Increasing Mental Resistance to the Influence of COVID-19 Conspiracy Theories

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Abstract

During the COVID-19 pandemic, many conspiracy theories were spread about the origins and health-risks of the virus, especially among social media. Beliefs in these theories not only inhibit effective risk communication but also have negative health and interpersonal consequences which complicate the fight against the pandemic. Therefore, this study tried to investigate whether an intervention could increase mental resistance towards these theories among students from Dutch universities between the age of 18 to 29. The 81 participants (N = 81) in this study were randomly allocated to either the experimental (N = 32) or control group (N = 49). Both groups received an intervention combining psychological inoculation and self-persuasion and a questionnaire, yet in different order to measure the effect of the intervention. Moreover, students were asked to evaluate the intervention. Findings reveal a difference in conspiracy beliefs among both conditions with students in the experimental condition believing less in conspiracy theories than students in the control condition. Furthermore, neither students' perceived threat, nor their attitudes towards COVID-19 policies and towards conspiracy theories in general were changed. However, due to limitations for this study, theoretical implications for this research need to be treated with caution. Hence, further research is needed to investigate the effectiveness of an intervention combining psychological inoculation and self-persuasion in increasing mental resistance towards COVID-19 conspiracy theories. This is because such an intervention may not only reduce the impact of conspiracy theories but also contribute to an acceleration in finding a way out of the COVID-19 pandemic.

Keywords: conspiracy theories, mental resistance, boosting, psychological inoculation, self-persuasion

Increasing Mental Resistance to the Influence of COVID-19 Conspiracy Theories

During the COVID-19 pandemic, different conspiracy theories became prevalent. These include beliefs, for example, that the pandemic is not real, that the virus was created by China as a bioweapon, or that COVID-19 vaccinations were used by powerful groups to build up a global surveillance regime to gain control over people's behaviour (Douglas, 2021). In general, definitions of conspiracy theories typically include the belief in some form of a group acting secretly, with malicious intent, towards an evil goal (e.g., Bale, 2007; Hornsey, 2020; Van Prooijen & Douglas, 2018). Importantly, while conspiracies describe an actual, verifiable event, conspiracy theories include speculative beliefs that such an event is occurring (Hornsey, 2020). In other words, conspiracy theories consist of non-supported or false speculative beliefs in specific events that blame some secret agency for acting with evil intent.

Such conspiracy theories often flourish in times of crises (Šrol, Ballová Mikušková, & Čavojová, 2021). A crisis is commonly defined as a situation in which the current system is threatened as there is little time and insufficient resources to respond to changes or threats in the environment (Mishra, 1996; Shaluf, & Said, 2003). Thus, crisis situations create uncertainties about how to respond to such a risk. These uncertainties lead people to try to seek for information in order to get an overall picture of the situation and find ways to return to their normal activities (Stieglitz et al., 2017; Weick, Sutcliffe, & Obstfeld, 2005). This need of information necessitates risk communication as a means to counteract such threats. According to the World Health Organization (WHO) (n.d.), risk communication is the "exchange of real-time information, advice and opinions between experts and people facing threats to their health, economic or social well-being". Hence, risk communication should help people to protect themselves and other people against the risk. The problem of crisis situations, however, is that it is often very difficult for official sources to give clear advice on what to do or to offer an easy solution to counteract the threat which leads to confusion or disorientation (Maitlis, & Sonenshein, 2010). Thus, crisis situations complicate effective risk communication.

Conspiracy theories, on the other hand, give people psychological comfort as they assign responsibility for such uncontrollable events (Banas, & Miller, 2013). Generally, people try to avoid assigning big events to randomness, which seems less understandable, controllable and anticipatable than evil acts of an enemy (Sullivan, Landau, & Rothschild, 2010). Instead, people turn to two automatic processes, namely pattern perception and agency detection (Van Prooijen & Douglas, 2018). Pattern perception entails looking for causal explanations for the crisis, while agency detection relates the causes of the crisis to some intentional agent being responsible for it. Conspiracy theories support this tendency by assuming an orchestrated plan

as the cause of a crisis. Due to this comforting function of conspiracy theories and inhibited risk communication such theories spread more easily in times of crisis.

The COVID-19 pandemic is no exception in these trends of an increased spread of conspiracy theories in times of crises. Especially at the beginning of its spread, there were many uncertainties about the origins and health risks of COVID-19. Governments thereby had to manage the task of communicating such a lack of knowledge about the virus to the public while at the same time developing and advocating strategies to counteract the virus (Paek & Hove, 2020). These uncertainties about the virus and its containment made it become a worldwide crisis and quick decisions needed to be made. Additionally, effective risk communication was further complicated by the extensive media coverage around the world (Abaido & Takshe, 2020). This is because the uncertainties about the cause and risks of the virus also resulted in misleading or even false information to be spread, especially on social media (Agley & Xiao, 2021; Su et al., 2021). This overabundance of information with a mixture of correct and false information has become known as an infodemic (Porat, Nyrup, Calvo, Paudyal, & Ford, 2020; WHO, 2020) which made it more difficult for lay people to decide which sources to trust (Bruns, Harrington, & Hurcombe, 2020). Due to this problem of deciding which sources to trust, people are more likely to adopt conspiracy theories which in turn inhibits effective risk communication.

The spread of conspiracy theories and inhibited risk communication can have a wide array of consequences. For example, conspiracy beliefs blaming China and 5G technologies to have caused the pandemic (Douglas, 2021), led people to destroy 5G technology masts and caused racially based attacks on people who were perceived to have an Asian descent (e.g., Bruns et al., 2020; Shahsavari, Holur, Tangherlini, & Roychowdhury, 2020). Moreover, conspiracy beliefs are associated with less trust in government and their decisions (Galliford & Furnham, 2017). This in turn led to resistance to public health regulations (Sibley et al., 2020), such as non-compliance with wearing face masks and social distancing (Bierwiaczonek, Kunst, & Pich, 2020; Shahsavari et al., 2020; Sternisko, Cichoka, Cislak, & Van Bavel, 2020). Apart from this, conspiracy beliefs also led people to be less inclined to vaccinate against COVID-19 (Hughes & Machan, 2021). Instead, people turned to ineffective or even dangerous alternative treatments, such as hydroxychloroquine (Rakedzon, Khoury, Rozenberg, & Neuberger, 2020) which increases the possibilities of spreading the COVID-19 disease (Abaido & Takshe, 2020). Hence, conspiracy theories may trigger a process which leads to racism and to violent and negative health-related behaviours. This in turn complicates the fight against the pandemic.

In order to reduce these impacts of conspiracy theories, interventions need to be developed to counteract them. For this, the factors influencing conspiracy beliefs need to be identified. Firstly, cognitive factors can have an effect on conspiracy beliefs. The uncertainties created in crisis situations increase peoples' need for information. This is because people perceive a lack of control (Nguyen & Nguyen, 2020) which in turn increases their perceived risk (Burns, Peters, & Slovic, 2012). These mechanisms thereby have been linked to conspiracy beliefs (Van Prooijen, & van Dijk, 2014).

These cognitive factors may influence how people behave socially in order to reduce their uncertainties and lack of control which in turn may also again influence the cognitive factors. The need to find information leads people to seek for information more excessively and their social interactions on social media are increased (Nguyen, & Nguyen, 2020). However, their lack of control leads them to neglect the quality of sources on social media. They rather believe in sources confirming their prior beliefs (Nguyen, & Nguyen, 2020), a tendency known as confirmation bias (Oswald and Grosjean, as cited in Bruns et al., 2020). They do so by joining online groups with similar mindsets, so-called echo-chambers, in which people mutually reinforce and polarize their potentially distorted worldviews (Schmidt et al., 2017). In these echo-chambers, they may come in contact with conspiracy theories and adopt them. Additionally, as already mentioned, peoples' trust in government was related to conspiracy beliefs (Galliford & Furnham, 2017). Hence social factors have an influence on whether people are able to reduce their uncertainties and whether they adopt conspiracy beliefs.

