

Can reasoning make you humble? Experimental tests to improve intellectual humility

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Abstract

In the present study, we tested whether inducing people to reflect on their knowledge may increase their intellectual humility. We hypothesized that asking participants to answer knowledge tests would prompt them to recalibrate their perception of their own knowledge, thereby fostering intellectual humility. Study 1 demonstrated a significant increase in intellectual humility following the intervention, whereas Study 2 replicated and extended these findings in a larger sample, confirming the effect despite its small magnitude. The observed increase may be due to the activation of analytical reasoning style or to the acknowledgement of one's knowledge limitations. However, further research is needed to corroborate these conjectures and explore the long-term effects of interventions to enhance intellectual humility.

Keywords: metacognition; intellectual humility; knowledge

Introduction

We often trust our knowledge more than we should. We think we understand more things than we actually do, and we are more certain about them than we should be. This excess of self-confidence about one's knowledge or understanding, sometimes called the "illusion of knowledge," is a common bias with far-reaching implications (Rozenblit et al., 2002). Indeed, numerous studies have demonstrated a systematic bias whereby individuals subjectively evaluate their knowledge as more accurate or complete than it objectively is, often without being aware of it (e.g., Glenberg et al., 1982; Lackner et al., 2022; Canady et al., 2023). These subjective assessments lead to miscalibration errors, typically resulting in an overestimation of one's own abilities. For example, individuals with low health literacy have been found to report the same or higher levels of confidence in their health knowledge than individuals with higher health literacy (Canady et al., 2023). Similarly, in an empirical study of text comprehension, participants overestimated their actual performance, and failed to identify textual inconsistencies even when explicitly instructed to do so (Glenberg et al., 1982).

These findings highlight a general imperfection in our metacognition: the relationship between what we know and

what we think we know is often weak or distorted. Recognizing these misperceptions, and the resulting calibration errors in our internal representation of accuracy, is crucial (Lackner et al., 2022). Indeed, such discrepancies can have far-reaching and harmful consequences, both for individuals and for society as a whole. Overestimating or underestimating one's competence can impair decision-making processes (Dunning & Kruger, 1999; Kahneman, 2011). Moreover, being unaware of one's own ignorance contributes to the spread of misinformation, with significant implications for policy-making (Lewandowsky et al., 2012), as well as to interpersonal conflicts resulting from an inability to accept opposing viewpoints (Fernbach et al., 2013).

For the above reasons, much attention has been paid to how to reduce the illusion of knowledge effect by fostering the ability to self-reflect, reconsider one's perspective, and recognize the shortcomings and potential limitations of one's point of view (e.g., Porter & Schumann, 2018). Interestingly, these qualities are integral to what is known as intellectual humility (IH), which, if expressed at the right moment and to the proper extent, is considered a virtue (Grossmann et al., 2020). Intellectual humility, defined as recognizing the limits of one's knowledge, is a general disposition associated with openness to dialogue, trust-building, receptiveness to feedback, questioning (Gagneur, 2020), and promoting respectful debate (Porter & Schumann, 2018).

Research has demonstrated that IH has a significant positive correlation with various indicators of cognitive and intellectual accuracy. These indicators include cognitive flexibility (e.g., Zmigrod et al., 2019), cognitive reflection (e.g., Krumrei-Mancuso et al., 2020), intelligence (e.g., Bowes et al., 2022; Zmigrod et al., 2019), and scientific literacy (e.g., Bowes et al., 2022). Furthermore, intellectually humble individuals are less inclined to assert knowledge of non-existent topics (Alfano et al., 2018; Krumrei-Mancuso et al., 2020). These individuals also tend to perform more accurately on critical thinking measures, while exhibiting lower tendencies to overestimate or overclaim their knowledge (Bowes et al., 2022). Behaviors such as admitting uncertainty, acknowledging intellectual mistakes, and avoiding overly confident statements have all been used as indicators of IH (Krumrei-Mancuso et al., 2024).

Research also suggests that IH may be crucial in enabling individuals to make well-informed decisions. For instance,

intellectually humbler individuals are better at distinguishing between robust and weak arguments, even when the conclusions of such arguments contradict their preconceived notions (Porter et al., 2020). Another noteworthy finding is that IH seems to be negatively correlated with anti-vaccination attitudes. This relationship appears to be largely driven by a willingness to revise one's viewpoint and a lack of intellectual overconfidence (Senger et al., 2021).

