched. When I look now at the first issue, I see both commonalities with current issues in science education, mathematics education, and technology education, and differences too. The first issue has more of an emphasis than issues of the journal do nowadays on matters that are specifically Canadian. Indeed, the opening editorial is titled 'Finally, a Canadian voice' (Hodson et al., 2001), and there is a 'Newsround' (Blades, 2001) in which we are told that 'Newsround is a special feature of the *Canadian Journal of Science. Mathematics and Technology Education* that was created to be a vehicle for sharing the latest news about SMTE [Science, Mathematics and Technology Education] in Canada' (p. 123). The first issue is more bilingual than is the case now. It is still the case that abstracts/*résumés* are provided both in French and in English, but in the first issue, the opening editorial is provided in both languages (with the French version preceding the English version), as is David Blades' Newsround/*nouvelles brèves*, and of the five main articles, two are in French.

In terms of content, there was much in that first issue that connects with today's debates in science education. Edgar Jenkins wrote about the scope of science education research and the field's strengths and weaknesses (Jenkins, 2001). Jerry Wellington wrote about the aims of science education. Indeed, his abstract would work as well today:

> The purpose of science education has been the subject of continuing debate over a long period. This article attempts to make explicit the recurrent tensions in that debate and to consider past frameworks for the aims of science education, arguing that no one element of the range of aims for science education should be over-emphasized at the expense of others. A varied "menu" of aims is required, partly in order to make science attractive to a range of learners. In reasserting the importance of a diversity of aims, the paper ends by bringing out some of its classroom implications. (Wellington, 2001, p. 23)

Marie Larochelle and Jacques Désautels looked at how university students frame disagreements among scientists and how they deliberate among themselves about socio-ethical issues (Larochelle & Désautels, 2001). Nadine Bednarz presented a case study of the university education of future secondary school mathematics teachers, exemplified by a course in algebra teaching (Bednarz, 2001). In the last of the five main articles in the first issue, David Tall and colleagues from a number of countries brought together findings from recent mathematics education doctoral dissertations on the development of symbols through arithmetic, algebra, and calculus (Tall et al., 2001).

For myself, *CJSMTE* soon became one of a handful of journals to which I regularly submit science education articles. To date, I have had six articles (excluding this one) published in *CJSMTE*. The first was in 2004 in a special issue edited by Bonnie Shapiro on longitudinal studies in science education. Bonnie was herself the author of a wonderful longitudinal study of children's understandings of light (Shapiro, 1994, 2004) and for her special issue she drew together some of the major figures who worked on such studies in science education, including Hannah Arzi, Gustav Helldén, and Joseph Novak. Looking it up on Google Scholar, I see that my own article has been cited a very respectable 90 times. Indeed, *CJSMTE* has been good to me in that regard: my six articles (Reiss, 2004; Rodd et al., 2014; Mujtaba & Reiss, 2015, 2016; Braund & Reiss, 2019; Reiss et al., 2023) have been cited a total of 299 times.

The Present: 2025

The World

I was born in the late 1950 s, one of the many whose parents had lived as adults through the Second World War. That was a good time to be born in Western Europe and, while there were obviously downs as well as ups, by the time *CJSMTE* was launched, there was much to be positive about. Democracy seemed inexorably to be on the rise. Indeed, the political scientist, Francis Fukuyama, famously argued in his *The End of History and the Last Man* (Fukuyama, 1992) that we were approaching the endpoint of history, in that the end of history, politically, is a set of liberal democracies.

That seems a touch optimistic now. I am neither a historian nor a political scientist, but it is clear that democracy has taken something of a battering over the last decade or two. There is not, of course, a single understanding of democracy; most people would cite free and fair national elections as a *sine qua* *non*, but other possible elements include freedom of expression and an independent judiciary. Figure 1 shows that, since 2010, the number of countries that have been becoming more autocratic has exceeded the number of countries that have been becoming more democratic.

