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Epistemic Vaccination: Computational Disinformation, Inoculation Theory, and Critical Information Literacy

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ABSTRACT The rapid adoption of the open internet and social media technologies for information seeking and sharing has led to the utilization of these technologies as vehicles for the spread of computational propaganda, disinformation, and misinformation. Scholars have investigated multiple avenues to combat the cognitive failure that results in acceptance and sharing of widespread misinformation. The most promising identified thus far is a psychological concept known as inoculation theory. This method can be conceptualized as a misinformation vaccine that can increase critical evaluation of newly encountered information and thereby increase the probability that this information will not be cognitively integrated and subsequently further shares within an individual's information network. This review aims to thoroughly discuss and synthesize the literature on disinformation and how inoculation theory fits within already utilized pedagogical paradigms as a potential antidote for this pertinent issue through the lens of critical information literacy.

KEYWORDS
critical information literacy, critical librarianship, disinformation

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Introduction

As a society, we have increasingly become reliant on the internet as our primary means of seeking information on a myriad of pertinent scientific, social, political, and cultural issues. In 2018, the World Economic Forum named misinformation as one of the top global risks to the environmental, economic, technological, and institutional systems upon which our future depends (WEF, 2018). The internet and social media have provided a system of algorithmic curation in which there are vulnerabilities to exploit if one wishes to attempt to manipulate consensus on a chosen subject via the diffusion of false information throughout a specific network of individuals (Howard, 2020). The spread of misinformation poses a serious threat to the public's understanding of science, politics, social context, and cultural behavior (Lewandowski et. al., 2017; Traeburg et. al, 2022). Critically, belief in misinformation can have downstream effects on attitudes and behavior, such as undermining climate change mitigation (Cook, Lewandowsky, and Ecker 2017), instigating violence (Jolley and Paterson 2020), and lowering vaccination intentions and compliance with public health guidelines (Loomba et al. 2021; Roozenbeek et al. 2020; van der Linden 2022).

The centrality of the internet and social media as a primary information source in modern life has inserted a new curricular challenge, namely, how to provide students with the cognitive tools necessary to be epistemologically successful when encountering new information in these spaces. Student's ability to evaluate credibility on the web should therefore be a priority—especially as a global pandemic forced an even stronger pivot toward technology in every aspect of students' lives (Ziv & Benne 2022). Most colleges and universities make some attempt at preparing students to sort fact from fiction online, but research suggests that the status quo information evaluation instruction needs to be reimagined (Ziv & Benne, 2022).

One such area of research that shows promise is that of inoculation theory, in which users experience weakened forms of false information to build a cognitive immunity and critical disposition when subsequently faced with new information (Basol, Roozenbeek, & Van der Linden, 2020). Inoculation theory is a technique which can be seamlessly blended into current critical information literacy teaching pedagogy through the theoretical lens of experiential learning. Through this review of the literature, the connection between the need for more robust information evaluation instruction in the information literacy context is clear, as is the most readily available and efficacious pedagogical tactic being evident in the utilization of inoculation theory in that context. This review will also demonstrate how the techniques inherent in inoculation theory fit within already implemented theoretical and pedagogical models such as the ACRL framework for information literacy in higher education, experiential learning theory, and information literacy instruction as liberatory social justice work.

Methodology

This paper adheres to the methodological framework of a theory synthesis paper (Jakkola, 2020). Such papers may also explore the conceptual underpinnings of an emerging theory or explain conflicting research findings by providing a more parsimonious explanation that pulls disparate elements into a more coherent whole (Jakkola, 2020). A theory synthesis paper can integrate an extensive set of theories and phenomena under a novel theoretical umbrella (Jakkola, 2020). The goal is to review the literature on disinformation, critical information literacy pedagogy, and form a symbiotic theoretical relationship between these elements and the literature on inoculation theory. This work aims to review the literature of each in detail while providing theoretical connections between each concept. This paper aims for a clear synthesis leading to a suggested pedagogical implementation which connects to the need for new pedagogical tools to combat disinformation, with the theoretical match of critical information literacy pedagogy and the psychological and educational psychology literature on enveloping inoculation theory within the proven pedagogical theories inherent in critical information literacy pedagogy such as experiential learning and active learning pedagogical technique.

