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Science always makes a difference

How do we know if science makes a difference? This question was posed to participants of a webinar hosted by the *South African Journal of Science* during the 2021 National Science Week. A report of the webinar has been provided by Masete¹. As a panellist in this webinar, I argued that science always makes a difference; and that therefore there is no need for an approach to quantify or detect or measure this difference. Indeed, attempting to separate out the science that makes a difference from that which is perceived to not make a difference does a disservice to the advancement of science. Science always makes a difference, because intrinsic to science is the pursuit of new knowledge. Even if this new knowledge is small in magnitude or influence, parochial, or restricted to a narrow subdiscipline, even if it is seldom cited, it provides one of many critical building blocks for future work. Here I summarise the position I outlined in the webinar, through arguing (1) the cases in which the 'difference' made by science is most tangible, (2) the more continuous impacts of scientific pursuit that likewise make a difference, and (3) that the difference that science makes does not always contribute a net good to society.

The 'difference' made by science is most tangible when it does lead to a breakthrough, a discovery or a solution to a problem. The difference made by science is clear and detectable when it involves raising awareness about a problem, improving the understanding of an issue, or improving the accuracy of models or forecasts. The difference that science makes is indisputable when it is seen to encourage young people to pursue further education, particularly in STEM fields, or when it addresses social ills. These differences are often the types of tangible outcomes that students pursuing STEM degrees expect to be able to contribute towards after graduation, and certainly are tremendously valuable.

However, I would argue that science equally makes a difference on a far more continuous basis, and at a far smaller scale. Conducting scientific research – following, engaging with, developing, refining, and repeating the scientific method makes a difference. Training young scientists, whether in the classroom or lecture theatre, the laboratory or the field, and whether in lectures or through demonstration, makes a difference. Communicating research findings, whether to an academic or public audience, whether in writing or verbally, whether to a small or large group, makes a difference. Using research to inform policy, without doubt, makes a difference.

The 'difference' that science makes, however, is not always for good, or for good in perpetuity. Science can also drive some of the world's greatest problems. What might be developed as a solution to a problem now, might become detrimental down the line. Mistakes are made in science, with catastrophic consequences. We also cannot ignore the role that science has played in some of the world's worst wars. In promoting science for good, we need to regularly reflect on the importance of research integrity, of ethical practices, of rigour in our approach, and in transparency in our procedures.

So if the question of 'when science makes a difference' is so easily answered by 'always', as I argue it is, what other questions should scientists be asking? I would posit:

1. What kind of difference do I, as a scientist, want to make?
2. How will I measure, quantify or detect the difference that I am making?
3. How will I determine whether the difference I have made provides a net positive outcome (however small or big) for the world now, and whether it will likely continue to do more good than harm in future?
4. How can I improve the impact of my science?

As a public, whether involved in the sciences or not, and whether working with a specific scientific subdiscipline or not, we also play an important role in recognizing the difference that science can make. We too need to self-reflect, and I argue that the following questions are important considerations:

1. How do we support science through recognising, and celebrating, the less tangible impacts?
2. How can we encourage 'science for good', or science which has a net positive impact?
3. How do we facilitate more people working in the sciences seeing and appreciating their value, and the difference that they make?
4. How can we best understand and learn from the outputs of science?

In recognising that science always makes a difference, the importance of science for good and science with good intention is heightened.

Reference

1. Masete D. How do we know if and when science makes a difference? *S Afr J Sci.* 2021;117(9/10), Art. #12226. <https://doi.org/10.17159/sajs.2021/12226>