

# A plausible connection: Models examining the relations between evaluation, plausibility, and the refutation text effect



Doug Lombardi <sup>a,\*</sup>, Robert W. Danielson <sup>b</sup>, Neil Young <sup>c</sup>

<sup>a</sup> Temple University, United States

<sup>b</sup> University of Southern California, United States

<sup>c</sup> University of California, Irvine, United States

## ARTICLE INFO

### Article history:

Received 14 October 2015

Received in revised form

28 January 2016

Accepted 22 March 2016

Available online 31 March 2016

### Keywords:

Critical thinking

Evaluation

Plausibility

Refutation text

Conceptual change

## ABSTRACT

Students are often asked to make evaluations of scientific explanations, which may involve judgments about the plausibility of competing alternatives. We examined undergraduate students' critical evaluations and plausibility perceptions of climate change when reading two different types of text: expository and refutation. Our findings show that greater critical evaluation and higher plausibility related to more knowledge after reading, but only with the refutation text. Furthermore, we found that greater plausibility had a stronger effect on knowledge after reading the refutation text, whereas greater background knowledge had a stronger effect on knowledge after reading the expository text. We also examined changes in students' plausibility and knowledge. There was significant changes in plausibility and knowledge with the refutation text, but no significant change in either variable with the expository text. These results suggest that evaluations and judgments about plausibility may be factors contributing to the refutation effect and knowledge reconstruction.

© 2016 Elsevier Ltd. All rights reserved.

## 1. Introduction

Recent reform efforts call for students to engage in scientific practices to increase their understanding and literacy in science (National Research Council, 2012). One such practice is the construction of scientific explanations. Scientists generate “plausible explanation[s] for an observed phenomenon that can predict what will happen in a given situation” (National Research Council, 2012, p. 67). The scientific community also compares the plausibility of alternative explanations when constructing scientific models and theories. However, with certain controversial and/or complex topics (e.g., climate change) scientists may generate explanations that seem implausible to students. In contrast, non-scientific explanations about such phenomena may seem more plausible than the scientific ones. This results in what Lombardi, Sinatra, and Nussbaum (2013a) call a “plausibility gap.”

Judgments about the plausibility of explanations may be associated with critical thinking. For example, Beyer (1995) notes that questioning the plausibility of explanations is one characteristic of skepticism, a disposition of good critical thinkers. Differentiating

between evidence that supports the truth of a claim, and theory that supports the plausibility of a claim (i.e., the claim's potential truthfulness; Lombardi, Nussbaum, & Sinatra, 2015), is also a characteristic of those that are developing critical thinking skills (Kuhn, 1999). By examining a theory's potential truthfulness, critical judgments about plausibility are inherently evaluative. Critical evaluations about the plausibility of explanations are also fundamentally linked to an individual's knowledge (Willingham, 2008), based on the presupposition that the plausibility is a tentative judgment and may contribute to knowledge revisions or reconstructions (Lombardi et al., 2015). Plausibility has also been theoretically implicated as an important factor in the process of conceptual change (see, for example, Chinn & Brewer, 1993; Dole & Sinatra, 1998; Kapon & diSessa, 2012; Posner, Strike, Hewson, & Gertzog, 1982), but until recently, almost no empirical research has validated the importance of plausibility in knowledge reconstruction (see, Lombardi et al., 2015, for a detailed review on plausibility in conceptual change).

Changing students' conceptions that are inconsistent with scientific understanding is notoriously difficult (Chi, 2005). Using refutation texts (i.e., texts that address and directly refute common misconceptions) is one instructional strategy that can promote conceptual change under certain situations (Sinatra & Broughton, 2011). Refutation texts have a structure that facilitates cognitive

\* Corresponding author. 1301 Cecil B, Moore Avenue, Department of Teaching & Learning, Ritter Hall, Room 450, Philadelphia, PA 19122, United States.

E-mail address: [doug.lombardi@temple.edu](mailto:doug.lombardi@temple.edu) (D. Lombardi).