Computational Disinformation

Disinformation is a specific type of misinformation in that it is disseminated with the sharer's explicit knowledge of its falsehood (Benkler, Faris, & Roberts, 2018). Disinformation is distributed in most instances for the purpose of perpetuating the narrative of propagandists. The intent is to share false information from a manipulative disposition. In this context, the primary motivation is to manipulate audience perception in order to control or change a specific narrative, render counternarratives invisible, or enact an epistemic questioning within an audience in which traditional truth valuations themselves begin to be questioned as a result of overwhelming exposure to falsehood (Howard, 2020). Disinformation may often return to the original definition of misinformation when it has become widely diffuse and shared deeply within a network of individuals who are no longer aware of the truth value of said information content (Benkler, Faris, & Roberts, 2018).

Deliberate dissemination of disinformation is ubiquitous today, and social media is arguably the most prominent and utilized conduit (Bradshaw & Howard, 2017). A wide range of agents working on behalf of political parties, government agencies, sociocultural organizations, typically related to far right and ultraconservative movements in some 80 countries, have indulged in the creation, dissemination, and promotion of disinformation (Bradshaw & Howard, 2017; Howard, 2020). This concept of overwhelming curation mechanisms within algorithmically driven social media platforms with false information to manufacture consensus, intentionally mislead, and control a narrative rendering opposing perspectives invisible is the aim of widespread disinformation campaigns (Howard, 2020). However, this intentional spread

of false information has consequences and may directly or indirectly generate emotional, physical, and epistemological harm in actual reality, far removed from these digital spaces.

Experts argue that online disinformation consumption is the catalyst for a wide range of adverse and potentially dangerous and violent outcomes (Piazza, 2022). For example, scholars argue that consumption of disinformation online can foster distrust of traditionally authoritative sources of information (Allcott & Gentzow, 2017; Warwick & Lewis, 2017). Online disinformation has also been shown to be linked to increasing hostility and erosion of faith in the trustworthiness of social and political institutions and establishment political and social figures (Beauchamp, 2019). Continued consumption of disinformation has been shown to result in heightened tolerance or outright support for fringe and anti-establishment actors and movements (Beauchamp, 2019). Berinsky notes that consumption of disinformation is also self-reinforcing in that it conditions individuals to become more receptive to further disinformation in the future (Berinsky, 2017). This purposeful manipulation of social epistemological grounding has a profoundly negative and polarizing effect on civic society and coarsens discourse amongst disagreeable factions, however, the deleterious effects continue when said disinformation campaigns contribute to actualized physical harm outside of digital spaces.

Exposure to disinformation and conspiracy theory online has been associated with enhanced racial, ethnic, partisan, and social group grievances, with a prevalence of the demonization and othering of "outgroups" (Tufekci, 2018). Disinformation disseminated online has been argued to have fomented episodes of political violence (Piazza, 2020). One needs only to turn to well documented incidents of political violence in which the perpetrator seemed to or has attested to radicalization through participation in online communities. Several multiple casualty events come to mind: the tree of life synagogue shooting in Pittsburgh, Pennsylvania; the Charleston church shooting perpetrated by Dylan Roof in 2015; the violence enacted in Charlottesville, Virginia in 2018; and the insurrection at the US capital on January 6 of 2020. There is a significant amount of academic research that alleges that terrorist activity is enhanced and reinforced through social media and the internet (Conway, 2017; Guadette et. al., 2020; Mølmen & Ravndal, 2021). When political and social actors disseminate false or misleading information through social media to manipulate political attitudes or mobilize supporters, their endeavors produce an environment in which domestic terrorism is more likely to occur (Piazza, 2020).

Inoculation Theory

Inoculation theory can be understood at a high level as an analogue to the well understood concept of inoculation related to vaccination against viral infection (Compton, 2013). Resistance to stronger challenges, for our purposes challenges related to false information, comes a result of pre-exposure to weaker challenges (Compton, 2013). The inoculation process is of course the exposure of an individual to weakened versions of anticipated persuasive challenges (Compton et. al, 2021). Pre-exposure challenges are designed

to be strong enough to motivate the mind's psychological defense systems, but not strong enough to overwhelm those defenses (Compton et. al, 2021). The goal is to generate a set of "mental antibodies" which in turn produce a psychologically defensive posture for individuals encountering novel information, with the idea that this defensive cognitive posture will provide a more thorough analytical evaluation of information upon initial contact.