Switching to matters closer to conventional science, it is clear that the natural world is in a substantially worse state nowadays than it was in 2001. This is perhaps most obvious with respect to anthropogenic climate change. Most people reading this piece will be familiar with the story. Anthropogenic climate change manifests itself in global warming, sea level rises, increasing acidification of the oceans (leading, inter alia, to coral deaths), extreme weather events (more frequent and more intense heatwaves, more droughts, heavier rainfall when it does rain, more powerful storms, and more floods), and some perhaps less-expected phenomena (including more earthquakes, more volcanic and lightning activity, more disease, less sleep, and more human migration). The rapidity of the changes is not always appreciated. Global warming is currently taking place about ten times as rapidly as after each of the eight Ice Ages that have occurred over the last 800,000 years (NASA, 2024).

It is not only anthropogenic climate change that is important; there is biodiversity loss too. Geologists recognise five so-called ‘mass extinctions’ (Bond & Grasby, 2017), defined as times when 75% or more of all species are believed to have gone extinct over less than two million years. It is sometimes said that we are living through the sixth mass extinction. We may be soon — but we haven’t got to it yet if we accept the standard definition. Precisely how many species have gone extinct as a result of human activity is unclear and probably varies considerably from taxon to taxon. A major review of mollusc extinctions (molluscs are the second largest animal phylum in terms of known species) concluded that, since about 1500 CE, possibly as many as 7.5–13% (150,000–260,000) of all known species (~ two million) have already been lost. This is a terrifyingly high figure in only 500+ years, and one that is bound to get far worse (Reiss, 2024). Molluscs were not chosen for the study because of any belief or knowledge that they were facing greater biodiversity pressures than other taxa.

The causes of rapid biodiversity loss are many and I do not need to go into them in any detail here. The most important is habitat loss — principally our use of land (and water) for agriculture. One of the more depressing statistics about the natural world is illustrated in Fig. 2. Agricultural mammals (mainly cattle, then pigs) constitute 62% of the mass of all mammals on Earth, humans 34% and wild mammals just 4% (Ritchie, 2022). These data come from 2015; things will only have gotten worse since then.

Science Education

In the countries that I know — principally the UK though I have undertaken studies in/on a number of other countries — it does not feel as if school science education has changed greatly since *CJSMTE* was first published. We still seem to have much the same debates about the balance between what we want learners to gain with respect to what we might term ‘content knowledge’ (what are magnets?, how do they behave?), skills (determining the strength of magnets, plotting field lines), the nature of science (making observations about magnets, testing hypotheses, the history of magnetism), and the applications of science (electric motors, electric generators, MRI scanners). School science curricula still struggle with the question of whether the same curriculum is suitable for all learners up to the school-leaving age or whether separate curricula are needed for those who are likely to go on to study science subsequently and very possibly use it in a career as opposed to members of the general public.

The Future

It is an old adage that it is easier to predict the past than it is the future — though on reflection predicting what happened in the past is not always straightforward. We still know, for example, remarkably little about

