RESEARCH ARTICLE

Using a Reconciliation Module to Change Minds about COVID-19

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ABSTRACT

Scientific skepticism surrounding COVID-19 precautionary behaviors was a leading controversy during the pandemic. A reconciliation module has been shown to help individuals accept scientific data while still maintaining core beliefs. This module, commonly used in evolution education research, consists of taking measures to reduce conflict, emphasize the nature of science, and teach students the facts. The aim of this research was to evaluate the impact of this module on college students' willingness to follow COVID-19 precautions in order to increase the awareness and implementation of these behaviors. We created a reconciliation module consisting of videos made by local community members. This module was then incorporated into a survey, where participants indicated if they changed their minds from the videos, and if they found the presenter respectful or relatable. There were also open-ended questions where students were able to expand on their responses. We found that the most indicative reason why students changed their view on the controversy of COVID-19 was that the presenter communicated new information to the student that they did not previously know, or cleared up something they did not understand. Investigating if presenters were relatable or not, the most common response was that the presenter was relatable due to a shared ideology between the presenter and student. Given the results, we propose that helping students understand scientific information is a key step in addressing controversial topics in science. However, this information is most influential when the instructor is perceived to be relatable. We discuss how instructors can apply these findings to help students whose cultural background differs from their own.

Introduction

Many people are skeptical of following COVID-19 precautionary behaviors. During the pandemic, following COVID-19 guidelines (e.g., mask-wearing, social distancing, obtaining a vaccination) became extremely politicized. This often led to a distrust of scientific and health recommendations from experts.[1–3] Despite many convincing scientific benefits, there was much controversy surrounding these recommendations.[4]

For instance, in a global study on vaccination acceptance rates, the US had the 2nd lowest acceptance at 56.9%.[5] Vaccine hesitancy, defined by the SAGE group as delay in acceptance or refusal of vaccination despite the availability of services, was reported as one of the most prevalent roadblocks in accepting precautionary behaviors.[6] A study indicated that vaccine hesitancy is caused by three major factors: confidence, complacency, and convenience. Vaccine convenience is defined as hesitancy because of perceived constraints to access vaccination services, while vaccine complacency is hesitancy because of a low perceived utility of the vaccine.[7] Hesitancy due to vaccine confidence is defined as lack of trust in the healthcare system and the scientific community as a whole. Another 2020 study showed that vaccine acceptance was positively correlated with a greater perceived impact of the COVID-19 pandemic, however, knowledge of vaccines and immunity and the number of people who respondents knew with COVID-19 were not correlated with increased vaccine acceptance, thus reaffirming the hesitancy regarding the COVID-19 vaccine as a whole.[8]

Other controversial precautionary behaviors include social self-isolation and government mandated business restrictions (social distancing,[9] business closures,[10] and school closures[11]). While these guidelines helped reduce transmission, studies showed that increased isolation could have negative psychological consequences.[12] Many people also held economic concerns regarding the government-mandated closing of non-essential businesses.[13] While much of the COVID-19 controversy was due to the social and economical implications of precautionary behaviors, this study will focus on increasing scientific confidence among the general public.

One hypothesized method to help individuals overcome scientific skepticism regarding COVID-19 is a reconciliation module. In teaching evolution, another science topic that garners skepticism, the reconciliation module for evolution acceptance (RECOEVO) has been shown to help individuals reconcile their religious beliefs with scientific data.[14] This research described the reconciliation module as an approach that emphasizes the nature of science, and offers students a way to accept scientific data on evolution while maintaining core religious beliefs, thus overcoming science skepticism. We hypothesize that this method may be transferable to other controversial topics.

Models similar to the RECOEVO module have been used to educate the public on other controversial healthcare and science topics. A relevant study looked at the acceptance of climate change. In this research, it was found that increasing a student's scientific reasoning ability helped students gain a deeper knowledge of scientific topics, and was able to "help students think more critically about new information."[15(p140)] Additionally, it was found that presenting climate change visually and explaining the scientific mechanisms of climate change increased acceptance.