The inoculation procedure in this context relies primarily on two specific components: forewarning, and refutational preemption, which influence both cognitive and affective practices (Maertens et. al., 2020). Forewarnings are exposures to the threat of counter-attitudinal attack to motivate resistance, and subsequent exposure to preemptive refutations of said attack to model the process of counterargument and provide content and framing for self-induced refutation in future encounters (Banas & Rains, 2010). The presence of counter-attitudinal content is conceptualized as triggering a cognitive threat response to motivate a message recipient to cognitively protect or defend a previously held, but now threatened position (Banas & Richards, 2017).

Scholarship related to inoculation theory has generally focused on understanding the processes of cognitive resistance, however, there is significant power in inoculation theory messaging having the ability to spread and diffuse across populations not initially exposed to the primary inoculation messaging (van der Linden & Maibach et. al., 2017). Inoculation treatments have been shown to enhance perceived interest in a target topic, as well as the intent and likelihood of socially contested issue being discussed (Compton & Pfau, 2009, Lin & Phau, 2007). This diffusion effect has been regarded as a powerful means to sustain the influence of the initial inoculation treatment (Goldenberg et. al., 2001). Research has also shown that not only do those inoculated end up conversing about the issue more often, and in greater detail, but the more these conversations occur, the stronger the resistance grows (Ivanov, et. al., 2015). Still further work has found that post-inoculation discussions of pertinent socially contested issues contain both advocacy content as well as efforts to reassure (Ivanov et. al., 2015).

Researchers have only recently begun to explore inoculation within its originally intended conception, the realm of propaganda and misinformation (Lewandowsky & van der Linden, 2021). This exploration of propaganda related inoculation began with inoculation intended to counter climate change misinformation but has since expanded into a variety of domains as the information ecosystem has become significantly more polluted with misinformation since 2016 (Traeburg et. al, 2022). Currently, research is being undertaken to examine the effects of inoculation in such disparate categories as Covid-19 and vaccination misinformation, online extremism, and various political and sociocultural forms of propaganda aimed at shifting public consensus in relation to pertinent "culture war" debates (Traeburg et.

al., 2022). The foremost takeaway thus far has been that technique specific inoculation, for example, instructing individuals about the techniques behind the spread of conspiracy theory, can confer a range of cognitive protections against numerous manifestations of that specific technique (Traeburg et. al., 2022).

The literature clearly indicates that inoculation theory has broad implications for the protection of individuals against manipulative information forces that have become apparent and vast within our sociocultural information networks. Developing the cognitive faculties to resist these attempts to manipulate our collective epistemology is becoming essential to interact with our information ecosystems. Inoculation theory may provide an essential technique to counter misinformation, and therefore must be considered as an essential component of information literacy pedagogy. If students are not adequately prepared to effectively navigate the information environment they will face upon leaving the academy, they may fall victim to misinformation and propaganda and diffuse such false information throughout their social networks which can eventually have cataclysmic epistemic consequences.

Critical Information Literacy Pedagogy & Inoculation Theory

The link between inoculation theory and critical librarianship lies within the conceptual idea of experiential learning. Critical pedagogues such as Paulo Friere emphasized the importance of experiential pedagogy (Kolb & Kolb, 2005). The process of exposure to pre-identified "weakened" forms of misinformation followed by the process of evaluation, reflective methods based on that evaluation, and the subsequent metacognitive result of developing a personal framework for evaluating new information sticks very closely to the spiral of experiential learning (Kolb & Kolb, 2009). When a concrete experience is enriched by reflection, given meaning by thinking, and transformed by action, the new experience created becomes richer, broader, and deeper (Kolb & Kolb 2009).

Scholars working within educational psychology have noted that a basic causative factor in the general achievement of learners studying in higher education is learners' engagement (Xerri et al., 2018; Derakhshan, 2021). As a reaction to the traditional teaching approach that is teacher-centric (Che et al., 2021) and following the inclination to expanding interest in a more unique, participative learning atmosphere, educational organizations are orienting toward learning approaches that cultivate students' involvement, interest, and dynamic participation (Kong, 2021). Experiential Learning is a successful teaching method facilitating active learning through providing real-world experiences in which learners interact and critically evaluate course material and become involved with a topic being taught (Boggu and Sundarsingh, 2019).

