What is this research about?
The scientific method is a popular, yet commonly misunderstood, term within science. Often assumed to imply that there is one right way of conducting scientific investigations (McComas, 1998), this conceptualization of the process of science results in science teaching that does not emphasize the tentative nature of scientific knowledge (Windschitl, 2004) and promotes an unrealistic view of scientific discovery as a neat, step-by-step process.

In contrast, teaching science as a process of inquiry is gaining increased support in science education (Kubicek, 2005). This approach embraces the notion that there are many ways to solve a scientific problem and supports a version of teaching science where students “steer their inquiry in the direction of their choosing” (Kubicek, 2005, p. 56). Furthermore, teaching science as inquiry has been linked to increasing student achievement in science, helping students work cooperatively with their peers while enhancing students scientific argumentation skills and developing positive student attitudes towards the study of science (Wilson, Taylor, Kowalski, & Carlson, 2010; Wolf & Fraser, 2008).

What you need to know:
This study examined pre-service science teachers’ attitudes towards and experiences with inquiry in science. Results showed that most pre-service science teachers entered their formal training believing in the traditional view of the scientific method. However, enrolment in a science methods course designed to challenge this view of science appeared to contribute to conceptual changes and the embracing of inquiry teaching in science by the majority of pre-service teachers.
as inquiry, inquiry-based teaching practices “have not been—and still are not— the norm in schools” (Luehmann, 2007, p. 825). This is often attributed to teacher beliefs towards the nature of scientific discovery (Luft, 2001) and their continued reliance on “the” scientific method.

This study investigated the attitudes and experiences of pre-service secondary school science teachers who are learning to teach science as a process of inquiry. The pre-service teachers were enrolled in a full-year science methodology course at an Ontario faculty of education, which aimed to challenge the belief that scientific investigation is only conducted using one universal step-by-step process.

In particular, the researchers were interested in understanding:

a) pre-service teachers’ attitudes towards science as a general process of inquiry involving both structured and unstructured approaches of investigation, considering that most of them had been students of the traditional scientific method in high school and in their university science degrees that viewed;

a) whether and in what way a science methods course could challenge those uncertainties and change pre-service teachers’ thinking towards the nature and process of science.

What did the researchers do?
The researchers used a mixed methods (qualitative and quantitative) data collection and analysis approach to answer their research questions. First the researchers developed a questionnaire designed to examine pre-service science teachers’ attitudes and experiences towards both the traditional scientific method and the inquiry approach to science. This questionnaire contained both open and closed questions and was administered at the beginning and end of the science methods course each year from 2005 to 2010. In total, 113 students completed the initial survey and 87 completed the final survey.

Researchers then selected 31 pre-service science teachers from three cohorts (2008, 2009, and 2010) and conducted face-to-face interviews in order to generate a deeper understanding of the data reported in the initial questionnaire. This sub-sample was purposely chosen to ensure a representative sample based on
gender, scientific discipline, and life experiences. Finally, all the data collected was analyzed for common themes.

What did the researchers find?
Results from the survey data indicated major shifts in the thinking of pre-service teachers over the duration of the methods course. At the beginning of the course, 86% of pre-service teachers reported that they were certain about the nature of science and believed in the traditional, unidirectional, step-by-step scientific method. At the end of the course, only 15% held this traditional view.

Furthermore, by the end of the course, 42% of pre-service teachers agreed that science teaching needed to move towards a more sophisticated understanding of science though inquiry.

The interview data also supported the survey findings, indicating that the pre-service teachers had come to understand the rationale behind teaching science as inquiry and what this sort of science teaching would look like in a classroom. There was also evidence of the participants coming to value the process of inquiry rather than just the final knowledge produced.

The researchers suggest that a methods course that challenges pre-service teachers’ uncertainty and apprehension about teaching science as inquiry can support conceptual change and help future science teachers let go of old ingrained habits and embrace inquiry-based science teaching.

How can you use this research?
The researchers suggest that Faculties of Education may wish to consider the following:

- Where possible, hire science methods instructors who have knowledge of and experience with inquiry learning.
- Consider other supports that may be necessary for pre-service teachers who enter their practicums with a desire to “go against the grain” of the traditional model of science teaching.

Furthermore, in light of this study, high school science teachers and administrators may wish to consider:
Pairing pre-service science teachers with staff who have embraced inquiry teaching in science;

being more open to teaching science as inquiry and flexible in their assessment of pre-service teachers who choose this approach.

Original article:
To learn more about this study, we invite you to read the original research article:


Other references:


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Inquiry, scientific method, science teaching

About this summary
The Ontario Education Research Exchange (OERE) is a project of the Knowledge Network for Applied Education Research, an Ontario network promoting the use of research in education. The OERE’s clear language summaries of academic research aim to support this mandate.

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