Another study looked at individuals' willingness to become organ donors. Following the study, it was found that the format in which the story was presented significantly affected whether the participants were willing to register as a donor or not. Furthermore, individuals were more willing to change public policy regarding organ donation when the information was presented with a certain emphasis. These data showed that the manner of presentation can have a great effect on the acceptance of controversial topics.[16]

By understanding the models used in these studies to reconcile controversial topics, we learn important implications regarding willingness to follow COVID-19 precautionary measures. In research done by Chan et al., individuals have different types of motivation when it comes to adhering to precautionary COVID-19 guidelines.[17] Individuals who are driven by controlled motivation (including things such as external contingencies or internal pressures) are less likely to follow precautionary COVID-19 guidelines compared to those driven by autonomous benefit (i.e. for their own interest or satisfaction). Other studies suggested that individuals with higher concern about the pandemic were correlated with higher adoption of precautionary behaviors.[18,19] Another illustrated that participants who believed that there was a conspiracy behind COVID-19 or did not trust any source of information on COVID-19 vaccines, were less likely to accept them.[20]

This research is a follow-up on previous research done to assess factors influencing college students' willingness to follow COVID-19 precautionary behaviors. Using an SEM model, the two factors that most influenced students' willingness to follow COVID-19 precautionary behaviors were

exposure to news and concern with the severity of COVID-19.[21]

Unwillingness to accept precautionary behaviors leads to increased transmission and death rates.[18] Additionally, proper implementation of precautionary behaviors has been hypothesized to save $5.2 trillion.[22] Therefore, understanding students' behavioral and psychological willingness to follow scientific recommendations could provide useful information to policymakers, enabling the planning of educational interventions, reducing costs, and effectively curbing the outbreak.

Methods
Population
Our sample population consisted of students in an introductory biology course for nonmajors at a large private institution in the Western United States during the Winter semester of 2021 (n=266). This population was chosen for two reasons: first, it was readily available population (i.e., convenience sampling); and second, more importantly, this population represents a highly-conservative Christian population that we would expect to demonstrate significant resistance against COVID-19 precautionary behaviors. Additionally, they are a highly homogenous group (thus eliminating some confounding variables) that shared an "in group" with the video presenters in the module. Although students were not asked about their religious affiliation, the institution is affiliated with and sponsored by a particular Christian church, with 98% of the student body identifying as members of this religion.

Reconciliation module
Students were given a module with six different videos regarding the COVID-19 pandemic, which are outlined below. The video structure was informed by the reconciliation module, a theoretical framework used in evolution acceptance among religious student bodies, meaning that efforts were actively implemented to address student concerns and offer solutions in a reconciliatory way. This module consists of multiple components, including taking measures to reduce conflict, emphasizing the nature of science, and teaching students the facts.[14] We recruited several experts to create videos that incorporated these various components. Our goal was to measure the influence our module had on students' views on COVID-19 precautionary behaviors, including masking, social distancing, and vaccination, and what caused students to change their attitudes. The videos were then incorporated into a survey, with questions after each video. The survey was part of a class assignment and was implemented using the Qualtrics(R) survey platform.

Videos in the reconciliation module
The presenters in the videos were from the local community, all of which shared the same religious affiliation with the majority of the student participants at the institution.

Video 1: A science professor explained the nature of science and the scientific process including how scientific research is carried out.
Video 2: A theology professor shared their thoughts as a religious individual about the influence of religion on science, specifically how there is no conflict between the teachings of the religion the university is associated with and the COVID-19 guidelines.
Video 3: A science professor shared statistics about COVID-19 deaths, and how to interpret these statistics.
Video 4: A science professor explained how mRNA vaccines work as a whole as well as specifically the COVID-19 vaccine.
Video 5: An ICU nurse shared their experience working in a hospital overflowing with COVID-19 patients, and how they were slowly running low on resources.
Video 6: Four undergraduate students shared their experiences of how the COVID-19 pandemic affected their lives, including the death of loved ones, and both positive and negative responses to the COVID-19 guidelines.

After each video, students responded to a series of questions including the questions related to this research project listed below. Questions 1,3 and 5 were on a 5-point Likert scale, while questions 2,4, and 6 were open answer.
1. This video changed my mind and attitude about COVID-19.
2. If this video did change your mind, or any of your attitudes about COVID-19, why did it do so? If not, why not?
3. I felt like I could relate to [name of presenter].
4. Please explain why you could, or could not, relate to [name of presenter].
5. I felt like [name of presenter] was respectful to me in the way they shared their information.
6. Please share why you thought [name of presenter] was respectful, disrespectful, or neither in the way they shared their information.