Both experiential learning and critical pedagogy prompt learners to do, reflect, think, and apply rather than just accept information for recitation and memorization (Butler et. al., 2019). This is critically important for the development of a critical disposition when a learner must navigate overwhelmingly complex information spaces. In a critical pedagogical model

rooted in experiential learning, the conventional role of the teacher shifts from knowledge provider to a mediator of experience through well-known systemic processes (Kong, 2021). This dynamic participation of both learners and teachers in the process of working through edifying experiential activities can enhance intrinsic student engagement, motivation, and interest in the material while ensuring the students can connect to a practical application for the cognitive skills they are learning and practicing in the classroom environment (Zelechoski et. al., 2017). The experiential nature of utilizing pedagogical methods inherent in the implementation of inoculation theory deepens the level of development of a critical cognitive disposition when exposed to new information.

Inoculation Theory, Critical Information Literacy Pedagogy, & The ACRL Framework

The practice of exposure, reflection, and group discussion of the efficacy of a piece of information, which is inherent in utilizing inoculation theory as a pedagogical driver of instruction in relation to information evaluation also links very clearly to the instruction goals inherent in the more critical aspects of the ACRL framework for information literacy. Focusing on meta literacy and metacognition, rather than a prescriptive model for specific information literacy recommendations, the *Framework* is descriptive of particular dispositions needed for rapidly changing literacy abilities and knowledges (McDowell &Vetter, 2022). The frame "authority is constructed and contextual" recognizes the situated nature of authority, one a signal and marker of credibility, based on the context of both the creator of a piece of information and the ways in which information is both needed and used (McDowell & Vetter, 2022). Inoculation theory and the experiential learning involved in exposure to weakened forms of misinformation encourages students to evaluate the contextual authority of the creators and publishers of a given piece of information, the context from which the piece of information is derived, and how the information has been utilized to holistically evaluate a piece of information's credibility.

The third frame, "information has value," is also a fundamental concept related to information evaluation. The *Framework* describes that "information possesses several dimensions of value, including as a commodity, as a means of education, as a means to influence, and as a means of negotiating and understanding the world" (ACRL, 2015). This is an intrinsic method of evaluation of misinformation found in the reflective processes of the inoculated. Part of the holistic evaluation of misinformation includes interrogating why the information would be produced, what is its value to the producer and sharers of said information, and how does it inform ones understanding of the information ecosystem within which the information was discovered.

The *Framework* has clearly pushed information literacy in a critical direction. The language inherent in the *Framework* paves the way for the information literacy classroom context to adopt techniques of experiential learning, particularly when dealing with the complexity of modern information spaces. Inoculation theory is a theoretical match for this

critical turn, particularly as a specific pedagogical tool to work towards engendering a critical disposition amongst learners when entering said information contexts.

Pedagogical practice in the information literacy context that provides individuals with skills to navigate an increasingly disinformation rich information environment is also a social justice concern. Minority groups have been targeted in increased frequency by misinformation campaigns (Bond, 2020), and engaging learners from these marginalized communities can directly combat these issues, while also reaching individuals outside of these groups whom would theoretically now be provided the cognitive inoculation against these measures. In addition, First-generation students (defined here as undergraduate students whose parents do not have a bachelor's degree) comprise the largest percentage (59% in 2015–2016) of students enrolling in colleges and universities in America, and also are at a significantly higher risk (56% vs. 40% of continuing education students) of not completing a degree within 6 years ("First Year Experience" [RTI International, 2019]). Among many institutional factors, self-efficacy remains a significant factor for degree completion and student retention (Thomas, 2014). Self-efficacy has been shown to have a significant impact on student identity (Stets et al., 2017; Williams et al., 2018). Utilizing experiential learning techniques as well as critical pedagogy to implement inoculation theory in the information literacy classroom context will engage students in the learning process allowing them to gain that crucial self-efficacy though problem-solving and peer to peer knowledge sharing as they work through evaluating a newly encountered pre-identified piece of false information.

Inoculation theory as a potential antidote to disinformation may have the ability to disrupt the efforts of social, cultural, and political propagandists as they attempt to spread disinformation targeting traditionally marginalized populations. We have witnessed these efforts in recent years in relation to Black Lives Matter protests, propaganda targeting immigrants from central and south America, the false information related to the health care and rights of trans individuals, and even the debate regarding the Supreme Court of the United States repealing Roe v. Wade. Information literacy instruction armed with the techniques inherent within the theoretical basis of inoculation theory seems to show some efficacy in the not only preventing the cognitive integration of false information, but also the further spread of false information.