Moreover, different demographic variables have been associated with conspiracy beliefs. These demographic variables thereby are expected to influence the ways in which the cognitive and social factors apply. Generally, although conspiracy belief has been found more often among people with lower formal education (Van Prooijen, 2017), Galliford and Furnham (2017) propose that also high education is related to beliefs in specific conspiratorial ideas. Additionally, low income was linked to conspiracy beliefs (Freeman & Bentall, 2017). Due to this, investigating students may be a good addition to educational literature by investigating whether conspiratorial thinking could also affect higher educational levels. Moreover, as students typically do not have a steady income, the effect of income on conspiratorial thinking may be investigated as well.

Additionally, Galliford and Furnham (2017) found that younger people may be more likely to support conspiracy theories. According to them, this may be due to the increased exposure of younger people to conspiracy theories on social media, in comparison to older people. On social media, information can be spread quickly, without being controlled or fact-

checked by experts (Lazer et al, 2018). Thus, false information about COVID-19 can spread faster than fact-checked information because false information does not require adherence to publication regulations. Recent statistics from Europe show that people in the ages from 18-29 most frequently use social media platforms (Khoros, 2021; Perrin, 2015). Additionally, students from European universities have been found to regard social media as their main news source and trust social media more than traditional media (Bantimaroudis, Sideri, Ballas, Panagiotidis, & Ziogas, 2020). Hence, students between the age of 18-29 may be more likely to be exposed to conspiracy theories and adopt them. In summary, due to their higher educational level and lower income but also their frequent social media usage, students between the ages of 18-29 are considered for this research. A model of the factors can be found in Figure 1.

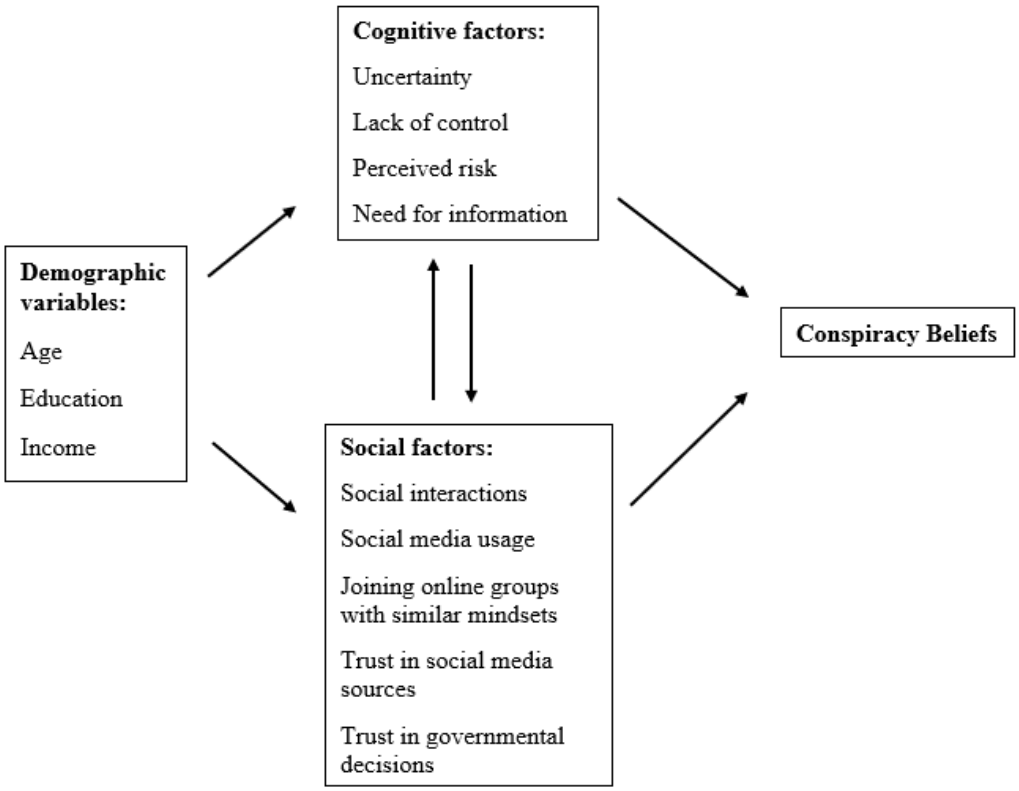

Figure 1. Schematic representation of the factors underlying conspiracy beliefs considered for this research and their expected relationship.

There were already multiple interventions designed for decreasing the impact of conspiracy theories. However, interventions targeted at correcting false information were mostly ineffective, as correcting false information is more time consuming than the mere diffusion of false information (Van Bavel et al., 2020). Instead of correcting false information, students may have to be targeted directly so that they do not adopt conspiracy beliefs even when being exposed to them. Thus, teaching students to detect inconsistencies or flaws in conspiracy

theories and to critically evaluate information they read about COVID-19 may be necessary in order to reduce the impact of conspiracy theories. In other words, their mental resistance towards COVID-19 conspiracy theories needs to be increased which in turn may lead them to behave in line with public health regulations. Therefore, the research question of this paper is the following:

How can mental resistance towards conspiracy theories regarding COVID-19 be strengthened among students between 18 and 29 years of age?

Theoretical Framework

Behaviour change. According to the theory of planned behaviour (Beck, & Ajzen, 1991), behaviour is dependent on a person's intention or motivation to perform a given behaviour. These intentions thereby are influenced by peoples' attitudes or beliefs and their perceived ability to perform such a behaviour. In order to change students' behaviours then, their attitudes need to be changed and their perceived ability to resist such theories needs to be increased. One possibility to achieve such changes is by teaching students how to detect inconsistencies in conspiratorial argumentation. Detecting underlying flaws in conspiratorial arguing could then lead students to intend or to be motivated to resist conspiracy theories. In other words, their mental resistance towards COVID-19 conspiracy theories may be increased which could then produce more desirable behaviours

One promising strategy to teach students how to reject false information may be the application of boosting. Boosting aims at fostering or increasing competences in order to achieve desirable behaviours (Hertwig & Grüne-Yanoff, 2017). Such competences can thereby be context specific but may also be used across situations. Hence, if people are boosted in detecting flaws or inconsistencies in one conspiracy theory, this may also apply to other conspiracy theories as well or even to critically evaluate sources in general. Boosts thereby are explicit and transparent and are time and cost efficient. Hence, they are effective for constantly changing behaviour over time. Also, in line with the theory of planned behaviour, boosts require motivational participation for behavioural change to occur. Prior studies already investigated successful boosts in risk literacy, uncertainty management and motivation (Hertwig & Grüne-Yanoff, 2017). Thus, such boosts may increase students' competences of mental resistance against conspiracy theories which in turn would create behavioural change.

As already mentioned, boosts require motivational participation. However, people who believe in conspiracy theories seem to be motivated to adopt conspiracy theories to uphold their worldview (Bruns et al., 2020). For behavioural change to occur then, they would have to be

motivated to fight conspiracies and to prevent these theories from being adopted. According to the protection motivation theory, whether people endorse adaptive or maladaptive responses is dependent on their appraisal of a potential threat and of their perceived ability to counteract the threat (Rogers, as cited in Norman, Boer, & Seydel, 2005). Hence, people need, on the one hand, to be made aware of the negative consequences that conspiracy beliefs can have to increase their threat appraisal. On the other hand, by increasing their competences in detecting inconsistencies in conspiracy theories, their coping appraisal is increased which then leads them to be motivated to protect themselves against the threat. This protection motivation eventually then creates behavioural change (Rogers, as cited in Norman et al., 2005), in the form of critical thinking about the content of sources. Due to this, this study is aimed at using not only messages which show people the potential threat of conspiracy beliefs, but also teaching students the underlying flaws or inconsistencies of different conspiracy theories.

Intervention models. One way to increase protection motivation and boost people's competences is by inoculating them towards conspiracy theories. As false information continues to be believed in even after it has been debunked or corrected (Lewandowsky, Ecker, Seifert, Schwarz, & Cook, 2012), pre-bunking may be more effective (Van der Linden, Roozenbeek, & Compton, 2020). This pre-bunking is incorporated in inoculation theory which, similar to medical vaccination, gives people a weaker version of false information to trigger critical thinking (Banas, & Miller, 2013; Van der Linden & Roozenbeek, 2020). Such critical thinking could in turn enable students to detect inconsistencies in the story provided and to develop arguments for why the presented information may be false.