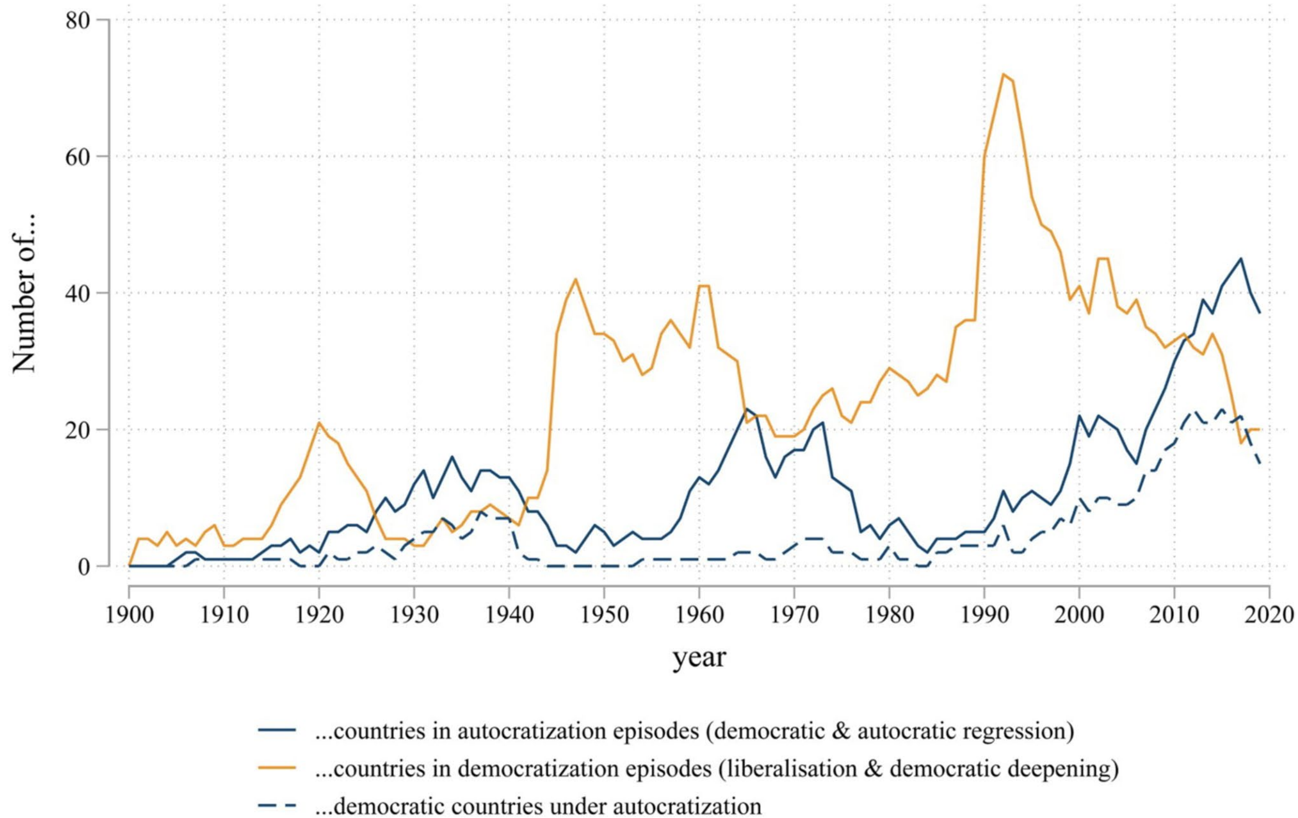

Fig. 1 Number of countries experiencing autocratization and democratization, 1900–2019 (Vanessa A. Boese, Staffan I. Lindberg, Anna Lührmann). *Source*: https://commons.wikimedia.org/w/index.php?curid=118170177