Pedagogical Implementation

An initial consideration when designing instruction around the concept of inoculation theory is the concept of implementation of an active or passive inoculation intervention (Traeburg et. Al., 2022). Passive inoculation interventions present individuals with information via text, or video which provides them with the necessary counterarguments to well-identified misinformation arguments (Roozenbeek & van der Linden, 2024). Active inoculation interventions involve individuals being taught how to think about why a given piece of information might be false and allowing individuals to develop their own counterarguments and

strategies for refutation (Roozenbeek & van der Linden, 2024). An additional instructional design consideration is between the concepts of issue-based or technique-based inoculation interventions (Roozenbeek & van der Linden, 2024). Issue-based inoculations directly address specific false information or arguments that are prevalent in a given information ecosystem, such as false or misleading information regarding climate science or vaccine safety (Maertens et. Al., 2020). In contrast, technique-based inoculation interventions are directed at tackling the underlying rhetorical strategies and manipulation techniques that are used across multiple issues and domains in order to mislead or misinform; examples of these techniques include logical fallacies, trolling, employing fake experts, or astroturfing an algorithmically curated spaced with constant posts, reposts and likes of a specific piece of content to ensure it begins to dominate the conversation (Cook et. al., 2017; Lees et. al., 2023; Zerback et. al., 2021). Once these distinctions are clearly understood, instructors can be intentional with pedagogical design and instruction can be planned around a specific concept, or an intermingling of multiple concepts.

The most direct conceptual framework for critical information literacy instruction would be active, technique-based inoculation. This would involve teaching students about the techniques behind misinformation rather than a debunking of misinformation on specific topics, with the goal of those students being able to more accurately discern misinformation and develop their own logical counterarguments against the false information they have encountered. Roozenbeek, van der Linden, and colleagues developed a web-based gamified inoculation intervention called "Bad News" in which players play the role of disinformation campaigner and develop false news stories utilizing the specific techniques of computational propagandists (Roozenbeek & van der Linden, 2019). Basol then studied the effectiveness of Bad News in a randomized control trial and found that participants rated items of misinformation from social media much more reliably as false information than the participants in the control group (Basol, et. al., 2020). Similarly, Maertens ran a series of identically designed studies over a longer period of time to attempt to uncover the effectiveness of Bad News as an active, technique-based inoculation intervention and found that for individuals who regularly received "booster" inoculations, or were asked to play Bad News multiple times over a period of several weeks/months, the effect of accurately identifying and labeling false information was as strong as when the inoculation intervention was initially administered (Maertens et. al., 2021; Maertens et. al., 2023). Bad News was also tested in the context of a Swedish high school environment and confirmed the boosted veracity discernment of students who received the active inoculation intervention in the form of the Bad News game. This literature points to active technique-based inoculation interventions as being efficacious in individuals learning about the techniques of misinformation, how to spot those techniques, and how to identify false information more accurately on the open internet.

Bad News can be easily integrated into library instruction as it takes approximately 15 minutes to make it through the entirety of the game. Once students have completed the game individually, the instructor could employ an active learning pedagogical strategy of having students break up into groups to discuss the misinformation techniques they learned about through playing Bad News. These small group discussions could be prompted with specific instructor presented questions such as, "In your groups, choose one of the techniques you learned about while playing Bad News and try to come up with 3-5 real world examples where you have seen these techniques in action," or "Discuss in your groups one of the specific misinformation strategies you learned about in Bad News, and generate a way you would be able to use that technique to spread a specific piece of true information, such as the current state of climate science." The results of these small group discussions can then be discussed as a larger group in which the instructor can help facilitate the discussion while aiding in clarification of potential misunderstandings related to techniques or concepts presented in Bad News. The instructor can also record student responses in a way that they are projected in front of the class live during the discussion and then shared out after the conclusion of the class to all participants. At the conclusion of this discussion, the instructor could then direct the students to pre-identified pieces of misinformation in which the students can be asked to discuss those pieces of misinformation in their groups while identifying the techniques behind them, and then doing some brief in-group lateral reading to generate a consensus on the issue by consulting several reputable sources. The instruction session could conclude with a discussion of each group's findings and a brief wrap up in which students openly discuss what they have learned in the instruction session, and how they may be able to apply these new critical and analytical skills going forward.