Inoculation needs two essential message characteristics in order to be effective. On the one hand, by forewarning the individual of a persuasive attack on one's attitudes, threat is induced which in turn activates the motivation to counteract such threat (Banas, & Miller, 2013; Van der Linden & Roozenbeek, 2020; Van der Linden et al., 2020). In other words, their threat appraisal is increased. By this forewarning about a persuasive attack, people may be more inclined to accept the boost for rejecting the conspiracy theories. One the other hand, refutational preemption provides the individual with arguments against threatening messages (Banas, & Miller, 2013; Van der Linden & Roozenbeek, 2020; Van der Linden, et al., 2020). This gives people the ability to counteract the threat which should increase their coping appraisal and motivate them to argue against the conspiracy theories. Both message characteristics should thus increase individuals' protection motivation and make them more resistant to false information. Work on inoculation theory has already been linked to conspiracy theories. For example, it was found to increase not only vaccination intentions (Wong &

Harrison, 2014) but also skepticism towards conspiratorial reasoning (Lewandowsky, Gignac, & Oberauer, 2013). It may therefore enable students to critically think about conspiracy theories.

In line with argument creation, self-persuasion is another strategy which may be used to foster critical thinking in students. Self-persuasion is based on the finding that if people are behaving in ways which are not consistent with their attitudes, they begin to change their attitudes in order to increase such consistency (Müller et al., 2009). According to cognitive dissonance theory, this is because people try to reduce unpleasant feelings of dissonance which is occurring when people experience a mismatch between their attitudes and behaviour (Festinger, 1962). Several studies showed that when people are being placed in a context where they have to develop arguments themselves which run counter to their attitudes, that their attitudes can be changed in line with the arguments that they create (Bem, 1965; Müller et al., 2009; Stone, Aronson, Crain, Winslow, & Fried, 1994). Self-persuasion has been proven to be more effective and stable over time than regular persuasion as people convince themselves that the attitudinal change came from within and not from an external source (Stone et al., 1994). Thus, combining psychological inoculation and self-persuasion may change students' attitudes. By this, their behaviour may become more aligned with official health-regulations.

For this, two forms of attitudes will be studied as dependent variables, namely attitudes towards COVID-19 policies and towards conspiracy theories. On the one hand, conspiracy beliefs are often linked to distrust and a detachment from politics (Galliford & Furnham, 2017) which in turn leads to the resistance towards official health regulations (Sibley et al., 2021). Therefore, self-persuasion may positively change students' attitudes towards COVID-19 policies. Moreover, by letting students detect the inconsistencies underlying conspiracy theories, their attitude towards conspiracy theories should become more negative. Based on this literary review, the threat message and the refutational preemption of psychological inoculation combined with self-persuasion through argument creation is expected to increase students' motivation to counteract conspiracy theories. Hence, combining psychological inoculation and self-persuasion should boost students' mental resistance towards COVID-19 conspiracy theories.

The Current Study

Based on previous literature, a combination of psychological inoculation and self-persuasion should be able to boost students' mental resistance towards COVID-19 conspiracy theories. The threat message included in the psychological inoculation should increase students' threat appraisal while the refutational preemption and the self-persuasion should increase students' coping appraisal in the form of detecting underlying flaws in the argumentation of

conspiracy theories. As psychological inoculation has been proven to be effective in the past not only in general but also specifically targeting conspiracy beliefs, it can be expected that (H1) an intervention combining inoculation and self-persuasion will help reduce students' belief in conspiracy theories regarding COVID-19.

Moreover, self-persuasion was found to effectively change peoples' attitudes over time (Bem, 1965; Müller et al., 2009; Stone et al., 1994). Therefore, it is further expected that (H2) students who received the intervention combining psychological inoculation and self-persuasion will show more negative attitudes towards conspiracy theories in general and (H3) will show more positive attitudes towards COVID-19 policies.

Method

Design

In this study, a randomized post-test only between-group design, with one experimental and one control group, was chosen. The condition to which the participants were randomly allocated was the independent variable. Three dependent variables were measured. The main dependent variable was participants' belief in COVID-19 specific conspiracy theories. Furthermore, in line with the first two hypotheses, attitudes towards COVID-19 policies and attitudes towards conspiracy theories in general were measured as dependent variables. Moreover, perceived threat towards COVID-19 information was used as a manipulation check. Additionally, the intervention was coupled with questions on the appreciation of the intervention following the experiment. This evaluation of the study was thereby used as an additional manipulation check.

Participants

The population for this study is students from Dutch universities aged 18 to 29 years old. A non-probability sampling design was chosen with the commonly used quota sampling. The quota sampling is used for selecting a sample from a location convenient to the researcher based upon the a priori decided upon inclusion criteria for the study (Kumar, 2014). Additionally, referral sampling was applied by asking participants to refer to further potential participants (Heckathorn, 2002). Moreover the so-called voluntary response sampling was used with which students of the a priori decided upon target population do have the chance to voluntarily participate in the study (Murairwa, 2015). This sampling method was applied by collecting participants via the SONA system of the University of Twente, where students are registered to receive mandatory credit points. When students participated via the SONA system, they received credit points for the completion of the study. Otherwise, no incentives were given. Overall, 151 participants took part in the study. For the analysis of this study, some cases needed

to be excluded or adjusted. Firstly, 46 cases had to be removed due to not completely filling in the survey. Furthermore, two participants needed to be excluded as their age was not in the range of the inclusion criteria. Moreover, 22 participants needed to be excluded as they did not state to study in the Netherlands. With this, 49 participants (N = 49) remained in the control group, while 32 cases (N = 32) remained in the experimental group. Participants' age thereby ranged from 19 to 26 years (M = 21.56, SD = 1.58). The distribution of gender was 25.9% male (N = 21) and 74.1 % female (N = 60). An overview of the remaining demographics of the participants can be found in Table 1.

Table 1

Demographics of the remaining participants included in the analyses

Demographic Variable	***N***	Percentage
Nationality		
Dutch	19	24
German	55	68
Other	7	9
Educational Level		
High School graduate or GED	56	69
Bachelor's degree	22	27
Master's degree	3	4
Monthly income		
No income	19	24
1-450€	27	33
451-1000€	22	27
1001-2000€	5	6
More than 2000€	2	3
Not want to answer	6	7

Note. N = 81

Randomization check. A randomization check was conducted to see whether there was a relationship between the demographic variables and the condition that the participants were assigned to. For this, a chi-square test of independence was performed on gender, nationality, educational level, and income. For a chi-square test of independence, several assumptions need to hold (McHugh, 2013). The assumptions of ordinal variables and independence of cells were met. However, the assumption that at least 80% of the cells in each test should have a count of at least five was violated for the variables nationality, educational level, and income. Educational level was therefore transformed into a dichotomous variable with lower education (*High school graduate or lower*) and higher education (*Bachelor graduate or higher*). Similarly, income was transformed to a dichotomous variable with lower income (*450€ or lower)* and higher income (*451€ or higher*). Also, because the majority of participants were German, nationality was transformed into the dichotomies German (*German*) and Other (*Dutch or Other*). Through this, the count of each cell was over five. The chi-squared test revealed a significant relationship between condition and income, χ^2 (1, N = 81) = 4.19, p = .04. Students with lower income were thereby more often assigned to the control condition than expected while students with higher income were more often assigned to the experimental condition. A summary of the results of the separate chi-square tests can be found in Table 2.

Table 2

Counts (and Expected Counts) for the Demographic Variables Across Conditions and the Respective Chi-Square Test of Independence (χ^2) [a]

Variable	Variable Levels	Counts		*N*	χ^2
		Control	Experimental		
Gender	Male	13 (12.7)	8 (8.3)	21	0.02
	Female	36 (36.3)	24 (23.7)	60	
Nationality	German	35 (33.3)	20 (21.7)	55	0.71
	Dutch and Other	14 (15.7)	12 (10.3)	26	
Education	Lower education	31 (33.9)	25 (22.1)	56	2.00
	Higher education	18 (15.1)	7 (9.9)	25	
Income	Lower income	33 (28.8)	13 (17.2)	46	4.19*
	Higher income	14 (18.2)	15 (10.8)	29	

Note. *N* of income is lower as students had the opportunity to not specify their monthly income.
*$p < .05$.