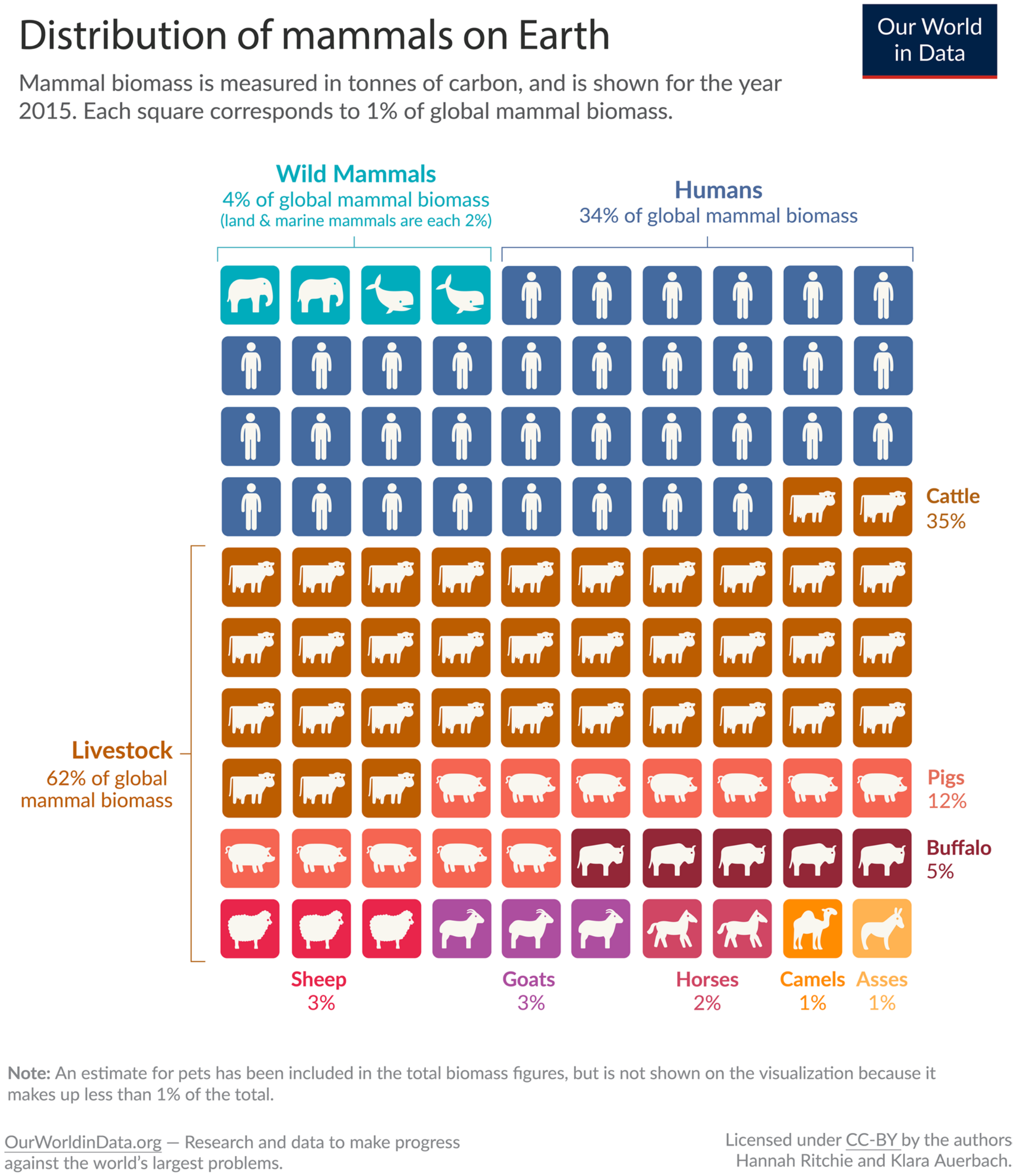

Fig. 2 Wild mammals make only 4% of the mass of mammals on the planet (Hanna Ritchie and Klara Auerbach). *Source*: https://ourworldindata.org/wild-mammals-birds-biomass

what led to the evolution of life on Earth; more generally, history, whether of humans or the natural world, is full of gaps and requires interpretation. Nevertheless, there is a discipline of future studies with its own specialist journals — e.g. *Futures* (in which I have published) and *Journal of Future Studies*. Furthermore, it was the management guru Peter Drucker who said 'The best way to predict the future is to create it' (also attributed to Abraham Lincoln). As science educators, we do have *some* input into the future of science education, so I will somewhat liberally interpret the last of the four possibilities that Editor-in-Chief Doug McDougall, on inviting me to write for this anniversary issue, said I might write about:

- A response to an article published in the first 25 years
- An update on one of your articles in the journal
- Your current work
- Whatever you wish to share

and suggest a number of ways in which I think school science education needs to change in the years ahead.

In doing so, I keep in mind that we can think of school science, my particular focus (rather than informal science education or university science courses, for instance), as an ecosystem (I am an out-of-doors biologist by background). There are many important species in this ecosystem. Perhaps above all, we need to consider the learners themselves, but then we also have to keep in mind those who teach them (too rapid a shift from their understanding of science education will simply not work) and those who pay for school education (often governments but also parents). There are other species too (including organisations that set high-stakes examinations, textbook authors, those responsible for pre-service and in-service teacher education, and those who inspect schools) but they occupy niches that are somewhat more peripheral than those occupied by students, teachers, and those who pay for science education — which together we can think of as the 'keystone' species.

Motivating Students

I start from what I regard as axiomatic — science education needs to motivate learners. Motivation builds on interest. If students do not find a reasonable proportion of what they are taught in school science to be interesting, they will be motivated neither to learn what their teacher intends them to learn nor to continue to learn any science once they are no longer required to. I will return to the issue of motivation in subsequent sections when I get to the specifics of such issues as the content of school science and how it is taught.