Conclusion

The literature related to disinformation and information literacy in higher education, while still limited in scope, points to the need for a reevaluation of pedagogical approaches to mitigate this growing problem and adequately prepare students to encounter an increasingly polluted information ecosystem. These efforts become ever more pertinent as propagandists and other bad actors begin to utilize more sophisticated artificial intelligence tools to further mask false information and increase the rapidity and breadth of the spread of said content.

One solution identified from the literature prevalent within the disciplines of psychology and communications is the concept of inoculation theory. Researchers have continually shown this technique to have some viable efficacy in bolstering the cognitive resistance of individuals to the acceptance and eventual sharing of false information within their information networks. Implementation of the concepts within inoculation theory to mitigate the effects of disinformation are clearly apparent in the research and the theory itself is easily translatable to the information literacy classroom context. Inoculation theory can be utilized as a pedagogical

tool to cognitively prepare students of higher education for their information consumption upon leaving the academy while potentially diffusing the effects of disinformation propagandists.

Librarians who teach information literacy in higher education contexts are ostensibly on the front lines of preparing individuals to engage with information in an ever-changing and ever more opaque information landscape. We have a duty as information professionals to cognitively prepare individuals to eradicate the successful campaigns of computational propaganda that have occurred on a regular basis in earnest since the 2016 election cycle in the American context. The first step in this process is auditing our approach to information literacy instruction and borrowing from other disciplines to ensure that we are adequately preparing individuals to go forth and wade through the opaque waters of our modern digital information environments. Librarians should consider borrowing pedagogical techniques from the inoculation theory literature for implementation within the information literacy classroom context. This literacy can not only prevent the spread of false information in relation to important scientific information, but also safeguard individuals form marginalized populations that are typically targeted by these campaigns as they are often utilized as pawns in culture war debates, and as straw people in political grandstanding. Librarians must utilize information literacy instruction time to ensure that we are producing foundationally sound epistemic practices regarding information evaluation and ensure the sanctity of the future of reality-based consensus and information integrity.

References

Association of College & Research Libraries (2015). *Framework for information literacy for higher education*. American Library Association. http://www.ala.org/acrl/standards/ilframework.

Allcott, H. & Gentsknow, M. (2017). Social media and fake news in the 2016 election. *Journal of Economic Perspectives, 31*(2), 211-236.

Banas, J. A. & Rains, S. A. (2010). A meta-analysis of research on inoculation theory. *Communication Monographs 77*(3), 281-311.

Basol, M.; Roozenbeek, J.; & Van der Linden, S. (2020). Good news about bad news: Gamified inoculation boosts confidence and cognitive immunity against fake news. *Journal of Cognition, 3*(1), 2. https://doi.org/10.5334/joc.91

Benkler, Y.; Faris, R.; & Roberts, H. (2018). *Network propaganda: Manipulation, disinformation, and radicalization in American politics*. Oxford University Press.

Berinsky, J. A. (2017). Rumors and health care reform: Experiments in political misinformation. *British Journal of Political Science, 47*(2), 241-262.

Bond S. (2020, October 30). Black and Latino voters flooded with disinformation in election's final days. *NPR*. https://www.npr.org/2020/10/30/929248146/black-and-latino-voters-flooded-with-disinformation-in-elections-final-days

Bradshaw S. & Howard, P. (2017). *Troops, trolls, and troublemakers: A global inventory of organized social media manipulation* (working paper). http://blogs.oii.ox.ac.uk/politicalbots/wp-content/uploads/sites/89/2017/07/Troops-Trolls_and-Troublemakers.pdf

Compton, J. (2013). Inoculation theory. In J. P. Dillard & L. Shen (Eds.), *The SAGE handbook of persuasion: Developments in theory and practice* (pp. 220–236). Sage Publications, Inc.