Apart from this, for examining whether the mean age differed significantly between groups a t-test of independent samples was performed. For t-tests, different assumptions need to be met in order to determine whether the correct conclusions can be drawn from the results of the test (Pandis, 2015). The assumptions of independent samples and no distorting outliers were met.[1] However, the assumption of normality was violated.[2] Thus, an additional Mann-Whitney U test was conducted to account for nonnormality. In SPSS, the software used for the analyses, the Mann-Whitney U test is always automatically corrected for ties and thus, this will not be mentioned for other Mann-Whitney U tests. The t-test revealed that the mean age did not significantly differ between the conditions, $t(79) = 0.11$, $p = .91$. The additional Mann-Whitney U test supported the findings from the t-test that there was no difference between groups ($U = 726.50$, $z = -0.57$, $p = .57$). Nevertheless, as condition and income were significantly related, the randomization cannot be considered entirely successful. Thus, the effect of income on conspiracy beliefs as a covariate was analyzed as an exploratory analysis.

Materials

The study was composed of several parts, namely the intervention and the questionnaire which included an additional measure of students' appreciation of the intervention.

Intervention. The intervention consisted of three parts which together were meant to boost participants' ability to critically evaluate information about COVID-19 and to resist conspiracy theories. The first part presented to the participants is a warning message. The warning message represents the threat component of the psychological inoculation. It states that the participant will be confronted with different views which are commonly shared among social media. They will be told that these views are not based on scientific evidence and can be influential on peoples' attitudes or beliefs and often distort facts to be believed by more people (see Appendix A). The content of the threat message was inspired by Pfau et al. (2005) who warned people of an incoming persuasive attack on the peoples' position. This warning was adapted by focusing the content on conspiracy theories about COVID-19 that are spread on social media. Furthermore, students were made aware that these theories use different techniques which are meant to make such views more believable. By this, the motivation to defend one's attitude should be strengthened. The second part incorporates the refutational preemption component of psychological inoculation. It entails a poster which is designed according to the Fact-Myth-Fallacy approach and presents different conspiracy theories regarding COVID-19 which are shared among social media, as well as the facts debunking these theories and the fallacies underlying the conspiracy theories (Cook, 2017). For the

complete poster see Figure 2.[3] Furthermore, for a description of the design choices of the poster see Appendix B.

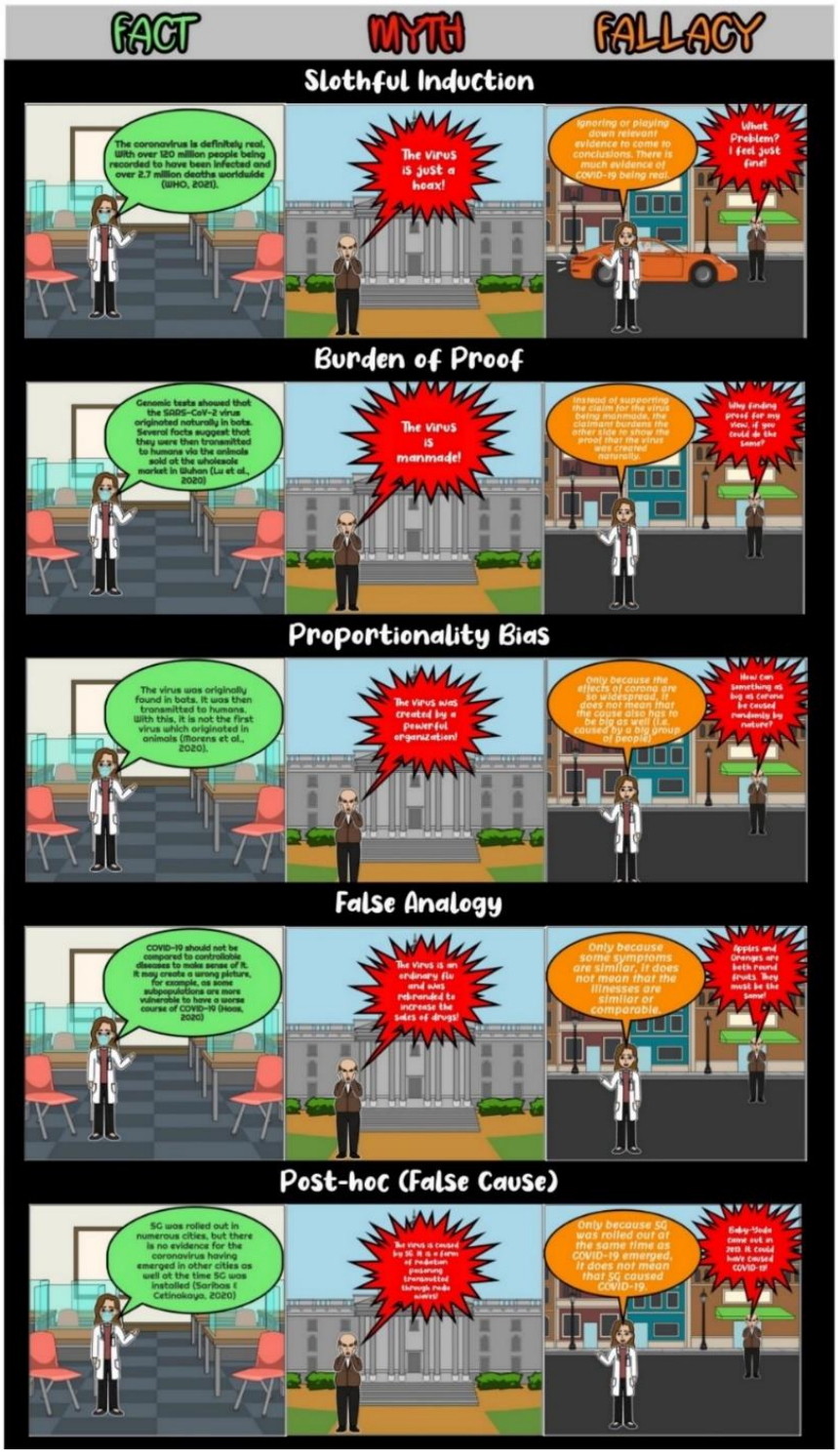

Figure 2. Refutational pre-emption component of psychological inoculation. The middle picture shows the respective conspiracy theories. The pictures on the left show the facts which debunk these conspiracy theories. In the right pictures, the orange speech bubbles display a description of the respective fallacies underlying the theories. The red speech bubbles in the right pictures show a very simplified example of these fallacies.

As a final part, students are shown two additional conspiracy statements and will be asked to create counterarguments against these statements. This part of the intervention included self-persuasion as students had to develop arguments themselves with which eventually their attitudes should be more aligned with. To do so, they were asked to either use the fallacies that they read before, use their own line of argumentation or both in order to critically evaluate the two additional theories. The answers given to the two theories will not be analyzed on their content. See Appendix C for the self-persuasion part.

Questionnaire. In the questionnaire, students were asked to indicate their perceived threat of information about COVID-19. Moreover, students' attitudes towards COVID-19 policies as well as their attitude towards conspiracy theories in general were measured. Also, they were asked to indicate the extent to which they believe in different theories that are shared among social media about the causes of COVID-19. These include the conspiracy theories which are also included in the intervention as well as three official explanations of COVID-19 to avoid acquiescence bias. This bias means that students would give the same answers on the items without evaluating their content or direction (Costello, & Roodenburg, 2015). For the ten statements about the coronavirus, see Appendix D. Additionally, students were asked to evaluate the study. The complete study was pilot tested on a few people from the target group in order to see whether the different parts of the study were understandable or needed further adjustments.

Measures

Conspiracy beliefs regarding COVID-19. The ten statements that were used to measure students' conspiracy beliefs were captured by a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The ten statements were thereby derived from prior studies investigating conspiracy beliefs during the COVID-19 pandemic (Freeman et al., 2020; Šrol et al., 2021) The three official statements were reverse coded. One example of a statement of a conspiracy theory was "The virus is produced by a powerful organization", while a statement of an official explanation was "The virus is naturally occurring". Higher scores thereby indicated higher belief in conspiracy theories. For this scale, Cronbach's Alpha indicated an acceptable reliability of $\alpha = .79$ (Gliem, & Gliem, 2003). Furthermore, as Cronbach's Alpha is dependent on the number of questions used in a scale (Tavakol & Dennick, 2011), Lambda 2 was inspected which is considered to be more robust than Cronbach's Alpha (Statistics How To, 2016). Thus, it may give a more precise estimate of the scale's reliability. The Lambda 2 for this scale was $\lambda = .83$.