Students had the option of leaving any of these questions unanswered.

Thematic coding

After all data was collected, we thematically coded, using inductive reasoning, questions 2, 4 and 6, which were open answer. The first question we coded was question 2: "If this video did change your mind, or any of your attitudes about COVID-19, why did it do so? If not, why not?" We only coded the responses where participants had previously answered "agree" or "strongly agree" that the video changed their minds about COVID-19 (question 1). This allowed us to identify reasons why participants changed their minds; thus, we did not code responses where participants disagreed or were neutral to the video changing their minds. For the first 20 responses, four separate coders came up with themes that emerged and we then reconvened and came to a consensus on the themes. We then coded another 20 responses separately and calculated interrater reliability. Our initial interrater reliability was 67.46%, so the four coders reconvened and modified the rubric. Approximately 20 more responses were coded and the interrater reliability was then 85.77%. The rest of the responses were then split and coded individually.

Next, rubrics were created for the responses to the questions; "Please explain why you could, or could not, relate to [name of presenter]" (question 4) and "Please share why you thought [name of presenter] was respectful, disrespectful, or neither in the way they shared their information" (question 6). The same processes as above were done for these two questions, with interrater reliabilities of 86.36% and 91.66%, respectively.

Results
Changing minds about COVID-19

When combining all survey responses from all participants in all six videos, 356 out of 1364

responses (26.1%) indicated that the video changed their mind about COVID-19 ("agree" or "strongly agree" on question 1). 232 responses were left blank and thus were not included in the total number of responses. Out of the 356 responses, 191 responded to question 2 asking why the video changed their mind, and thus could be thematically coded.

It was evident that from the responses we coded, 49.7% of students changed their minds because they learned new information or cleared up misconceptions (these two ideas were thematically coded into one category due to overlap). This indicates that the most indicative reason why students changed their view on COVID-19 precautionary behaviors was that the presenter communicated new information to the student that they did not previously know, or cleared up something they did not understand. The next most common reason for participants changing their minds was realizing COVID-19's seriousness (22.5%), followed by participants gaining confidence in current beliefs (8.4%).

For video 2, which consisted of a theology professor sharing about how the COVID-19 guidelines are not in conflict with the dominant religion of the institution, two separate thematic categories were created just for responses for this video. These included first, that participants acknowledged that they have a religious obligation to follow the COVID-19 guidelines, and second, that participants recognized that religious leaders affirmed their viewpoint. Out of all responses coded for this video, 44.8% and 27.6% were coded into these two categories, respectively.

There were also 8.4% of responses that we could not thematically code into any categories and were thus categorized as "other".

Table 1. The percentage of responses thematically coded into each category for reasons participants changed their minds based on each video.

Thematic code	Learned new information	Gained Confidence in current beliefs	Realized COVID-19's seriousness	Religious obligation	Religious leaders affirmed viewpoint	Other
Video 1	56.7% (17/30)	13.3% (4/30)	16.7% (5/30)	N/A	N/A	13.3% (4/30)
Video 2	6.9% (2/29)	13.8% (4/29)	3.4% (1/29)	44.8% (13/29)	27.6% (8/29)	3.4% (1/29)
Video 3	73.3% (22/30)	3.3% (1/30)	23.3% (7/30)	N/A	N/A	0%
Video 4	82.2% (37/45)	8.9% (4/45)	0%	N/A	N/A	8.9% (4/45)
Video 5	28.9% (13/45)	2.2% (1/45)	62.2% (28/45)	N/A	N/A	6.7% (3/45)
Video 6	33.3% (4/12)	16.7% (2/12)	16.7% (2/12)	N/A	N/A	33.3% (4/12)
Total	49.7% (95/191)	8.4% (16/191)	22.5% (43/191)	6.8% (13/191)	4.2% (8/191)	8.4% (16/191)