Compton, J. & Pfau, M., (2009). Spreading inoculation: Inoculation, resistance to influence, and word-of-mouth communication. *Communication Theory, 19*(1), 9–28. https://doi.org/10.1111/j.1468-2885.2008.01330.x

Compton, J.; Van Der Linden, S.; Cook, J.; & Basol, M. (2021). Inoculation theory in a post-truth era: Extant findings and new frontiers for contested science, misinformation, and conspiracy theories. *Social and Personality Psychology Compass, 15*(6). https://doi.org/10.1111/spc3.12602

Conway, M. (2017). Determining the role of the internet in violent extremism and terrorism: Six suggestions for progressing research. *Studies in Conflict & Terrorism, 40*(1), 77-98.

Cook J.; Lewandowsky S.; & Ecker U.K.H. (2017). Neutralizing misinformation through inoculation: Exposing misleading argumentation techniques reduces their influence. *PLoS ONE* 12(5): 1–21. https://doi.org/10.1371/journal.pone.0175799

Derakhshan, A.; Kruk, M.; Mehdizadeh, M.; & Pawlak, M. (2021). Boredom in online classes in the Iranian EFL context: sources and solutions. *System* 101:102556. https://10.1016/j.system.2021.102556

Gaudette, T.; Scrivens, R.; & Venkatesh, V. (2020). The Role of the Internet in facilitating violent extremism: Insights from former right-wing extremists. *Terrorism and Political Violence*, *34*(7), 1339–1356. https://doi.org/10.1080/09546553.2020.1784147

Howard, P. (2020). *Lie machines*. Yale University Press.

Ivanov, B.; Sims, J. D.; Compton, J.; Miller, C. H.; Parker, K. A.; Parker, J. L.; Harrison, K. J.; & Averbeck, J. M. (2015). The general content of post inoculation talk: Recalled issue-specific conversations following inoculation treatments. *Western Journal of Communication*, *79*(2), 218–238. https://doi.org/10.1080/10570314.2014.943423

Jaakkola, E. (2020). Designing conceptual articles: four approaches. *AMS Review 10,* 18–26. https://doi.org/10.1007/s13162-020-00161-0

Jolley D. & Paterson, J. L. (2020). Pylons ablaze: Examining the role of 5G COVID-19 conspiracy beliefs and support for violence. *British Journal of Social Psychology* 59(3): 628–40. https://doi.org/10.1111/bjso.12394

Kolb, A. Y. & Kolb, D. A. (2005). Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning & Education*, 4(2), 193-212.

Kolb, A. Y. & Kolb, D. A. (2009). The Learning Way: Meta-cognitive Aspects of Experiential Learning. *Simulation & Gaming*, *40*(3), 297–327. https://doi.org/10.1177/1046878108325713

Kong, Y. (2021). The role of experiential learning on students' motivation and classroom engagement. *Frontiers in Psychology, 12*(77) 1272-1276. https://doi.org/10.3389/fpsyg.2021.771272

Lees J.; Banas J.A.; Linvill D.; Meirick P.C.; & Warren P. (2023). The spot the troll quiz game increases accuracy discerning between real and inauthentic social media accounts. *PNAS*

Nexus, 2(4). https://doi.org/10.1093/pnasnexus/pgad094. PMID: 37065618; PMCID: PMC10096901

Lewandowsky, S. & van der Linden S. (2021). Countering misinformation and fake news through inoculation and prebunking. *European Review of Social Psychology, 32*(2), 348-384. https://doi.org/10.1080/10463283.2021.1876983

Lin, W.K. & Pfau, M. (2007). Can inoculation work against the spiral of silence? A study of public opinion on the future of Taiwan. *Journal of Public Opinion Research, 19*(2), 155-172. https://doi.org/10.1093/ijpor/edl030

Loomba, S.; de Figueiredo, A.; Piatek, S.; de Graaf, K.; Larson, H. (2021). Measuring the impact of COVID-19 vaccine misinformation on vaccination intent in the UK and USA. *Nature Human Behaviour*, *5*(3), 337–48. https://doi.org/10.1038/s41562-021-01056-1

Maertens, R.; Ansel.; & van der Linden, S. (2020) Combatting climate change misinformation: Longevity of inoculation and consensus messaging effects. *Journal of Environmental Psychology, 70*(101455). https://doi.org/10.1016/j.jenvp.2020.101455

Maertens, R.; Roozenbeek, J.; Basol, M.; & van der Linden, S. (2021). Long-term effectiveness of inoculation against misinformation: Three longitudinal experiments. *Journal of Experimental Psychology: Applied, 27*(1), 1–16. https://doi.org/10.1037/xap0000315