Attitude towards COVID-19 policies and conspiracy theories in general. Students' attitude towards conspiracy beliefs in general as well as towards COVID-19 policies were measured with the questions "Please indicate to what extent you think that conspiracy theories are..." and "Please indicate to what extent you think that policies that are pursued to counteract COVID-19 are...". These questions were answered using six bipolar adjective pairs (*negative/positive, bad/good, unfavourable/favourable, unacceptable/acceptable, wrong/right, foolish/wise*) on a scale from 1 to 7. Higher scores thereby showed more positive attitudes towards either conspiracy theories in general or COVID-19 policies. Similar to the perceived threat measure, the attitude measure has also been used in prior inoculation research (e.g., Banas & Miller, 2013; Pfau et al., 2009). The scale for attitude towards COVID-19 policies showed an excellent internal consistency with Cronbach's Alpha being $\alpha = .96$ (Gliem, & Gliem, 2003) and Lambda 2 being $\lambda = .96$. The scale for attitude towards conspiracy theories in general also showed an excellent internal consistency with Cronbach's Alpha being $\alpha = .90$ (Gliem, & Gliem, 2003) and Lambda 2 being $\lambda = .90$.

Perceived threat. This variable, which was measured as a manipulation check, was operationalized by using bipolar adjective pairs. Perceived threat was measured with the question "Please indicate to what extent you think that information about COVID-19 spread on social media is...". To answer this question, five bipolar adjective pairs were used (*unintimidating/intimidating, nonthreatening/threatening, not risky/risky, not harmful/harmful, and safe/dangerous*) on a scale from 1 to 7, with higher scores indicating higher perceived threat. This measure of perceived threat has been repeatedly used in the past and has been shown acceptable internal consistency (e.g., Banas & Miller, 2013; Pfau et al., 2009). In this study, the scale indicated a good internal consistency with Cronbach's Alpha being $\alpha = .81$ (Gliem, & Gliem, 2003) and Lambda 2 being $\lambda = .82$.

Study Evaluation. The evaluation questions were used as an additional manipulation check to see whether students' appreciation of the intervention differed between groups. Thereby different 5-point Likert scales were used depending on the type of question. For the different questions and scales, see Appendix E. Thereby higher scores indicated a more positive evaluation of the study. The only exceptions here was the question about the number of examples needed, as either too many or too few examples could be considered negatively and the open question asking for further improvements. These questions were not included in the main analyses but were still considered for interpreting the findings.

Procedure

Firstly, the participants were asked to give informed consent on participating in the study. In the study description of the informed consent, more general information was given about the purpose of the study. It was stated that the study is about how students from Dutch universities evaluate information regarding COVID-19 in times of crisis. Thereby participants were not told that the study investigates students' conspiracy beliefs as this could have influenced the results. This study was approved by the BMS Ethics Committee of the University of Twente.

After that, students were randomly divided into two groups, one experimental and one control group. Students in both groups received the intervention as well as the questionnaire to measure the dependent variables. Students in the experimental condition firstly received the intervention. The intervention started with a warning message which informed the students that they would be shown persuasive messages which may influence their beliefs.. After that, they were presented a poster entailing different conspiracy theories, the facts showing why these theories are not true as well as the underlying logical fallacies of the conspiracy theories. These conspiracy theories were firstly presented to the participants one after another with a timer being set before they could skip to the next one to make sure that they carefully read each of the conspiracies with the according information to debunk them. Next, they were asked to create arguments against two further conspiracy theories, using the fallacies shown in the poster or their own line of argumentation. As an additional help the complete poster with all the theories and fallacies was displayed again for the students to be used to develop their arguments.

After the intervention, students in the experimental condition were shown a questionnaire which measured the dependent variables. In the questionnaire, students in the experimental condition were firstly asked three questions to measure their perceived threat of information about COVID-19, their attitudes towards COVID-19 policies as well as their attitude towards conspiracy theories in general. Next, they were asked to indicate the extent to which they believe in the conspiracy theories as well as the official explanations about COVID-19. In order for students' answers on their conspiracy beliefs to be as pure as possible, students in the control condition were first shown the ten statements, so that the other questions in the questionnaire could not influence their answers to the conspiracy statements. Also, students in the control condition were asked to fill in the questionnaire first and received the intervention afterwards. By this, the differences between conditions could be investigated.

After having completed the intervention and the questionnaire, students in both groups were asked to fill in questions to evaluate the study as a manipulation check primarily, but also

for further improvements. Moreover, they were asked to fill in demographic questions. Lastly, students were debriefed about the more specific information regarding the study's purpose and are given an additional possibility to opt out if they wish to do so. The completion of the full study took participants around 20-30 minutes.

Data Analysis Plan

For the data analysis, the Statistical Package for the Social Sciences (SPSS: Version 26) was used. Separate independent samples t-tests were conducted to check for both manipulation checks regarding perceived threat and the evaluation. To test the hypotheses, the effects of condition on conspiracy beliefs, as well as attitude towards COVID-19 policies and attitude towards conspiracy theories in general were investigated through additional separate independent samples t-tests. Before this, however, the assumptions for an independent samples t-test were checked before having conducted the test, namely independent groups, an approximately normal distribution of scores, no distorting outliers and equal variance of scores in both groups. For all tests, the significance threshold was set to $\alpha \leq .05$.

Results

Descriptives

For the descriptives, the means and standard deviations of both conditions on each scale as well as the correlations between the scales irrespective of the condition were investigated. A significant positive correlation was found between students' conspiracy beliefs and their attitudes towards conspiracy theories in general $r(79) = .28$, $p = .01$. Thus, students who scored higher in conspiracy beliefs also showed more positive attitudes towards conspiracy theories in general and vice versa. Furthermore, the relationship between students' attitudes towards COVID-19 policies and their attitude towards conspiracy theories was found to be negatively correlated, $r(79) = -.33$, $p < .01$. This means that participants who showed more positive attitudes towards COVID-19 policies, showed more negative attitudes towards conspiracy theories in general and vice versa. Both correlations can be interpreted as weak (Schober, Boer, & Schwarte, 2018). Correlations between the other scales were found to be non-significant, $p > .05$. A summary of the correlations can be found in Table 3. The means and standard deviations of the respective scales can be found in Table 4.

Manipulation checks

In order to see whether the intervention was successfully implemented, two manipulation checks were conducted. Firstly, perceived threat was used as a necessary component of psychological inoculation, to see whether the intervention was successful. For this, a t-test was conducted for investigating the differences of perceived threat between groups.

Table 3

Correlations Between Scales

Scales	1	2	3	4	5
1. Conspiracy Belief					
2. Attitude Conspiracy Theories	.28*				
3. Attitude COVID-19 Policies	-.21	-.33**			
4. Perceived Threat	-.01	-.03	-.02		
5. Mean Evaluation	.08	-.05	.17	-.03	

*$p < .05$, ** $p < .01$, two-tailed

Again, an assumption check was conducted for a t-test. The assumption of independent samples[4] and normality was met. Moreover, one outlier had to be adjusted.[5] However, Levene's test for equality of variances was found to be significant, $F(1,79) = 5.27$, $p = .02$, which means that equal variances could not be assumed. The respective Welch's two samples t-test, which control for unequal variances, found that the perceived threat of the control group did not significantly differ from the experimental group, $t(77.65) = -0.30$, $p = .76$. Thus, the manipulation could be considered unsuccessful in the sense that it did not raise participants' perceived threat of information about COVID-19.

Besides this, an independent samples t-test was performed on the difference of mean evaluation scores of the participants between conditions. Again, the assumptions for a t-test were examined. The assumptions of normality, no distorting outliers and equal variances across groups were met. The t-test showed a non-significant difference between groups, $t(79) = -0.36$, $p = .72$. In other words, students who were assigned to the experimental group did not evaluate the intervention differently than the students in the control condition. Thus, regarding the evaluation, the manipulation could be regarded as successful as there was no difference in evaluations between groups.