Given the potential benefits of IH, numerous studies have investigated strategies to cultivate this virtue (Whitcomb et al., 2017). Research indicates that IH can vary across individuals and contexts, thereby offering opportunities for targeted interventions. For instance, techniques such as guided reflection, structured writing or reading exercises, and educational approaches (e.g., Meagher et al., 2019; Anderson et al., 2021) have shown promise in fostering IH. Also adopting a more distanced perspective during reflective practices has been associated with temporary increases in IH (Kross et al., 2012). However, existing IH interventions (e.g., reflective writing, perspective-taking) often lack scalability due to time-intensive protocols (Porter et al., 2021). In comparison, interventions based on knowledge calibration (having participants reflecting on the limits of their own knowledge) appear as a much, but empirically validated, alternative. Still, knowledge calibration remains largely underexplored as a way of promoting IH. This motivates the present research.

Our study focuses on the relationship between intellectual humility and knowledge perception. We hypothesize that exposure to objective knowledge tests will (a) reduce self-reported certainty and (b) increase scores on validated IH measures, consistent with metacognitive recalibration (Koriat, 2000). The general idea is that encouraging people to reflect on their own knowledge and its limits may boost their IH. In order to test this hypothesis, a simple protocol is employed, whereby the participants' IH is measured both before and after they answer a knowledge test. The present approach is inspired by the seminal work of Rozenblit and Keil (2002), who developed a multi-step method to evaluate knowledge calibration. One of the steps involved answering a knowledge question, which was followed by a decrease in participants' self-assessed knowledge.

In our study, participants are asked about a number of topics varying in degrees of self-involvement (see below for details). For each topic, we implemented a set of ten closed-ended questions. To test our central hypothesis, we ran two experiments, measuring levels of IH both before and after administering knowledge tests, and compared them. We expected to find higher levels of IH after than before the treatment.

Pre-test study for treatment calibration

For all the topics, we created a scale of ten questions to test participants' knowledge of each topic. The set of ten questions derived from an original list of about 20 questions

per topic, taken and adapted from the literature or based on online scientific and news materials.

The original list of questions was administered to a sample ($n = 100$) of participants recruited on the online platform Prolific. The sample consisted of Italian respondents and was balanced for gender. For each statement, participants could select an option among True / False / I don't know.

The ability of respondents to answer the questions informed the final selection of items. For each topic, we first identified the questions with a high discrimination index, that is, those items that were often correctly answered by the best-performing participants (the top 27%), and, at the same time, often missed by the worse-performing participants (the bottom 27%). When the discrimination index was comparable among items, qualitative considerations guided the final choice, for example: proportion of true and false statements, similarities among items, proportions of correct answers, and so on.

The resulting knowledge tests are available [here](#).

Methods – Study 1

The goal of this study was to test whether the participants' IH increased after answering knowledge questions.

Participants. A total of 260 volunteer participants (mean age = 28.9, $sd = 8.8$; 153 females) were recruited through social networking sites, survey exchange platforms, and word-of-mouth. Participants did not receive any compensation for their participation in the study. The only exclusion criterion was fluency in English, as the study required participants to comprehend and respond to the questions in English.

Procedure. The survey was conducted using Qualtrics, and organized in a single session, with participants assessed in their IH immediately before and after the knowledge tests. The total duration of the experiment was below 5 minutes.

Materials. To assess IH, we employed the scale developed by Leary et al. (2017), a six-item unidimensional tool that measures the extent to which people recognize the fallibility of their beliefs without reference to particular subjects or domains. Participants answered the questions using a 5-point likert scale from 1 "Strongly disagree" to 5 "Strongly agree". The scale has good internal consistency (Cronbach's $\alpha = 0.82$).

For the treatment, we employed the ad-hoc knowledge tests mentioned above.

Results – Study 1

Since the test for normality assumption yielded significant results, a non-parametric statistical approach was used. A Wilcoxon signed-rank test was performed to compare the pre- vs post-assessments of IH. The results were significantly different ($p < .001$), and the statistics are summarized in table 1 below.

Table 1. Test statistics for study 1. The pre column refers to the mean IH assessment before treatment, whereas the post column depicts the average IH assessed afterwards.

Intellectual Humility		Test	Test statistics	p
Mean (sd)				
Pre	Post	Student	-3.565	<.001
4.098(0.56)	4.176(0.60)	Wilcoxon	-4.298	<.001

The first study provided support for our hypothesis by demonstrating a small but significant increase in intellectual humility after the knowledge test. However, the study had a significant limitation: it was conducted in a single session, making the results susceptible to demand effects. To address this limitation, we conducted a second study with a larger sample size to replicate and extend the findings.