Maertens, R.; Goldberg, B.; Simons, J.; Xu, R.; Lewandowsky, S.; Maturo, V.; Roozenbeek, J.; & van der Linden, S. (2023). Psychological booster shots targeting memory increase long-term resistance against misinformation. *PsyArxiv Preprints*. https://doi.org/10.17605/OSF.IO/7WQZT

McDowell, Z. J. & Vetter, M. A. (2022). Wikipedia as Open Educational Practice: Experiential Learning, Critical Information Literacy, and Social Justice. *Social Media + Society*, *8*(1). https://doi.org/10.1177/20563051221078224

Mølmen, G. N. & Ravndal, J. A. (2021). Mechanisms of online radicalisation: How the internet affects the radicalisation of extreme-right lone actor terrorists. *Behavioral Sciences of Terrorism and Political Aggression*, *15*(4), 463–487. https://doi.org/10.1080/19434472.2021.1993302

Piazza, J. (2020). Fake news: The effects of social media disinformation on domestic terrorism. *Dynamics of Asymmetric Conflict, 15*(1), 55-77. https://doi.org/10.1080/17467586.2021.1895263

Roozenbeek, J.; Schneider, C.; Dryhurst, S.; Kerr, J.; Freeman, A. L. J.; Recchia, G.; Van Der Bles, A.M.; & van der Linden, S. (2020). Susceptibility to misinformation about COVID-19 around the world. *Royal Society Open Science* 7. https://doi.org/10.1098/rsos.201199

Roozenbeek, J. & van der Linden, S. (2019). Fake news game confers psychological resistance against online misinformation. *Palgrave Communications 5*(65). https://doi.org/10.1057/s41599-019-0279-9

Roozenbeek, J. & van der Linden, S. (2024). *The psychology of misinformation*. Cambridge University Press.

RTI International. (2019). First year experience, persistence, and attainment of first-generation college students. *NASPA*. https://firstgen.naspa.org/files/dmfile/FactSheet-02.pdf

Stets J. E.; Brenner P. S.; Burke P. J.; & Serpe R. T. (2017). The science identity and entering a science occupation. *Social Science Research*, 64, 1–14. https://doi.org/10.1016/j.ssresearch.2016.10.016

Thomas D. (2014). Factors that influence college completion intention of undergraduate students. *The Asia-Pacific Education Researcher*, 23(2), 225-235. https://doi.org/10.1007/s40299-013-0099-4

Tewell, E. (2015). A decade of critical information literacy: A review of the literature. *Communications in Information Literacy, 9*(1), 24–43. https://doi.org/10.15760/comminfolit.2015.9.1.174

Tewell, E. (2018) The practice and promise of critical information literacy: Academic Librarians' involvement in critical library instruction. *College & Research* Libraries*, 79*(1)10-34. https://doi.org/10.5860/crl.79.1.10.

Traeburg, C.; Rozenbeek, J.; & van der Linden, S. (2022). Psychological inoculation against misinformation: Current evidence and future directions. *The ANNALS of the American Academy of Political and Social Science, 700*(1), 136-151. https://doi.org/10.1177/00027162221087936

Tufekci, Z. (2018). How technology took us from Tahrir Square to Donald Trump. *MIT Technology Review*. https://www.technologyreview.com/s/611806/how-social-media-took-us-from-tahrir-square-to-donald-trump.

Van der Linden S. (2022). Misinformation: Susceptibility, spread, and interventions to immunize the public. *Nature Medicine*. https://doi.org/10.1038/s41591-022-01713-6.

Van der Linden, S.; Leiserowitz, A.; Rosenthal, S.; & Maibach, E. (2017). Inoculating the public against misinformation about climate change. *Global Challenges 1*(2). https://doi.org/10.1002/gch2.201600008

Warwick, A. & Lewis, R. (2017). Media manipulation and disinformation online. *Data and Society*. https://datasociety.net/pubs/oh/DataandSociety_MediaManipulationAndDisinformationOnline.

Zerback, T.; Töpfl, F.; & Knöpfle, M. (2021). The disconcerting potential of online disinformation: Persuasive effects of astroturfing comments and three strategies for inoculation against them. *New Media & Society, 23(5)*, 1080–1098. https://doi.org/10.1177/1461444820908530