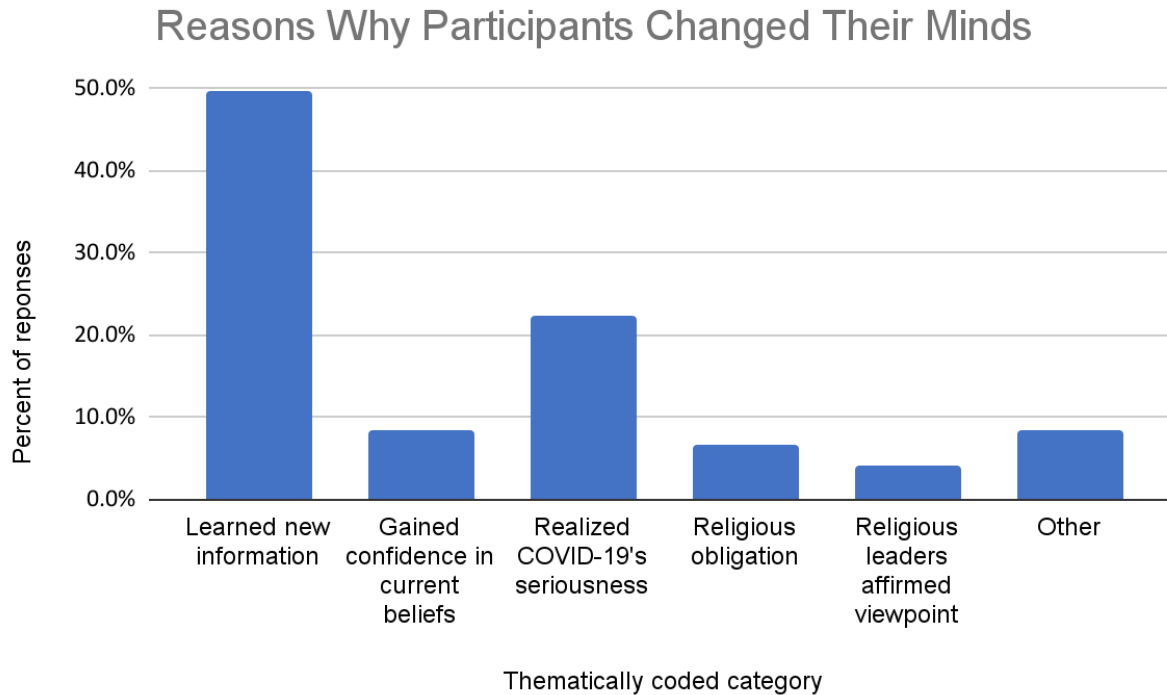## Reasons Why Participants Changed Their Minds

Figure 1. Bar graph comparing the most prevalent thematically coded reasons why participants changed their minds about COVID-19 precautionary behaviors

Changing minds through relatability

Within those students who reported that their minds were changed, we assessed reasons that students found the presenter relatable/unrelatable (question 4). We coded a total of 123 responses. We omitted 23 neutral responses, as we wanted to find reasons why or why not participants found the presenter relatable, and thus "neutral" indicates the participant does not feel one way or another. 95.9% of responses indicated that the presenter was relatable. It was found that shared experience or ideology was the leading cause of relatability in all videos but video 5, with 42.3% of respondents indicating this (see Table 2). Video 5 was of a nurse sharing her experience working in overcrowded hospitals due to COVID-19. Additionally, 29.3% of all responses indicated the participant liked the presenter's personality, 14.6% indicated the presenter was easy to understand, and 4.1% indicated they trusted the credentials of the presenter. 5.7% of responses could not be coded into any category. A small percentage (4.1%) reported that they found the presenter unrelatable due to disliking the presenter's personality (0.8%) and not having a shared experience or ideology (3.3%).

Table 2. The percentage of responses thematically coded into each category for reasons participants found presenters relatable (or not relatable) based on each video.

