Careful How You Teach:

Massive Open Online Courses (MOOCs), Critical Media Literacy and Misinformation

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Chapter 1: Introduction

We are living through a crisis of truth. The shared foundations of knowledge and collective agreement on what constitutes "reality" are increasingly difficult to sustain in the face of mis- and disinformation. False and misleading claims, once relegated to the margins of public discourse, now circulate widely in mainstream media, social networks, and everyday conversations. Digital platforms amplify these distortions, creating echo-chambers where individuals are more likely to encounter content that reinforces pre-existing beliefs rather than evidence-based knowledge (Broockman & Kalla, 2022, 2023; Garimella et al., 2021; Wojcieszak, 2010; Yan, 2021). The lack of engagement from government bodies to enforce any standard for social media platforms to counter misinformation has resulted in the offloading of responsibility to individual users who lack the rigorous training to be protected from rampant misinformation exposure (Isaac & Schleifer, 2025). Misinformation often spreads faster and further than factual reporting (Valaskivi, 2022; Xu, 2019; Xu & Guo, 2018), a problem now exacerbated by the rapid rise of AI-generated content, which makes fabrications even more convincing and harder to detect. In such a landscape, individuals (particularly young people) are increasingly vulnerable to manipulation, confusion, and the erosion of trust in institutions of knowledge and expertise.

The problem is especially pressing in education. Students frequently encounter misinformation not only through social media but also through peers, families, and popular culture. Because misinformation often aligns with pre-existing worldviews, attempts to correct it can trigger defensive reactions such as the *worldview backfire effect* (Bail et al., 2018), making misinformation more entrenched rather than less. Repeated exposure, even through well-meaning correction, can reinforce falsehoods via the *illusory truth effect* (Ecker et al., 2022; Pennycook et al., 2018) For teachers, this creates a pedagogical dilemma: how to address misinformation without inadvertently amplifying it. These challenges extend across

topics such as climate change, vaccination, and other politicised scientific domains, where educators are compelled to navigate not only subject matter but also the contested social and cultural beliefs attached to it.

In response to this crisis, educators and researchers have increasingly turned to media literacy as a crucial safeguard. Critical engagement with media (questioning sources, verifying claims, and recognizing biases) offers a way to inoculate learners against misinformation and equip them to navigate digital environments more responsibly. While schools and universities are embedding media literacy into curricula, distance education also plays a vital role in addressing this urgent need. Massive Open Online Courses (MOOCs), in particular, have emerged as significant vehicles of public pedagogy. They extend access to critical media literacy training beyond traditional classrooms, reaching diverse and global learners who might otherwise lack access to higher education.

This thesis is both a reflection of mis- and disinformation and a critical review of how MOOCs can be mobilized as educational interventions against mis- and disinformation. Specifically, it examines two MOOCs that address topics heavily targeted by mis- and disinformation, analyzing how they structure content, frame critical media literacy skills, and attempt to build learner resilience to their influence. By situating MOOCs within the broader crisis of truth, this thesis aims to contribute to scholarly and practical efforts to strengthen media literacy and foster informed, critical citizenship in the digital age.

Critical Media Literacy

All media communicates messages, whether overt or covert, that shape how individuals perceive and understand the world. The ability to interpret these messages requires one to be able to comprehend the content but also deconstruct the symbols, ideological frameworks, and social-cultural contexts through which meaning is being produced (Kellner & Share, 2005). Technological advancements have greatly increased the

amount of information exposure for the average citizen. Information no longer remains passively available, where individuals would have to take the initiative to go to information hubs to retrieve it. In the modern day, information is pervasive and purveyors of misinformation take a more active role by directly and indirectly targeting individuals who are most susceptible. From personalised news feeds to social media echo-chambers, critical media literacy has become an essential skill for navigating contemporary communication environments.

Kellner and Share (2019) identify critical media literacy as a vital means of empowering citizens to interpret media messages critically, resist various forms of manipulation, and engage in constructive media production as active participants in a democratic society. Kellner and Share's (2019) definition of critical media literacy encompasses "reading and writing of all types of texts, as well as to deepen analysis to more critical levels that examine the relationships between media and audiences, information and power" (p. 8). This orientation extends beyond basic media comprehension to include the critical examination of how knowledge, authority, and ideology are constructed and circulated through media systems.