Testing the hypotheses

To test these hypotheses, t-tests were conducted on both attitude scales and student's conspiracy beliefs. For students' conspiracy beliefs, there were no distorting outliers.[6] However, an additional Mann-Whitney U test was conducted as the data was not normally distributed[7]. Additionally, equal variances could not be assumed[8]. The respective Welch's two samples t-test revealed a significant difference between groups, $t(79.00) = 2.19$, $p = .03$. An additional Mann-Whitney U test supported the findings of the t-test by showing a significant

result (U = 559.50, z = -2.18, p = .03). Due to this, the first hypothesis can be accepted because the experimental group scored lower in conspiracy beliefs (M = 1.39) compared to the control group (M = 1.62).

The second hypothesis expected that students in the experimental group will show more negative attitudes towards conspiracy theories in general. The assumptions of no distorting outliers and equal variances were met. However, the assumption of normality was violated.[9] Hence, again an additional Mann Whitney U test was conducted. The t-test suggested that students' attitude towards conspiracy theories did not significantly differ between groups, $t(79) = 1.14$, p = .26. The Mann-Whitney U test thereby supported the findings from the t-test that there was no difference between groups (U = 635.00, z = -1.46, p = .15). This means that the intervention did not change students' attitude towards conspiracy theories. Hence, the second hypothesis needs to be rejected.

Lastly, for the third hypothesis, students in the experimental group were expected to show more positive attitudes towards COVID-19 policies. The assumption of equal variances was met. However, four outliers had to be adjusted and normality was not met.[10] Thus, another Mann Whitney U test was conducted. The t-test on students' attitude towards COVID-19 policies revealed a non-significant difference between the two conditions, $t(79) = 0.36$, p = .72. Additionally, due to nonnormality, a Mann-Whitney U test was conducted which also did not find a significant difference between the groups (U = 756.00, z = -0.27 p = .79). Thus, also students' attitude towards COVID-19 policies could not be changed with the intervention. This means that also the third hypothesis needed to be rejected. The mean, standard deviations and the results of all t-tests can be found in Table 4.

Exploratory analyses

A multiple regression analysis was conducted to see how much students' attitudes towards conspiracy theories in general, their attitudes towards COVID-19 policies, and their perceived threat could account for their conspiracy beliefs. Again, different assumptions needed to be checked (Osborne, & Waters, 2002). Regarding Normality, Shapiro-Wilk tests and plots indicated that all variables deviated more or less from univariate normality distribution. However, continuance of analysis was still possible since most variables only deviated slightly. Also, the confirmatory analysis for the third and main hypothesis revealed that there were five outliers for students' conspiracy beliefs. Yet, as these outliers were due to natural variation, the regression analysis was conducted twice, once with the outliers and once without the outliers. By this it could be seen whether the outliers had an impact on the assumed model.

For the regression analysis with the outliers kept, the assumptions of linearity,

Table 4

Means (M), Standard Deviations (SD) and the Results of the Separate Independent Samples T-tests (t) Between the Conditions and the Respective Scales[a]

	Control		Experimental		
Scales	M	SD	M	SD	***t***
1. Conspiracy Belief	1.62	0.53	1.39	0.35	2.19*
2. Attitude Conspiracy Theories	1.98	0.79	1.77	0.86	1.14
3. Attitude COVID-19 Policies	5.04	1.39	4.87	1.63	0.36
4. Perceived Threat	4.57	1.18	4.66	0.84	-0.30
5. Mean Evaluation	3.52	0.65	3.57	0.66	-0.36

Note. Conspiracy Beliefs and Mean Evaluation range from 1 to 5; Attitude Conspiracy Theories, Attitude COVID-19 Policies and Perceived Threat range from 1 to 7

[a] $N = 81$,

*$p < .05$, two-tailed

homoscedasticity, and no multicollinearity were met. For the regression analysis with the outliers kept, it was found that the combined effect of perceived threat and both attitude scales could explain a significant amount of variance in students' conspiracy beliefs, $R^2 = .10$, $R^2_{Adjusted} = .06$, F (3,77) = 1.07, $p = .05$. However, an investigation of the individual predictors further revealed that neither of the three could significantly predict students' conspiracy beliefs. The effects of each predictor variable can be found in Table 5.

Table 5

Effects of Perceived Threat, Attitude Towards COVID-19 Policies and Attitude Towards Conspiracy Theories on Conspiracy Beliefs With Outliers Kept [a]

			95% CI	
Coefficient	B	β	LL	UL
Perceived Threat	-0.01	-0.02	-0.11	0.09
Attitude Conspiracy	0.13	0.22	-0.01	0.26
Attitude Policies	-0.05	-0.15	-0.13	0.03

Note. [a] $N = 81$

Additionally, the multiple regression analysis was conducted after having excluded the outliers for conspiracy beliefs. Once more, the assumptions of linearity, homoscedasticity, and no multicollinearity were met. The regression analysis without the outliers showed that the combined effect of the predictors could significantly predict students' conspiracy beliefs, R^2 = .14, $R^2_{Adjusted}$ = .10, F (3,72) = 3.79, p = .01. After having removed the outliers, only the attitude towards COVID-19 policies was found to have a significant effect, B = -0.05, t = -2.05, p = .04. This means that more positive attitudes towards COVID-19 policies lead to less conspiracy beliefs and vice versa. Thus, from the three independent variables, only attitude towards COVID-19 policies could account for students' conspiracy beliefs. The effects of each independent variable after the removal of the outliers can be found in Table 6.

Table 6

Effects of Perceived Threat, Attitude Towards COVID-19 Policies and Attitude Towards Conspiracy Theories on Conspiracy Beliefs With Outliers Removed [a]

			95% CI	
Coefficient	B	β	LL	UL
Perceived Threat	0.03	0.10	-0.04	0.11
Attitude Conspiracy	0.09	0.20	-0.01	0.18
Attitude Policies	-0.05*	-0.24	-0.11	-0.002

[a] *N = 76*

**p < .05*

Apart from this, an analysis of covariance was conducted to account for the unequal distribution of students' income across groups. For this, a one-way ANCOVA was conducted to investigate the difference of conspiracy beliefs across groups controlling for income. Again, several assumptions need to hold for an ANCOVA (Leppink, 2018). The assumptions check revealed that none of the assumptions was severely violated. After controlling for income, there was still a significant effect of condition on conspiracy beliefs, F (1,78) = 4.89, p = .03, η_p^2 = .06. Income, nevertheless, showed a nonsignificant effect on conspiracy beliefs, F (1,78) = 0.16, p = .69, η_p^2 < .01. This means that the income of the students could not account for students' conspiracy beliefs, but that the condition had an effect on conspiracy beliefs. In other words, although the randomization of income was not successful, this unequal distribution did not cause the difference in conspiracy beliefs between groups.

In summary, it was found that there was a difference in conspiracy beliefs between groups. Students in the experimental group believed less in conspiracy theories than students in the control group. However, there were no significant differences between groups on both attitude scales.

Discussion

This study was aimed at investigating whether an intervention was able to increase mental resistance towards conspiracy theories regarding COVID-19 among students from Dutch universities between the age of 18 to 29. This was expected to be achieved by boosting students' competences in detecting flaws or inconsistencies in conspiracy theories and to critically evaluate information about COVID-19. For this, a combination of psychological inoculation and self-persuasion was used. Although inoculation has already been used to inhibit self-persuasion (Haynes, 2015), a combination between the two has so far not been studied. Nevertheless, there seems to be a link between both theories with counterarguing as an essential component of both theories. Due to this, the first hypothesis stated that intervention combining psychological inoculation and self-persuasion would be able to decrease students' conspiracy beliefs regarding COVID-19. This hypothesis could be supported as students in the experimental condition believed less in conspiracy theories about COVID-19 than students in the control group. However, against expectations, students' attitudes towards conspiracy theories in general and COVID-19 policies could not be changed. Therefore, the second and third hypotheses were rejected.

The finding that students in the experimental condition believed less in conspiracy theories about COVID-19 would suggest that the intervention was successful in increasing mental resistance. However, students with lower income were more often assigned to the control condition than expected. Also, students with higher income were more often assigned to the experimental condition and showed lower conspiracy beliefs. Thus, it could be assumed that the difference in conspiracy beliefs was due to this unequal distribution of income. Nevertheless, an analysis of covariance revealed that income could not explain the difference in conspiracy beliefs across groups, yet that the condition to which students were assigned could. Hence, this indicates that the condition indeed caused the found effect. This in in line with prior research on inoculation theory which also was able to reduce peoples' conspiracy beliefs (e.g. Banas, & Miller, 2013).