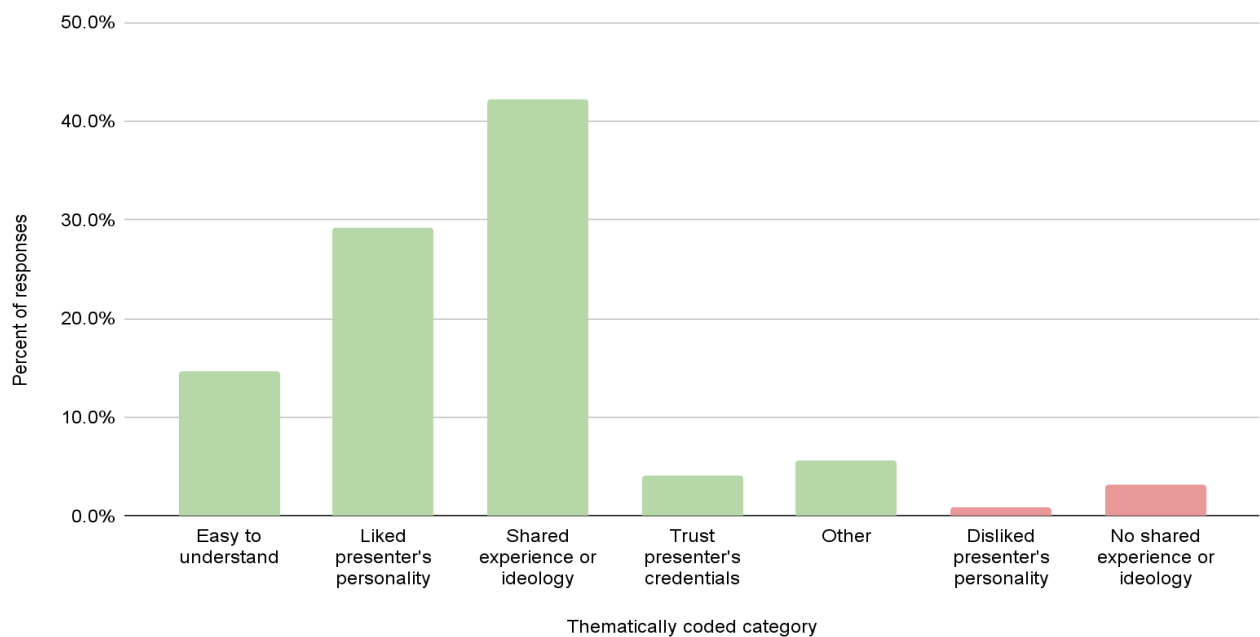| Thematic Code	Relatable					Not Relatable	
	Easy to understand	Liked presenter's personality	Shared experience or ideology	Trust presenter's credentials	Other	Disliked presenter's personality	No shared experience or ideology
Video 1	23.8 % (5/21)	33.3% (7/21)	38.1% (8/21)	0%	4.8 % (1/21)	0%	0%
Video 2	18.2% (4/22)	36.4% (8/22)	45.5% (10/22)	0%	0%	0%	0%
Video 3	21.4% (3/14)	21.4% (3/14)	50.0% (7/14)	0%	0%	7.1% (1/14)	0%
Video 4	26.1% (6/23)	21.7% (5/23)	30.4% (7/23)	13.0% (3/23)	4.3% (1/23)	0%	4.3% (1/23)
Video 5	0%	38.7% (12/31)	32.3% (10/31)	6.5% (2/31)	12.9% (4/31)	0%	9.7% (3/31)
Video 6	0%	8.3% (1/12)	83.3% (10/12)	0%	8.3% (1/12)	0%	0%
Total	14.6% (18/123)	29.3% (36/123)	42.3% (52/123)	4.1% (5/123)	5.7% (7/123)	0.8% (1/123)	3.3% (4/123)

Figure 2. Bar graph comparing thematically coded reasons whether or not participants who changed their minds found the presenters relatable. Green represents relatable responses while red represents unrelatable responses.

Respect

For the students that changed their minds about COVID-19, we also assessed if they viewed the presenter as respectful. The overwhelming majority of students responded "agree" or "strongly agree" that the presenter was respectful (94.8%), with 43.9% stating it was because of the personality/demeanor of the presenter in the video. We decided to not focus on this finding.

Discussion

In this study, we were able to identify several different aspects that, when incorporated into teaching, made students more open to accepting scientific discoveries—even if those discoveries seem to contradict their initial beliefs. While focused specifically on COVID-19, our findings can likely at least inform the teaching of other controversial science topics.

