

Primary teachers' views of the nature of science in the wake of the Covid-19 pandemic

Research question: *In the wake of the Covid-19 pandemic, are primary teachers' views of the nature of science different to before?*

School science lessons involve teachers replicating the accepted tenets of professional science in the classroom (e.g. Littledyke *et al.*, 2013); as Fairbrother and Hackling put it, 'being a scientist for a day' (1997, p887). Children conduct experiments where they control variables (fair tests), collect and interpret data, use inductive/deductive reasoning to arrive at conclusions, and objectively evaluate the reliability and validity of the experiments. This approach reflects a 'scientific method'; the concepts underlying these processes are collectively called the *nature of science* [NOS] (Azevedo & Scarpa, 2017; Lederman & Lederman, 2014).

It is well established that primary teachers in the UK, US and elsewhere have views of the NOS that differ from those of professional scientists (McComas *et al.*, 2020) which is problematic since children may not be exposed to a completely authentic version of a scientific method. Given the potential impact of this disparity in knowledge on the scientific literacy of children we are interested in surveying a sample of serving primary teachers in order to investigate whether their experiences during the Covid-19 pandemic have changed their understanding of the NOS.

Since the onset of the European phase of the pandemic in early 2020 the UK populace has been subjected to an almost daily diet of science in the media (Cowper, 2020; Williams, 2020). These experiences include: the Prime Minister giving regular briefings on live TV flanked by senior government scientists who offered scientific rationales for policy; information on epidemiology concepts (lockdowns, social distancing, isolation, shielding, R rate); how viruses operate (longevity of virus particles, face masks, ventilation of indoor spaces); treatment of disease (ventilators, hospital admission rates, extenuating medical factors); and prophylaxis (vaccination, immunity). This information was offered in parallel with rational arguments based on scientific principles, including research methodologies, many of which are embedded in the NOS concepts. The current study is an attempt to uncover whether these experiences have had any effect on primary teachers' views of the NOS.

As a follow-on study (part 2) we will run focus groups whose membership is recruited from part 1 participants. Part 2's focus will shift, the aim being to generate lesson ideas and resources for use in school that will involve *children* reflecting on their own experiences during the pandemic, in order to help them construct appropriate NOS concepts. Improving children's NOS concepts will help give them

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a more authentic view of science, advancing their scientific literacy and making them more informed citizens. For instance, they will be able to better evaluate Covid-19 related science, challenge government policies, and assess the reliability of a story posted on social media.

The online questionnaire phase aims to accrue 300-400 respondents and uses a variant of an established instrument, the *Student Understanding of Science and Scientific Inquiry* (SUSSI). The original SUSSI was developed for use with teachers from the US, China and Turkey (Liang, 2006); our variant keeps the same items but has changed the vocabulary with some to make it more accessible to English primary teachers. The questionnaire also includes an additional section at the end of the SUSSI sequence comprising of several items related to pedagogical matters, a specific focus for part 2 of the study.

Once a respondent completes each item on the questionnaire there is further question stating, 'Would you have chosen a different response before the Covid-19 pandemic?'. If 'Yes' is selected there is a link to a page where the same question is repeated with the caveat 'Before the Covid-19 pandemic...', and a box for an open-ended response that gives the respondent an opportunity to explain why their view has changed.

Semi-structured interviews will follow from the questionnaire phase, accruing a smaller sample (n = 30-40). The focus is more pedagogical, discussing the questionnaire items where respondents have indicated that they would have given a different response pre-pandemic.

Quantitative methods of analysis will be applied to the data. For instance, Multivariate Analysis of Variance (MANOVA) will be used to statistically compare responses between different sub-groups to explore any variation. Differences within groups will be explored using Students' t-test and chi-square test for independent samples. Quantitative analysis of textual data from open-ended items will be analysed using thematic analysis, aided by NVIVO, in a search for common themes both within and between the subgroups.

References

Azevedo, N. H., & Scarpa, D. L. (2017). A systematic review of studies about conceptions on the nature of science in science education. *Revista Brasileira de Pesquisa em Educação em Ciências*, 621-659.

Cowper, A. (2020). Covid-19: are we getting the communications right?. *BMJ Online*, 368.

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Available at:

https://www.bmj.com/content/368/bmj.m919.short?casa_token=-yGnlqxXbK8AAAAA:Yz_ke87Atl5f7hA6BSVV7Psr-mIvrhVwVjYkc_0gUAb-M17_gsYy1gYOfhaCdRZW_o5C1ZQZ_w

(Accessed 23-2-21).

Fairbrother, R. & Hackling, M. (1997). Is this the right answer? *International Journal of Science Education*, 19, 887-894

McComas, W. F., Clough, M. P., & Nouri, N. (2020). Nature of Science and Classroom Practice: A Review of the Literature with Implications for Effective NOS Instruction. *Nature of Science in Science Instruction*, 67-111.

Lederman, N. G. and Lederman, J. S. (2014) Research on teaching and learning of nature of science. In *Handbook of Research on Science Education, Vol. 2*, ed. Lederman, N. G. and Abell, S. K., pp.600–620. New York: Routledge.

Liang, L. L., Chen, S., Chen, X., Kaya, O. N., Adams, A. D., Macklin, M., & Ebenezer, J. (2006). Student understanding of science and scientific inquiry (SUSSI): Revision and further validation of an assessment instrument. In *Annual Conference of the National Association for Research in Science Teaching (NARST)*, San Francisco, CA (April, Vol. 122).

Littledyke, M., Lakin, L., & Ross, K. (2013). *Science Knowledge and the Environment: A Guide for Students and Teachers in Primary Education*. Abingdon: Routledge.

Williams, J. (2020). Covid has exposed how poor our scientific literacy is. *TES Online*. Available at:

<https://www.tes.com/news/covid-has-exposed-how-poor-our-scientific-literacy>

(Accessed 23-2-21).