Positioned with this theoretical framework, this study approaches all media as inherently embedded with implicit and explicit messages that must be decoded to mitigate susceptibility to biases, manipulation, and misinformation. In the current age where information flows rapidly, requires active participation, and is algorithmically curated, the risk of encountering misinformation and disinformation has intensified, often compounded by individuals' biases and emotions, which influence judgements, beliefs, and behaviours (expanded upon in Chapter 2).

UNESCO recognizes media and information literacy as a fundamental human right, the capacity to competently access, analyse, evaluate, and communicate with the variety of

forms of media that people encounter in daily life (Varis & Pérez Tornero, 2004, 2010). Though it does not explicitly foreground misinformation deconstruction, it emphasizes empowering citizens to recognize how media can "... filter their perceptions and convictions, mould popular culture and influence personal decisions" (Pérez Tornero, 2004; Varis & Pérez Tornero, 2010. p.73). Aligning with this perspective, critical media literacy education should not solely focus on correcting falsehoods but on equipping learners with analytical tools to critically engage with information across various media contexts. With the ultimate goal being to cultivate self-aware and informed citizens capable of identifying and challenging misleading or manipulative content in an ever evolving information ecosystem.

Purpose and Significance of the Research

Massive Open Online Courses (MOOCs) have grown in popularity in recent years as a free or low-cost option for adult university-level education on a variety of topics. Their flexibility allows participants to learn at their own pace while gaining exposure to expert knowledge and diverse perspectives. Although MOOCs are primarily marketed and designed for adult learners, their pedagogical frameworks and strategies for addressing misinformation provide valuable insights for educators working within formal K-12 grade systems. Understanding how MOOCs construct learning experiences around topics targeted by misinformation can help inform classroom practices and guide the adaptation of critical media literacy strategies for younger audiences.

This thesis critically analyses two MOOCs focused on topics heavily targeted by misinformation (news and vaccination). The first MOOC, *Making Sense of News,* instructs students on the production of news media, the factors that influence which news stories are reported, and how news is interpreted by audiences. The second, *Anti-vaccination and Vaccine Hesitancy*, informs students on the history of vaccines, how vaccines are made and function, along with debunking various popular vaccine myths. I highlight effective and

ineffective pedagogical practices, evaluate how course design fosters the teaching critical media literacy, and propose strategies transferable to public school education and course design in general. By examining these MOOCs through the lens of teaching as both preventative and corrective action against misinformation exposure, this study seeks to articulate best practices for cultivating informed, critical, and resilient learners capable of navigating misinformation both online and offline.

The significance of this research lies in its contribution to contemporary discussions of curriculum development and digital pedagogy. It aligns with the current Ontario curricular emphasis on digital and media literacy. For grades K-8, Strand A2 Digital Media Literacy of the Language Curriculum requires students to be able to "A2.3. gather, evaluate, and use information, considering various perspectives, to construct knowledge and demonstrate learning" and "A2.5. demonstrate an understanding of the interrelationships between the form, message, and context of a text, the audience, and the creator" (Ministry of Education, 2023a). Similarly, for grades 9-12 Overall Expectation A2, specific expectation A2.3 states "conduct research, considering accuracy, credibility, and perspectives, with a focus on misinformation, disinformation, and curated information, to construct knowledge, create texts, and demonstrate learning, while respecting legal and ethical considerations" (Ministry of Education, 2023b) specifically highlights efforts for countering misinformation.

The findings from this research can serve as a guideline for updating the curriculum to better address the need for critical media literacy instruction that effectively counters misinformation and disinformation. Moreover, this study analyses the pedagogical approaches of online and distance-learning formats can offer educators practical guidance for designing engaging instruction that engages learners with varying levels of misinformation exposure. Beyond formal subject areas such as science, social studies, or health, this research advocates for embedding misinformation awareness and debunking strategies across curricula

and digital learning spaces, specifically MOOCs, to support the development of informed and critically literate citizens.