Methods – Study 2

The goal of this study was both to replicate the results of Study 1 with a larger sample of participants and with a richer set of knowledge tests, and to check how a two-week span between the first and the second assessment of IH modulates the increase in IH.

Participants. A total of 828 participants (mean age = 48.5, *sd* = 15) took part in our study. The sample was a representative Italian panel recruited through Bilendi, an online labor market platform. The only requirement to participate in the study was to be an Italian native speaker above 18 years old. Participants were remunerated according to Bilendi’s guidelines for online studies.

Procedure. The procedure of Study 2 was consistent with Study 1, with the addition of a few topics and two weeks between the first and the second assessment. The test-treatment was administered during the second session.

Materials. To measure participants’ IH, the authors first implemented an Italian translation and adaptation of the general IH scale by Leary (2017). The translation demonstrated good internal consistency (Cronbach’s α = 0.857, CI [8.44; 8.70]), in line with the original version. For Study 2, we used a different response Likert scale, ranging from 0 to 100. The choice was made to capture greater nuance and sensitivity in participants’ responses, allowing for a more detailed measurement of intellectual humility.

The treatment was the same as Study 1, with a slightly different list of topics – climate change, evolution abortion, anxietytics, I Promessi Sposi, and feline immunodeficiency - each accompanied by a corresponding knowledge test. The addition of topics lengthened the intervention, while keeping the entire session under five minutes.

Results – Study 2

As for study 1, a non-parametric test was employed due to the non-normal distribution of the data. The results are reported in Table 2 below.

Table 2. Test statistics for study 2.

Intellectual Humility		Test	Test statistics	p
Mean (sd)				
Pre	Post	Student	-2.311	0.011
71.1(14.9)	72.2(14.7)	Wilcoxon	-2.747	0.003

Similarly to the previous study, we detected a significant increase in IH from the pre- and post-assessment, a result that confirmed both the results of Study 1 and our main experimental hypothesis.

Discussion

Intellectual humility, defined as recognizing the limits of one’s knowledge and an openness to new evidence, is closely linked to metacognition and the accuracy of self-perceptions of knowledge and understanding (Porter et al., 2022).

Building on evidence that individuals systematically overestimate their knowledge (e.g., Glenberg et al., 1982; Canady et al., 2023), we hypothesized that confronting participants with objective knowledge tests would (a) reduce subjective overconfidence and (b) promote more accurate self-appraisal, thereby fostering intellectual humility (IH).

In practical terms, we assumed that asking participants to answer knowledge tests would prompt them to recalibrate their perception of their knowledge, forcing them to confront its limitations. We hypothesized that this process would lead to an increase in their IH.

Across two studies, we confirmed this hypothesis. In Study 1, we measured a significant increase in IH following the knowledge test, establishing proof of concept for our protocol. More importantly, Study 2 replicated and extended these findings in a larger, more representative sample while addressing some of the methodological limitations of Study 1. In particular, we used an enriched set of knowledge tests and introduced a two-week interval between the two assessments of IH. The consistent findings in both studies suggest the existence of a replicable effect, albeit with a small effect size.

There are at least two possible mechanisms to explain this effect, one not excluding the other. First, the mere act of answering knowledge questions prompts participants to activate their analytical and reflective thinking, thereby reducing the automatic use of heuristics, which are often employed when asked to evaluate one’s knowledge (Koriat, 2000). Second, the scrutiny of information retrieved from

memory in order to answer knowledge questions inevitably confronts participants with the limits of their knowledge. This confrontation aligns with the definition of intellectual humility, which involves the awareness of the limits of one's knowledge (Hoyle et al., 2016). However, these two possible interpretations of the findings remain speculative, as the present studies did not directly measure the underlying processes purportedly responsible for the effect. Future research should seek to explore such psychological mechanisms.

While our studies demonstrate short-term effects, the longevity of these gains remains untested. Prior research on related interventions, such as reflective diary exercises (Grossman et al., 2021) or studies debiasing the illusion of understanding (Fernbach et al., 2013), suggests that sustaining improvements may require repeated or reinforced interventions. Longitudinal design with follow-up assessments are needed to evaluate whether IH gains persist and whether repeated exposure yields cumulative benefits.

In consideration of the well-documented associations between IH and improved reasoning, open-mindedness, and reduced susceptibility to misinformation (Bowes & Tasimi, 2022; Krumrei-Mancuso et al., 2020), our findings emphasise how simple interventions such as knowledge calibration could promote these epistemic virtues. These are critical for both individual decision-making and societal discourse in an era of increasing polarization and misinformation

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