However, against the expectations of inoculation theory, the perceived threat of the students could not be increased. In the case of a successful inoculation, perceived threat should be increased which in turn should increase students threat appraisal and thus, activate students'

motivation to counteract the threat (Banas, & Miller, 2013; Van der Linden & Roozenbeek, 2020; Van der Linden et al., 2020). The findings of this research suggest that inoculation may also be effective without perceived threat and thus, the threat appraisal being increased. This is in line with findings from a meta-analysis of inoculation research of Banas and Rains (2010), which was also not able to find significant effects of threat on resistance. According to Pfau et al. (1997), perceived threat may be moderated by peoples' issue involvement. Thereby both, too low and too high issue involvement would make it difficult for an inoculation intervention to elicit additional threat. Either case would, therefore, be an explanation for why students in the experimental group did not show higher perceived threat than students in the control group.

Moreover, contrary to the theory of self-persuasion, students' attitudes towards COVID-19 policies and conspiracy theories in general could not be changed. According to self-persuasion, attitudinal change can be created when creating a dissonance between peoples' attitudes and behaviours (Bem, 1965; Müller et al., 2009; Stone et al., 1994). This is because, people try to decrease the unpleasant feelings created by such a dissonance (Festinger, 1962). Prior research, furthermore, suggested that when people have to create arguments which are not in line with their behaviour, that their attitudes then may be changed in accordance with the arguments that they were asked to create (Bem, 1965; Müller et al., 2009; Stone et al., 1994). Therefore, it was expected to change students' attitudes towards conspiracy theories more negatively and towards COVID-19 policies more positively. In this study, these findings were tried to be replicated by letting students create arguments against conspiracy theories which should then lead to reduced conspiracy beliefs. Once more, however, no change in attitudes could be observed.

An explanation for this could be that some students mentioned that they found the example that the virus escaped a laboratory investigating bat coronaviruses inappropriate to be considered as a conspiracy theory. During the setup of the study, the WHO announced after an intensive investigation that the lab theory was "extremely unlikely" (WHO, 2021b). Due to this, there was no evidence to support this theory (Frutos, Gavotte, & Devaux, 2021). However, during the time of data collection, there was a turn in opinions as the lab theory could still not be completely rejected and further investigations were demanded (Bloom et al., 2021). Also, the USA publicly announced further investigations into this topic (Tyler, 2021). Therefore, this rather gives reason to see these assumptions about the origin of the virus as actual conspiracies rather than conspiracy theories. In case of an actual conspiracy, there would be no reason for why students should develop arguments against this conspiracy which would contradict the supposed intention of the self-persuasion in this case. This would mean that it would not be

possible to create a dissonance between attitudes and behaviours and thus, explain why the self-persuasion was not able to create attitudinal change. Hence, other examples need to be used in future studies in order to achieve a successful self-persuasion.

There was another limitation to this study with regards to the design of the refutational preemption component. Several students indicated that they had problems with the readability of the poster. The necessary upload of the poster on the website for building the survey, made a decrease of the quality of the picture inevitable. Also, some students mentioned that the design and the bright colours of the poster were distracting. Petterson (2010) proposed guidelines for providing clarity with graphical messages. However, with the pictures decreased quality, the guidelines for legibility of pictures were not met. The perceived complex design of the pictures and the problems of legibility may have led to inferior learning and memory retention (Petterson, 1993). The poster was meant to teach students different fallacies underlying conspiracy theories, based on which they then should create arguments in the self-persuasion part. Therefore, the design may have inhibited the argument creation. Thus, future studies may use a less complex design and more legible pictures to guarantee an appropriate information transmission and more effective refutational preemption and self-persuasion.

Apart from this, an exploratory regression analysis revealed that after the removal of the outliers on the conspiracy belief scale, that attitudes towards COVID-19 policies could account for students' conspiracy beliefs. Thus, students with more positive attitudes towards COVID-19 policies believed less in conspiracy theories about COVID-19 and vice versa. These outliers were removed to see whether they influenced the assumed model. This is in line with findings from prior research who also found a link between higher conspiracy beliefs and less COVID-19 policy support (Earnshaw et al, 2020; Freeman et al., 2020). This suggests that conspiracy beliefs and COVID-19 policy support may also be related. It has to be mentioned, however, that some variables deviated more or less from normality. However, continuance of analysis was still possible since most variables only deviated slightly. Nevertheless, the results of the analysis should be treated with caution.

Implications

Although this intervention combining psychological inoculation and self-persuasion was found to be able to decrease students' conspiracy beliefs, further research is still necessary. This is because according to Bickman (1987), theoretical implications could only be made, if the implementation of the theory was impeccable. However, due to the limitations regarding the examples used in the self-persuasion part and the issues with the readability and design of the poster, drawing theoretical implications is difficult and should be treated with caution. Prior

literature on psychological inoculation and self-persuasion showed that both could effectively reduce people's conspiracy beliefs and change peoples' attitudes (e.g., Banas, & Miller, 2013; Müller et al., 2009). Also, there seems to be a link between both theories with counterarguing as an essential component of both theories. Therefore, the combination of both is still promising for being used in reducing the impact of conspiracy theories in times of COVID-19. Hence, further research is still needed to investigate the effectiveness of this combination.

Additionally, this study found that conspiracy beliefs could be reduced without perceived threat to be increased. This is in contrast to inoculation theory which presupposes threat as necessary for inoculation to be effective (Banas, & Miller, 2013; Van der Linden & Roozenbeek, 2020; Van der Linden et al., 2020). This would further mean that, against the assumption of the protection motivation theory (Rogers, as cited in Norman et al., 2005), peoples' threat appraisal would not have to be increased for people to be motivated to counteract the threat. Therefore, although implications taken from this research should be treated with caution, investigating the importance of perceived threat for inoculation theory and protection motivation theory should not be neglected.

Moreover, a link between conspiracy beliefs and COVID-19 policy support was suggested by the exploratory regression analysis. However, for this relationship, prior research does not give indications for the underlying causes for this link (Earnshaw et al., 2020; Freeman et al., 2020). Hence, in order to get insights into why such links may be present, future research may identify in what ways COVID-19 policy support and income influence conspiracy beliefs.

Future research

Future research is still needed for investigating the effectiveness of the combination of psychological inoculation and self-persuasion in boosting peoples' competences to detect flaws in conspiratorial arguing. This is because both methods have been promising means for achieving attitudinal change and a reduction in conspiracy beliefs in the past (e.g., Banas, & Miller, 2013; Müller et al., 2009). However, due to the limitations of this study, it is questionable whether the contrasting findings from this study are able to prove inconsistencies in both theories (Bickman, 1987). Therefore, revising these limitations is important for further research to be able to test the effectiveness of an intervention combining psychological inoculation and self-persuasion.

Furthermore, the influence of perceived threat on inoculation interventions still needs to be investigated. Although Banas and Rains (2010) also could not find a significant effect of perceived threat they suggest that future research would still be necessary as their meta-analysis was based on a rather small sample. They further propose that future studies may need to

manipulate perceived threat to get more insights into its exact influence on conspiracy beliefs (Banas & Rains, 2010). This is because threat messages have only rarely been manipulated in terms of their elicited perceived threat. Therefore, an ideal amount of perceived threat could not be established yet. As perceived threat was measured as a manipulation check in this study, it is not possible to say whether differences in the wording of the warning message would have been able to elicit higher levels of perceived threat. Moreover, as Pfau et al. (1997) state that perceived threat may be moderated by peoples' issue involvement, the underlying mechanisms for such a moderation may be investigated.

Additionally, the statements from the self-persuasion part may be changed which were mentioned to be inappropriate to be considered as conspiracy theories. For example, it would be possible to use some of the arguments from the poster for the self-persuasion part. As for the other conspiracy theories there is no evidence suggesting that these theories describe actual conspiracies (check sources in Figure 2), this limitation could be overcome. Moreover, as this intervention was aimed at boosting students' competences in the different underlying fallacies, this would further enable that examples of different fallacies would still be included. Hence, using examples of the poster for the self-persuasion part could improve the effectiveness of the self-persuasion while still ensuring a sufficient boost in different fallacies.