Research Questions

This research responds to the general question: *How do Massive Open Online Courses (MOOCs) teach media literacy for subjects that are targeted by misinformation and what strategies do they employ to reduce the risks associated with misinformation exposure?* The specific focus of this thesis is on three key questions:

1) What are the risks involved with misinformation exposure and how do they impact teaching efforts?
2) What pedagogical tools, strategies, and assessments are employed by these MOOCs to create effective and engaging distance education courses?
3) How can educators designing online courses adapt misinformation aware practices for subjects targeted by misinformation?

Definitions of Key Terms

A number of terms are used throughout this thesis in relation to misinformation vs disinformation and associated topics like confirmation bias. In order to provide clarity for readers in distinguishing between these terms, I provide a brief definition of each. They are also addressed in more detail in the literature review in Chapter 2.

Confirmation Bias- The tendency for people to search for information that confirms their preconceptions and ignore or distort information or data that contradicts their preconceived notions and beliefs (Myers & DeWall, 2015; Nickerson, 1998; Peters, 2022).

Conspiracy Theories- A narrative of ideas that attempts to explain the causes of significant social and political events or phenomena as being orchestrated by undercover

organisations to enforce control over the the decisions, knowledge, and insight the public are privileged to receive (Douglas & Sutton, 2023; Douglas et al., 2019; Nera & Schöpfer, 2023).

Debunking- The process of presenting corrective information after exposure to misinformation content. Aims to combat misinformation by dismantling its arguments through pointing out its inherent logical fallacies and discredit the claims made within misinformation content (Chan et al., 2017; Tersman, 2017).

Disinformation- Often used interchangeably with misinformation as both definitions involve false information; however, is distinct from misinformation by its association with an implied malice and a deliberate intent to mislead audiences though the manipulation or omission of facts in order to achieve an intended goal (i.e., to sway public opinion, cause general confusion, advance a certain narrative, etc.), often associated with engineered propaganda (Wu et al., 2019).

Fake News- False information broadcast or published as news, often with political motivation. Fake news can be shared both intentionally and unintentionally (Wu et al., 2019).

Inoculation- The action of immunising someone against a harmful disease through the use of vaccination rendering that disease harmless. In reference to misinformation, inoculation is the act of forewarning and exposure to weakened examples of misinformation which are then debunked, in the effort to prime unsuspecting audiences to be sceptical to stronger forms of misinformation should they encounter them (Lewandowsky & van der Linden, 2021).

Media Literacy- The ability to access and decode the messages that exist within the various forms of media consumed; understand how these messages impact the consumer's thoughts, feelings, and behaviour; and bring about the awareness of creating media in a thoughtful and conscious manner (Media Literacy Now, n.d). In reference to misinformation, media literacy allows people to take notice of misinformation content and have the digital

literacy to analyse the claims made through a critical lens, preventing the unintentional spread of that misinformation through social circles.

Misinformation- Information that is false, incorrect, or misleading and can be used to intentionally or unintentionally deceive or spread inaccurate information. Misinformation can be used as an umbrella term to include the various forms misinformation content can take, like fake news, rumours, disinformation, unverified information, etc. (Wu et al., 2019).

Worldview Backfire Effect- A contested phenomenon that is said to occur when strongly held beliefs, especially those that reflect and impact worldviews, such as those central to one's identity (ex. biases, political affiliations, the ideas one believes to be true, etc.) are challenged and the holder of those beliefs is made to defend them, resulting in further solidifying the holder's stances on their initial beliefs rather than opening up to alternative perspectives (Lewandowsky et al., 2012; Swire-Thompson et al., 2020; Taber, & Lodge, 2006).

Organization of the Thesis

This thesis is organized into four main sections, each building towards a comprehensive understanding of how Massive Open Online Courses (MOOCs) can serve as educational interventions against misinformation.

Beginning with a literature review that provides an overview of the multifaceted nature of misinformation, examining its cognitive and social impacts on individuals and communities. It also reviews empirical and theoretical research on mitigation strategies, including debunking and inoculation methods as well as educational interventions while acknowledging potential pitfalls that may inadvertently spread or reinforce misinformation. The literature review concludes by situating MOOCs within this broader context, highlighting

their potential as scalable platforms for fostering critical media literacy training among diverse and distant learners.

