



# Investigating interest and knowledge as predictors of students' attitudes towards socio-scientific issues<sup>☆</sup>



Tonje Stenseth, Ivar Bråten<sup>\*</sup>, Helge I. Strømsø

University of Oslo, Norway

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## ABSTRACT

The present study investigated the extent to which topic interest and topic knowledge, independently and interactively, predicted attitudes towards two socio-scientific issues: the potential risk associated with nuclear power plants and human-induced climate change. In a sample of 153 Norwegian upper-secondary school students, topic knowledge was found to be a better predictor of attitudes towards nuclear power plants than was topic interest, whereas topic interest was found to be a better predictor of attitudes towards climate change than was topic knowledge. Thus, more knowledgeable students seemed less likely to be concerned about the potential risk of nuclear power plants than were less knowledgeable students, and more interested and engaged students seemed more likely to judge climate change to be human-induced than were less interested students. Moreover, for both issues, students' interest in the topic and their topic knowledge interacted, with the relationship between interest and attitude depending on students' level of topic knowledge. This interaction differed between the two issues, with a stronger relationship between interest and attitudes observed at lower than at higher levels of knowledge for the nuclear power issue and a stronger relationship between interest and attitudes observed at higher than at lower levels of knowledge for the climate change issue. Theoretical and educational implications of the findings are discussed.

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## 1. Introduction

In democratic societies, socio-scientific issues are often publicly debated (Bromme & Goldman, 2014; Sinatra, Kienhues, & Hofer, 2014). Participation in such discourse reflects people's attitudes towards the issues, understood as their relatively enduring evaluative judgments about them (Bizer, Barden, & Petty, 2003). The myside bias phenomenon implies that when dealing with controversial issues, people tend to evaluate and generate evidence, as well as test hypotheses, biased by their prior attitudes (Stanovich, West, & Toplak, 2013). Empirical research corroborates this view, with information consistent with people's prior attitudes more likely to be recalled, evaluated positively, and included in mental representations of situations and issues than attitude-inconsistent information (Andiliou, Ramsay, Murphy, & Fast, 2012; Kahan et al., 2012; Kardash & Scholes, 1996; Lord, Ross, & Lepper, 1979; Maier & Richter, 2013, 2014; McCrudden & Sparks,

2014; Murphy & Alexander, 2004; Strømsø, Bråten, & Stenseth, 2015; van Strien, Brand-Gruwel, & Boshuizen, 2014; Wiley, 2005).

Given the potentially wide-ranging, negative consequences of people's prior attitudes towards socio-scientific issues for an open-minded and constructive democratic discourse on how to understand and solve them (Sinatra et al., 2014), it is important to understand the psychological antecedents of such attitudes (Critchley, 2008; Sinatra et al., 2014). In an educational context, this seems particularly pertinent because those antecedents may be targeted through instruction to promote attitudes more conducive to decisions and actions informed by scientific evidence. So far, however, educational psychologists seem to have paid less attention to the antecedents than to the consequences of such attitudes. According to Bizer et al. (2003), motivational as well as cognitive factors may contribute to making people's attitudes weaker or stronger. Consistent with this view, we set out to investigate personal interest and topic knowledge as predictors of high school students' attitudes towards two publicly debated and essential socio-scientific issues: potential risk associated with nuclear power plants and anthropogenic (i.e., human-induced) climate change.

### 1.1. Theoretical assumptions and prior research

According to the Elaboration Likelihood Model (ELM) of Petty and colleagues (Petty & Briñol, 2012; Petty & Wegener, 1999), relatively

<sup>☆</sup> The sample of students in the current work also contributed to data reported by McCrudden, Stenseth, Bråten, and Strømsø (2016). However, data and analyses included in this article are unique to this study.

<sup>\*</sup> Corresponding author at: Department of Education, University of Oslo, P.O. Box Blindern, N-0317 Oslo, Norway.

E-mail address: [ivar.braten@ped.uio.no](mailto:ivar.braten@ped.uio.no) (I. Bråten).

enduring attitudes likely to have consequences for behavior are formed through a “central” processing route involving higher degrees of engagement with and elaboration of the issue at hand.<sup>1</sup> Among the individual difference variables that can be assumed to determine attitude formation is how motivated individuals are to assess the central merits of an issue, with personal involvement in an issue being integral to this motivational construct (Petty & Briñol, 2012). Likewise, topic knowledge that allows people to assess issue-relevant information in relation to that knowledge can be assumed to play an important role in arriving at a reasoned attitude (Petty & Briñol, 2012; Petty & Wegener, 1999). The role of topic knowledge may increase when the issue is more complex because it then requires more background to understand it (Petty & Wegener, 1999). Also, higher topic knowledge may in some instances, especially when the issue is considered less important, decrease the role of motivation because a person may decide to make an evaluative judgment based on knowledge alone (Petty & Wegener, 1999). Conversely, students with limited knowledge about a particular issue may be more likely to draw on their personal involvement in the issue when taking a stance on it (Murphy, 2001). In brief, it can be assumed that motivational engagement and knowledge-based elaboration, independently or interactively, contribute to attitude strength.