Motivating Teachers

It seems obvious that high-quality science education would seek (needs) to motivate students; it is important that teachers are motivated too. A recent comprehensive review of the international evidence looked at why people become teachers — or do not — and found similarities across countries (See et al., 2022). Among OECD countries, in descending order of importance, the order of factors as to why people enter the teaching profession is as follows: opportunity to influence children, a reliable income, a steady career, a way of contributing to society, a secure job, and it fits with one's personal life (e.g. it is a family-friendly career). When it comes to why teachers leave the profession, a study in Belgium found that those who leave early in their teaching career cite job insecurity, excessive workload, classroom management issues, and feeling demoralised, while the decisive factor for experienced teachers is the profession's flat career structure (Amitai & Van Houtte, 2022). An Australian study found that intentions to leave the teaching profession were related to heavy workloads, health and well-being concerns, and the status of the profession (Heffernan et al., 2022). Other studies produce comparable results — for example, a US study of former public school teachers found that both before and as a result of the COVID pandemic, stress was given as the most common reason for leaving the profession (Diliberti et al., 2021). A study in England of three schools in different deprived areas found that factors that were particularly important in encouraging teacher retention were as follows: making a difference to students, the wider community and society; creating positive relationships with students; supportive colleagues; and feeling valued by school leaders (Arthur & Bradley, 2023).

Content

When I first started teaching high school biology, back in the 1980 s, there seemed to be an implicit belief that school biology had to cover everything. So, in 16-19 biology we studied algae, bryophytes (including the details of alternation of generations), pteridophytes (OK, we didn't spend much time on those), conifers, and angiosperms. (The last argument I had with the person to whom I am married was about whether cycads should have been included too — she, a palaeopalynologist, thought they should, a view I, perhaps unwisely, dismissed as ridiculous). We also went thoroughly through the animal kingdom, phylum by phylum, beginning (from memory) with the main types of sponges and ascending, à la Aristotle's *Scala Naturae*, to mammals and *Homo sapiens*. Later in the course, we had a similarly comprehensive overview of human anatomy and physiology, covering just about every organ of the body.

Things have gotten better. A few decades ago, it was pointed out that you needed to know as many words for a good pass in biology in the main end-of-school examination for 16-year-olds as you did in French. (Soon after, I found myself in charge of the second edition of the Institute of Biology's *Biological Nomenclature: Recommendations on Terms, Units and Symbols*; I managed to reduce the number of required terms by 10%, which was something.) Nevertheless, the sciences, particularly biology, still seem to strive for comprehensiveness in a way that would seem bizarre to historians, geographers, or those teaching literature. We teach students a selection of great poetry, plays, novels, and short stories, not the entire canon of fiction. A better way forward in the sciences would surely be to have a relatively low-level comprehensive coverage before students get to high school and then go for depth, not breadth. This would provide more space in the curriculum for topics that, at present, are somewhat squeezed out or absent.

One area where, in many countries, school science could do more is health education. There is a good argument that health education should not be the preserve of biology lessons but included as a subject in its own right or included in general studies or form tutor groups or such like. The trouble with this otherwise attractive argument is that this way of teaching health education enjoys much less status than putting it in science. The topics taught in general studies or form tutor groups are often not treated as seriously, by students and by teachers, as those taught in subjects like science, mathematics, and the majority language of students. Furthermore, biology teachers tend to know a lot about health education. I spent years teaching sex education, and it is rather useful being completely on top of questions to do with irregular periods, when a woman is most likely to conceive in her menstrual cycle, how effective different types of contraception are, the characteristics of different sexually transmitted infections, and so on.

Of course, many biology teachers find it somewhat embarrassing to teach sex education when they first do so, but it is a lot less embarrassing than it is for those who do not know some of the science. The International Reproductive Health Education Collaboration (IRHEC) is currently undertaking several country studies to see what school students have learnt about sex and reproductive health and what they would like to learn. In the one published study to date (England), students were critical of the narrow set of topics taught: "Topics that were frequently suggested for addition to the curriculum included consent, fertility and infertility, endometriosis, PCOS, miscarriage, abortion, masturbation, menopause, menstruation, pregnancy, sexual assault and how to access sexual and reproductive health services" (Maslowski et al., 2024, p. 185).