Moreover, a less complex design may be used for the refutational preemption. As students mentioned that the design may have been misleading or distracting, a less complex design may lead to a better information transmission and memory recall in the future (Petterson, 1993). By this, the effectiveness of the poster or the refutational preemption part of the psychological inoculation may be improved.

Apart from this, future research is still necessary to clarify the causes for the relations between COVID-19 policy support and conspiracy beliefs. This is because in this research, students' attitude towards COVID-19 policies could account for students' conspiracy beliefs and thus, may be further investigated. In summary, by targeting future research in these directions, it may be possible to get a clearer picture for how to effectively increase resistance to such beliefs. This in turn may enable to reduce the impact on conspiracy theories and hence, may contribute to an acceleration in finding a way out of the COVID-19 pandemic.

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Footnotes

[1] There were two outliers which, however, were still in the range of the inclusion criteria for the study and thus, represented natural variation. Therefore, these outliers were kept for the analysis.

[2] A Shapiro-Wilk-test revealed that the age of the students was not normally distributed, $W(81) = 0.92$, $p < .01$. Additionally, a visual inspection of the respective histogram showed that the data was skewed to the left.

[3] The source of the World Health Organization (WHO,2021) in the green speech bubble in the top left cartoon picture will be referred to in the reference list as WHO (2021a)

[4] The assumption of independent samples was met for all t-tests in this study as participants could only be assigned to one of the two groups. Thus, this was not mentioned for further t-tests.

[5] Outliers for all scales were changed to the mean, +-2 standard deviations of the respective scales. Such outliers were kept in the analysis due to the rather low number of cases in this study, given that they did not show any unexpected scores on the items.

6 There were five outliers for students' conspiracy beliefs which, however, even after the correction to two standard deviations above the mean remained outliers. These scores were kept in their original form. This is because the mean score of conspiracy beliefs was found to be rather low and the standard deviations small. It may be that such scores indeed represent natural variation, so higher conspiracy beliefs for these participants. Thus, correcting or removing these outliers may violate the representativeness of the data collected

[7] A Shapiro-Wilk test revealed a non-normal distribution of students' conspiracy beliefs, $W(81) = 0.83$, $p < .01$. An inspection of the histogram revealed the distribution of scores was strongly skewed to the left.

[8] A Levene's test for equality of variances was found to be significant, so equal variance could not be assumed, $F(1,79) = 4.44$, $p = .04$.

[9] A Shapiro-Wilk test revealed that the scores on the attitude towards conspiracy theories in general scale were not normally distributed, $W(81) = 0.91$, $p < .01$. An inspection of a histogram showed that the distribution of scores was skewed to the left.

[10] A Shapiro-Wilk test revealed that the scores on the attitude towards COVID-19 policies scale were not normally distributed $W(81) = 0.92$, $p < .01$. An inspection of a histogram showed that the distribution of the scores was skewed to the right.

Appendices

Appendix A

Warning message

Warning!

In the following you will be confronted with some views that are spread on social media. Information on social media often tries to persuade you of possible conspiracies. These ideas may potentially be influential attacks on your attitudes or beliefs regarding COVID-19. Thus, your attitudes or beliefs are tried to be challenged or even changed. Such conspiracy theories are often not based on scientific evidence nor do they draw the correct conclusions from scientific evidence. There are multiple techniques on which conspiracy theories draw upon to make their claims seem valid or argumentatively correct. Yet, such techniques often are just used to distort the real situation in order to be believed by large numbers of people. Be aware of such influences when you evaluate information on social media.

Appendix B

Complete poster

In the poster (Figure 1) five examples were given each of which consisted of three cartoons which were used as a rather playful style of information transmission. The combination of textual with graphical information should increase students' comprehension of the material (Schnotz, 2005). By this, the fallacies were expected to be understood and remembered more easily. The left picture thereby always showed the facts regarding the specific conspiracy theory. Here, a classroom setting was chosen with a woman with a white coat and a face mask which should portray a rather scientific setting. Furthermore, the speech bubble for the facts were designed in a green colour to indicate the scientific correctness of the facts. To establish a contrast to the first picture, the second picture shows an angry man who shouts the respective conspiracy theory. These speech bubbles were designed in red. As the colour read is commonly linked to danger (Pravossoudovitch, Cury, Young, & Elliot, 2014), using red speech bubbles should indicate that these statements represent an incoming threat on peoples' attitudes. The angry man is thereby positioned in front of a building which should resemble a council house to indicate the opposing position of conspiracy theories about COVID-19 and governmental decisions made to counteract the virus. On the last picture a rather neutral setting and colour was chosen. It not only again shows the woman from the first picture, explaining the underlying fallacy of the respective theories, but also, the angry man who gives a greatly simplified example of this fallacy. This simplified example should help to understand how the respective conspiracy theory uses such a fallacy to be more believable.

Appendix C

Self-Persuasion part

Instruction: In the following you will be confronted with some more views that can be found on social media which do not have scientific evidence supporting them. Please develop arguments for why such statements are wrong. For this, you may either use some of the fallacies shown in the poster below, use your own line of argumentation or even do both. There is no right or wrong answer. We would just like to ask you to critically think about why these statements are false.

	Fallacy	Counterargument
COVID-19 is a biological weapon created by China		
The virus spread from a lab in Wuhan which studies bat coronaviruses		

Appendix D

Ten statements about the coronavirus

Please indicate to what extent you agree with the following statements about the Coronavirus.

	Strongly Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
The virus is a hoax	○	○	○	○	○
The virus is manmade	○	○	○	○	○
The virus is produced by a powerful organization	○	○	○	○	○
COVID-19 is a biological weapon created by China	○	○	○	○	○
The virus is naturally occurring	○	○	○	○	○
The virus is caused by 5G and is a form of radiation poisoning transmitted through radio waves	○	○	○	○	○
The virus is most likely to have originated by bats	○	○	○	○	○
The virus is most likely to have started at a wet market in China (marketplace selling fresh meat, fish, produce, and other perishable goods)	○	○	○	○	○
The virus is caused by climate activists to stop climate change	○	○	○	○	○
The virus is only an ordinary flu which was rebranded to increase the sales of drugs	○	○	○	○	○

Appendix E

Evaluation Questions

Instructions: In the following you will be asked some questions about the intervention design. The intervention consisted of two parts. The first part was the poster with the different fallacies of different views shared on social media. The second one was the assignment where you were asked to develop arguments against certain statements yourself. Please answer the following questions as honestly as possible, so that the study may be improved for future studies.

Generally, how would you evaluate the intervention?

- ○ Liked it a lot
- ○ Liked it somewhat
- ○ Neutral
- ○ Disliked it somewhat
- ○ Disliked it a lot

How would you evaluate the design of the poster?

- ○ Liked it a lot
- ○ Liked it somewhat
- ○ Neutral
- ○ Disliked it somewhat
- ○ Disliked it a lot

How would you evaluate the assignment?

- ○ Liked it a lot
- ○ Liked it somewhat
- ○ Neutral
- ○ Disliked it somewhat
- ○ Disliked it a lot

Was the poster easy to understand?

- ○ Extremely easy
- ○ Somewhat easy
- ○ Neither easy nor difficult
- ○ Somewhat difficult
- ○ Extremely difficult

How would you evaluate the difficulty of the assignment?

- ○ Extremely easy
- ○ Somewhat easy
- ○ Neither easy nor difficult
- ○ Somewhat difficult
- ○ Extremely difficult

Was the language in general easy to understand?

- ○ Extremely easy
- ○ Somewhat easy
- ○ Neither easy nor difficult
- ○ Somewhat difficult
- ○ Extremely difficult

How would you evaluate the amount of text or examples that you had to read on the poster?

- ○ Far too much
- ○ Slightly too much
- ○ Neither too much nor too little
- ○ Slightly too little
- ○ Far too little

Were there any distractors for you while completing the intervention?

- ○ A great deal
- ○ A lot
- ○ A moderate amount
- ○ A little
- ○ None at all

Were you motivated to complete the study?

- ○ A great deal
- ○ A lot
- ○ A moderate amount
- ○ A little
- ○ Not at all

Did you have fun in completing the intervention?

- ○ A great deal
- ○ A lot
- ○ A moderate amount
- ○ A little
- ○ Not at all

Do you have any suggestions for future improvement?

_____