The emphasis on the roles of motivational and cognitive factors in attitude formation seems consistent with the Cognitive Reconstruction of Knowledge Model (CRKM) of Dole and Sinatra (1998). The CRKM implies that the likelihood of adopting a particular stance on a scientific issue depends on motivational factors associated with personal relevance (e.g., interest and involvement) as well as on key aspects of learners' existing knowledge (e.g., strength and coherence). A final reason for focusing on personal interest and topic knowledge as predictors of attitudes in this study is that both individual difference variables figure prominently in current, influential models of learning and building understanding from complex information sources, such as Guthrie and Wigfield's (2000) engagement model and Alexander's (2005) Model of Domain Learning.

Research on students' personal interest and topic knowledge in relation to their attitudes towards socio-scientific issues has produced inconsistent results, however. Regarding personal interest, some studies (Kardash & Howell, 2000; Murphy & Alexander, 2004; Sinatra, Kardash, Taasobshirazi, & Lombardi, 2012) have found relationships between undergraduates' interest and their positions on socio-scientific issues. For example, Sinatra et al. (2012) found that undergraduates' personal involvement in the form of their “willingness to take mitigative action” (p. 1) was positively related to attitudes towards climate change that reflected the scientific consensus on the issue (Intergovernmental Panel on Climate Change, 2008). In contrast, Kardash and Scholes (1996) did not find any association between undergraduates' interest and their judgment of the causal relationship between HIV and AIDS.

Regarding topic knowledge, some studies (Kardash & Howell, 2000; Kardash & Scholes, 1996; Murphy & Alexander, 2004) did not find any reliable associations between participants' topic knowledge and their judgment of the issues they targeted. In contrast, Lombardi, Seyranian, and Sinatra (2014) found that undergraduates' knowledge about human-induced climate change was positively related to their endorsement of a view commensurable with available scientific evidence (Intergovernmental Panel on Climate Change, 2008).

One likely reason for inconsistent findings is great variation in the issues that were targeted, ranging from the HIV–AIDS relationship (Kardash & Howell, 2000; Kardash & Scholes, 1996) to human-induced climate change (Lombardi et al., 2014; Sinatra et al., 2012). Moreover, although the cited studies used samples with a large majority of females, it is surprising that none included gender in their analyses (see Section 1.2). Of note is also that none explored possible interactions

of personal interest with topic knowledge in relation to students' attitudes.

A study by Kahan et al. (2012), however, suggested that personal interest and topic knowledge may interact in determining people's attitudes towards socio-scientific issues. These authors found that people's interests and values, but not their scientific knowledge, were related to their concerns about the risk of climate change. Moreover, the importance of personal interests and values was greater among more knowledgeable than among less knowledgeable people. Notably, the same main effect of personal interest and values and the same interaction effect emerged when people's attitude towards nuclear power risk was the dependent variable. One interpretation of these findings is that greater scientific knowledge makes people better equipped to argue and form a position that is consistent with their personal interests (Kahan et al., 2012). Likewise, Gauchat (2012) demonstrated the importance of people's interests and values to the formation of attitudes towards scientific issues, with the importance of such mechanisms increasing with people's educational level. These interaction effects are different from the possible interaction between motivation and knowledge described by Petty and Wegener (1999) and Murphy (2001) (see above), which may be more pertinent when issues are considered less important by participants (Petty & Wegener, 1999).

## 1.2. The present study

We set out to investigate the extent to which Norwegian high-school students' attitudes towards the potential risk associated with nuclear power plants and human-induced climate change could be uniquely predicted by their personal interest in the issues and their knowledge about them, as well as by interactions between these two variables. There are differences between the two issues that may highlight the context-specificity of psychological mechanisms involved in attitude formation regarding socio-scientific issues. Whereas the UN Intergovernmental Panel on Climate Change (2008) has established scientific, if not public, consensus on the issue, stating that it is “virtually certain” that global temperatures will increase in the future and “extremely likely” that human activities are responsible for this increase, the UN International Atomic Energy Agency (2012) presents safety data documenting that the operational level of nuclear power plant safety around the world “remains high” despite public debate and opposition in several countries. By having students rate the degree to which they considered climate change to be anthropogenic, we thus assessed how well their attitudes accorded with scientific consensus on the issue. However, by asking them to rate the degree to which they considered nuclear power plants to be generally high risk, we assessed the strength of attitudes that were not supported by scientific evidence. Of note is also that nuclear power plants are not in use in Norway, making it likely that our participants would be less personally involved in that issue than in the issue of climate change, which is highly pertinent in northerly regions of the world.

In summary, we addressed the following questions:

1. To what extent can students' personal interest in and their knowledge about nuclear power, independently and interactively, predict their attitudes towards nuclear power plant risk?
2. To what extent can students' personal interest in and their knowledge about climate change, independently and interactively, predict their attitudes towards human-induced climate change?

Regarding the first question, we expected that topic knowledge would negatively predict attitudes not supported by scientific evidence, with the role of personal interest being less pronounced in this context because students would not consider this issue very relevant given the lack of nuclear power plants in the country. However, we also expected that the relationship between students' personal interest and their attitudes would depend on their level of topic knowledge, with a stronger relationship observed at lower than at higher levels of topic knowledge.

<sup>1</sup> Alternatively, less enduring attitudes that are unlikely to predict behavior are formed through a “peripheral” route involving less engagement and elaboration.

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