Perhaps unsurprisingly, given what I have written above about anthropogenic climate change and biodiversity loss, I am of the opinion that schools could do more in these areas and much is now known about what works well in climate change education (Monroe et al., 2019; Rousell & Cutter-Mackenzie-Knowles, 2020). What a school can do about climate change and biodiversity loss is not, of course, restricted to what happens in science teaching. At the whole-school level, there is much that a school can (should) do in terms of such things as its energy use, the food it provides, how it deals with food waste, and the school grounds. Nevertheless, science lessons play an important part too and climate change education raises particular questions as to its purpose and, getting into the section below on pedagogy, how the topic is taught. The occurrence of anthropogenic climate change is no longer a controversial scientific issue but how we respond to it is controversial, both scientifically (think geoengineering) and politically. Do we want to teach only to enhance knowledge and understanding, or do we also want to teach to shift attitudes and change underlying dispositions?

A final suggestion about content. I think we do want more teaching about the uses of science, including the sorts of careers open to those who go on to study science or other science, technology, engineering, and mathematics (STEM) subjects after school. In part, this is because many students who choose to study science once it is no longer compulsory do so for reasons of extrinsic motivation — in particular, they believe it will help them to get a good job (Mujtaba et al., 2020; Sheldrake et al., 2017). This is not to imply that we want to give the impression that all applications of science are beneficial — we want students to develop a critical attitude. Indeed, I would favour including more in school science teaching about the military uses of science. Most students, I suspect, greatly underestimate the importance of the military-industrial complex for scientific research. I am not a pacifist, so I am not making this suggestion hoping that students will be put off science. But I do think that students should know about the uses to which science is put, and school textbooks do not, I suspect (I am unaware of any research on this issue) provide a balanced account.

Pedagogy

Nothing is more important to a school student's learning than their teachers. One of the finest science teachers I have ever known, Colin Harris, taught me, over 4 years, all the physics I learnt at school. Thanks to him, I went to university intending to read physics. Within 10 days, I realised I wasn't a physicist — it was just that Mr Harris' teaching had been so good — and I switched to biology. Looking him up on the web just now, I see that, sadly, he has recently died (27 July 2025); I am glad that, while I was a school teacher, I got the opportunity, having accepted an invitation to give a talk at his school, to tell him how important his teaching had been to me.

Looking back on it, there were at least four things that made Colin Harris' teaching so good. First of all, he had complete classroom control. At that age, I didn't think about such matters, and I could not have said why some teachers had it whereas a minority didn't — I am afraid I can remember several of us, when we were about12 years old, running one teacher ragged as he got more and more frustrated at his inability to maintain discipline. Secondly, Colin Harris had excellent subject knowledge and was able to communicate it. This point hardly needs stressing — to use the language that I now know, if you do not have content knowledge and pedagogical content knowledge, you are not going to be very effective as a teacher. A third factor was that we had wonderful discussions in his lessons. It felt like we could talk about anything to do with physics, even if only tangentially connected, but at the right time, he would bring us back to the core issues he wanted us to learn about. Finally, I benefitted hugely from the fact that when I did my 'Advanced' levels (the two, three, or four subjects one does in England over 2 years once one has completed one's compulsory schooling), we were at the very beginning of Nuffield Advanced-level Biology, Chemistry, and Physics.

The involvement of the Nuffield Foundation in curriculum innovation from the 1960 s onwards led to a revolution in science courses in England for 11–18-year-olds. The content was stretching — we were even introduced in Advanced-level Physics to the Schrödinger equation — and the practical work was wonderful — we measured the gravitational constant, G, and the charge on an electron, e (well, we tried to) — and we spent 2 weeks on what I would now call an Independent Research Project. The project I did was not especially successful — it was about factors that affected the frequency at which pieces of wood vibrate (length, composition, and so on), and I wasn't able to produce any insightful theoretical underpinning for the results I found. But it was the first time in science that I had been given much autonomy, and I got completely hooked on the project, working all hours and being completely self-organised, whereas normally my parents had to badger me to do my homework.