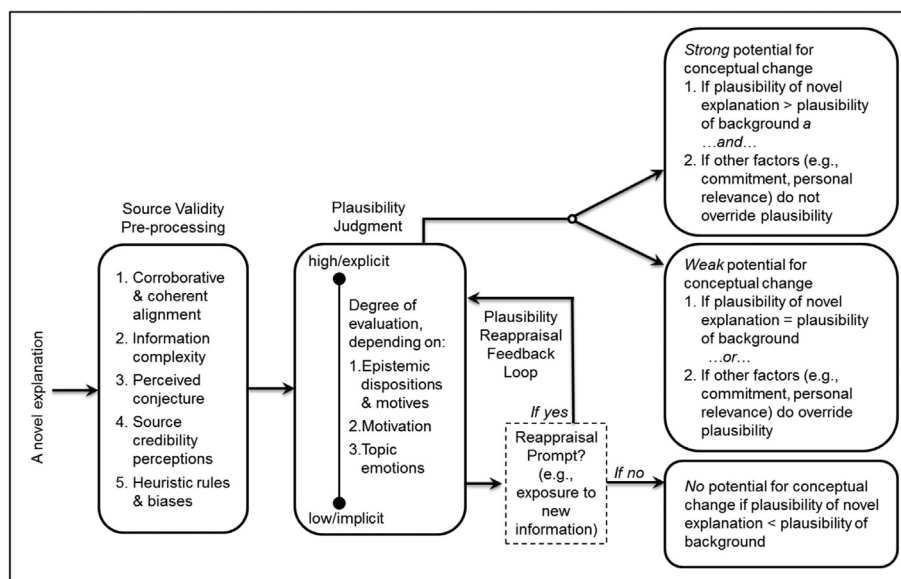


Fig. 1. A model of the role of plausibility judgments in conceptual change (PJCC). From Lombardi, Nussbaum, and Sinatra (2015), *Educational Psychologist*.

conflict and explicitly promotes one argument over another (Guzzetti, Snyder, Glass, & Gamas, 1993; Hynd, 2001). Kendeou and O'Brien (2014) have recently proposed that refutation texts may promote knowledge revision if the text strengthens a novel conception “through the building of integrated networks of information” in long-term memory, while simultaneously diminishing the “interference created by” a competing pre-existing conception (p. 360). This process aligns with the notion of reappraising plausibility (i.e., reconsidering previous judgments about plausibility when exposed to new information), where an idea achieves “enhanced epistemic status” because it is deemed more truthful due to increased perceived validity (Rescher, 1976, p. 117). A necessary, but not sufficient, condition for conceptual change is that the plausibility of the novel conception must be greater than that of the existing conception (Lombardi et al., 2015; Posner et al., 1982).

Lombardi et al. (2015) recently proposed a theoretical position on tentative epistemic judgments called the plausibility judgments in conceptual change (PJCC) model.<sup>1</sup> This theoretical model posited that initial judgments about plausibility might be reappraised through explicit and higher level evaluations (see Fig. 1 for a graphical schematic of the model, which shows how reappraisal of plausibility could elevate initial judgments from regimes of low/implicit evaluations to high/explicit evaluations). Reappraisal of plausibility, in turn, may be a component of knowledge reconstruction if the novel conception is now more plausible than the preexisting conception. Although one of many factors needed for knowledge reconstruction (Dole & Sinatra, 1998), plausibility may be particularly critical in situations where there is an appreciable gap in judgments of truthfulness between alternative conceptions (Lombardi et al., 2015).

The purpose of this study was to provide an empirical examination of Lombard et al.'s (2015) theoretical position by specifically looking at how students' level of evaluation related to perceptions of plausibility and understanding of climate change. We also examined how a refutation text—an instructional mode that may potentially

activate an ability to critically evaluate explanations—changed students' judgments about the plausibility and knowledge of climate change. This study is also motivated by the need to investigate a vastly underdeveloped research area that may have great importance to science education given the recent emphasis on including scientific practices in the classroom (National Research Council, 2012), as well as efforts to embed evaluative problem solving throughout the curriculum (e.g., as has been instituted in Finland; Darling-Hammond, 2010). Prior to discussing our methods and results, we first provide a brief overview of the extant literature on plausibility, critical evaluation, and refutation texts in order to provide an underlying justification for this study.

### 1.1. Plausibility

Students often consider non-scientific explanations more plausible than those tendered by scientists, especially for controversial topics (e.g., climate change; Lombardi et al., 2013a). Plausibility is a tentative epistemic judgment (Rescher, 1976) that may often be made implicitly through automatic cognitive evaluations (Hinze, Slaten, Horton, Jenkins, & Rapp, 2014). For example, reading comprehension studies have revealed relatively long reading times and eye fixations, as well as other automatic cognitive disruptions, are associated with implausible word combinations, sentences, and statements when compared to times with more plausible text (Isberner & Richter, 2013; Matsuki et al., 2011; Yang, Wang, Slattery, & Rayner, 2014). Long and Prat (2008) suggest that judgments about plausibility do not result from working memory limitations because individuals with both high and low working memory capacity had similar reading comprehension when explicitly instructed to evaluate the text information during reading. A recent study also shows that readers recalled implausible statements better than plausible ones (de Pereyra, Britt, Braasch, & Rouet, 2014). Likewise, in mathematics, a false estimation process based on implicit plausibility evaluations resulted in shorter verification times for multiplication problems with even–even and odd–odd product pairings (LeMaire & Fayol, 1995).

Judgments about plausibility may be made explicit through social and cultural practices, such as legal adjudication, scientific discourse, and classroom instruction. For example, Diakidoy and

<sup>1</sup> A preliminary version of this model appeared in Lombardi et al. (2013a). The updated model contains a major reconceptualization of the feedback loop where plausibility may be reappraised and how reappraisal is impacted by evaluations that may be critical, both of which are central constructs in the present study.

Download English Version:

<https://daneshyari.com/en/article/365474>

Download Persian Version:

<https://daneshyari.com/article/365474>

[Daneshyari.com](https://daneshyari.com)