One of the key takeaways from our research was the persuasive power of new information. As seen in the results, the most common reason students gave for changing their minds was new information presented in the video lectures. Students reported that the new information helped to clear up misconceptions and shift their opinions. This finding is especially surprising in an atmosphere of current research that has demonstrated the prevalence of identity-protective cognition.[23] When individuals demonstrate identity-protective cognition, they avoid and ignore information that contradicts the general opinion of their group. As a result of this practice, we would have expected that scientific information in conflict with the students' current beliefs should have had little impact on their future opinions, even when shared persuasively. By stark contrast to the expected results, the findings presented in this study demonstrate the power this conflicting information had to change student's beliefs.

One possibility is that the persuasive power of scientific information is amplified by the teacher's perceived in-group status, that is, the culture or identity they share with the students. While research has found that students respect teachers who help them understand information,[24] this understanding is only a first step in the process of acceptance. The vast majority of students and faculty at this institution, including those who presented the videos in this study, are members of the same religious group as students. This shared identity likely contributed to the high levels of presenter relatability reported by students, and made them more open to the information that was shared. Students likely believed the instructors to be part of a perceived in-group and, as a result, were open to the information that ultimately shifted their opinions. We propose that while helping students understand scientific information is key, this information is most persuasive when instructors are considered part of the in-group.

This proposal is supported by the second finding from our results, which is that the majority of the students who changed their minds reported that the presenter was relatable. The students explained that the presenter was relatable because they seemed to have a shared experience or ideology. In a 2014 article, it was found that "shared experiences become signifiers of shared ideology, allowing the researcher to encompass a privileged position of trust as an ally in a perceived struggle" (p.4).[25] These findings are in line with other current research that has shown positive role models are an important part of helping students change their minds and accept other controversial biological concepts, like evolution.[26,27] Students have stated that professors who demonstrate their own ability to reconcile help students to reconcile their own religiosity with evolution. These students found their professors to be relatable examples to follow in reconciliation.[26] These students, similarly to the students in our study, benefited from being witnesses to an example of a member of their in-group accepting the new information that may contradict their previous beliefs.

While the research suggests that teacher relatability and in-group status have overwhelming advantages when addressing controversial science topics, we recognize that many teachers do not share a cultural or religious identity with their students. For example, while many undergraduate students and the majority of the public are religious, most biologists are not.[28–30] How can these instructors apply the findings of this study? Even when not part of an inherent shared identity, teachers can decrease conflict, improve relatability, and increase acceptance of controversial science topics by applying the principles of cultural competence. These principles have been supported by several researchers and discussed in many contexts.[30–33]

Cultural Competence has been shown to be effective in helping religious students accept evolution when taught by teachers with secular cultural identities. In their research, Barnes and Brownell explain, "the foundation of a culturally competent teaching approach is to create an inclusive teaching environment for all students in any setting" (p.6).[30] Teachers can strive to create an inclusive setting through a variety of different means. First, they can acknowledge and validate that students may experience a feeling of conflict between their personal beliefs and the information

being presented.[30] This creates a space in the classroom for students who are working through reconciliation. Additionally, if the teacher does not model reconciliation for their students because of cultural differences between the teacher and the learners, the teacher can provide other role models for the students[30]. These role models can be introduced as a guest speaker or through learning about the stories of other scientists through various media sources. Educators can also create an inclusive environment for all learners through designing culturally relevant pedagogy. Culturally relevant pedagogy and cultural competence work together to support diverse learners, because culturally relevant pedagogy is designed to value cultural knowledge and worldviews of all students.[34]

We expect that students across the world will be better equipped to handle controversial topics in science as the principles discussed in this study are extended and applied to other contexts. Such contexts could include especially diverse classrooms and large-scale online learning. Further research should also investigate how the findings and practices discussed in this paper can be applied to additional topics such as climate change, alternative energy sources, and genetically modified organisms.

Conclusion

Our results show that the most influential factor in changing individuals' attitudes toward COVID-19 was learning new information, which included clearing up misconceptions. Although this differs from previous research, we believe it may be due to in-group influence, as our presenters in the reconciliation module shared many similar identities to the majority of the student participants.

Our results also showed that of the students who were influenced, the majority of them found the presenter relatable because of a shared ideology. This is consistent with current research, as individuals view those with shared ideologies as someone they can trust, and are more likely to be influenced by them.

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