There is now a growing literature on Independent Research Projects. A systematic review showed that benefits are found in relation to the learning of science, affective responses to science, intention to pursue careers involving science, and development of a range of skills (Bennett et al., 2018). Nor were, as is sometimes supposed, the benefits restricted to 'high-achieving' students. Studies that looked at traditionally under-represented groups indicated that such students also felt more positive about science because of undertaking such projects. Not a million miles away from Independent Research Projects are initiatives to help students be more creative in school science, and it is perhaps unsurprising that inquiry-based approaches to science education can enhance students' scientific creativity (Xu et al., 2024).

Recent years have also seen a considerable growth in enthusiasm for teaching about socio-scientific issues, the key idea being that to understand many of the world's pressing issues one needs both a robust understanding of science and an appreciation of the way that science interacts with other academic disciplines, such as politics, economics, and ethics (e.g.Garrecht et al., 2023; Nolan & Zeidler, 2025). One of the strengths of the socio-scientific approach to science teaching is that it fits well with recent Vision III arguments that science education should be more critical and align itself more with political action (see the discussion in Sjöström, 2025). As someone who has argued for many years that there is a role for more teaching about ethics in school science education (e.g. Reiss, 1999), I welcome more teaching about socio-scientific issues. However, although the appropriate research does not seem to have been undertaken, my prediction would be that, while many students find learning certain science topics in this way to be motivating, this is not true for all students. I think back to myself as a nerdy 14-year-old. What I enjoyed was the pure physics of physics; I would not have been interested in a debate to do with the pros and cons of different ways of generating electricity.

Finally, though this could have been included in the above section on content as well as this one on pedagogy, I cannot pass by the extraordinary way in which the mainstream conclusions of science are now dismissed by increasing numbers of politicians and members of the public. I am writing this on the day that the director of the US Centers for Disease Control and Prevention (CDC) has been fired by the White House and, in a departing statement, accused Health Secretary Robert F. Kennedy Jr. of "weaponising public health" (Yousif, 2025). But there is nothing special about this day. Almost any day would have provided a comparable headline, whether about health issues, fossil fuels, climate change, or a number of other matters of science policy in the USA and in an increasing number of other countries. It's back to the future for Trofim Lysenko.

We have long known that the scientific consensus on evolution is rejected by quite large numbers of people on the grounds that it clashes with their interpretations of scripture, but science educators have devised ways of addressing this issue (e.g. Billingsley et al., 2019; Reiss, 2019). What has arisen more recently is mistrust of science in various other areas, a feature that has wider implications than for science alone (Collins & Evans, 2026). As a number of science educators have argued, we need school science education to respond to this issue (Reiss, 2022; Osborne & Pimentel, 2023). At the same time, it is important that we remember the lessons learned from evolution education — we do not want to characterise those who do not accept the conclusions of science as stupid; that is counterproductive.

The Sites and Times of Learning

Finally, a few thoughts about the sites and times of learning science. School education across the world is still dominated by a model in which for up to about a dozen years of their lives, children spend 5 days a week for about 36 to 44 weeks of the year,about half their waking hours, in groups of 20–50 being taught indoors by a single teacher in front of them. Sometimes, somewhat unfairly, characterised as a form of affordable child minding, this arrangement has prevailed for generations. The 2020–2021 pre-vaccination COVID pandemic troubled this model but has not yet fundamentally altered it.

And yet, in many countries, school absenteeism is markedly higher now than pre-COVID; home schooling is on the rise, and most of us, as adults, are used to working and learning for some of the time at home or pretty much anywhere, rather than having to go to a particular place. I am not one of those who forecasts an imminent end to conventional schooling, but I do look forward to more of a partnership between in-school and out-of-school learning. Science has every reason to hope to benefit from such a trend. The benefits of out-of-school learning in science have long been acknowledged (e.g. Braund & Reiss, 2004).

Concluding Thoughts

I am a science educator and, while I am well aware that *CJSMTE* is also a mathematics education journal and a technology education journal, I can only write about my area of knowledge. In science education, *CJSMTE* holds a position as a leading journal in the field. Much has changed in the world since its first issue appeared a quarter century ago, but the issues facing school science education have never been more pressing. Here, I have included some reflections on changes over the past 25 years and have suggested how science education itself needs to change with regard to science content, science pedagogy, and the sites and times of learning. No doubt *CJSMTE* will continue to publish articles on these and other matters.

Declarations

Conflict of Interest The author declares no competing interests.

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