The second chapter outlines the methodological approach taken, detailing the rationale for course selection, data collection techniques, analytic procedures, and the qualitative criteria used to evaluate pedagogical design and learner engagement. Followed by the results chapter, which presents the key findings derived from the analysis of the two MOOCs addressing misinformation related topics.

Next, the discussion chapter interprets these findings in relation to existing literature on media literacy and counter-misinformation strategies. It considers the pedagogical implications of the observed strategies and identifies effective approaches for designing online learning experiences that enhance critical thinking and provide resilience to persuasive misinformation.

The thesis concludes by synthesizing the major insights and proposing recommendations for educators and instructional designers. Particular attention is given to how these findings can inform future teaching practices, both within and beyond online environments, by offering guidelines for course development that confronts misinformation constructively while mitigating the risks associated with repeated exposure to false content.

Chapter 2: Literature Review

This research aligns with the critical media literacy (Kellner & Share, 2019) in that it aims to not only to inform about the variety of misinformation media out there but also provide strategies of combatting misinformation. In keeping with the purposes for this research, this literature review addresses (I) misinformation in its various forms, (II) the effects of misinformation on individuals and groups, as well as effective strategies for teaching content that is frequently targeted by misinformation. Then, I tie these strategies to critical media literacy practices and ways misinformation is combatted and the potential downfalls that can arise as a result of unintentional exposure. The second part of the literature review addresses MOOCs and effective online or distance education strategies.

Misinformation

Misinformation is an umbrella term to encompass many forms of false, inaccurate, misleading, and any other incorrect information. The Oxford Dictionary defines misinformation as "false or inaccurate information, especially that which is deliberately intended to deceive" while Merriam-Webster (n.d.) simplifies it to "incorrect or misleading information". One implies intentional malice (disinformation), while the other shows no indication of intent (misinformation). In a paper by Vraga, and Bode (2020), attempting to define misinformation, gives importance to the distinct differences between misperception (what people believe) and misinformation, as beliefs people hold that are unsubstantiated. Giving importance to the relation between people's beliefs in misinformation and its connection to supporting evidence and expert consensus. Though this definition focuses on the information's relationship to facts and highlights people holding unsubstantiated beliefs, it fails to focus on the information itself and the variety of forms it can take to influence those beliefs. Though these elements do play a role in the form misinformation can take, the word is colloquially used to reference a variety of false and incorrect information. Wu et al. (2019)

distinguishes the words misinformation and disinformation in terms of the information's intent to misinform and method of spread. Wu et al. (2019) categorise misinformation on social media into non-exclusive categories, which can be useful when attempting to understand the various forms misinformation can take.

Differentiating misinformation spread based on intentionality can help to understand how misinformation can be seen as both an unavoidable byproduct of natural human interaction and a designed tool that is actively wielded to intentionally deceive. A tool so inconspicuous that people become unknowing participants in its execution, promoting its messaging and ideas. Wu et al. (2019) defines unintentionally-spread misinformation as being unintentional to deceive its recipients, propagated by people as a need to inform their social network and trust in the information's sources. Put simply, unintentional misinformation is any false/incorrect/untruthful information that is spread without the explicit intent to deceive the receiver. This form of spread may be most familiar within social circles where the information originates from a trusted party (ex. family, friends, popular influencers, etc.) and is not independently verified by the person delivering it. Consider how often a rumour, myth, or urban legend is encountered in one social circle and repeated in another for the sake of an interesting conversation, knowing full well it has not been personally verified. There was no malice behind the repeating of that misinformation but simply a consequence of human interaction, however, even these moments of benign repetition can influence the believability of misinformation (Hassan & Barber, 2021). How often misinformation is shared within social interactions is difficult to determine but online spaces like social media sites provide records of how people interact with misinformation in general. One MIT research study published that half of their 50,000 participants were sharing misinformation online frequently because they often do not realize what they are sharing (Pennycook et al., 2021).

As mentioned previously in this section, intentionally-spread misinformation (also called *disinformation*) is easiest to understand when perceived as a coordinated effort with a specific agenda (messaging) and a target audience in mind. An example of intentionally-spread misinformation are disinformation campaigns, a coordinated group effort with an agenda to popularise a piece(s) of misinformation with the intent to disrupt, cause confusion, fuel conspiracy theories, and/or discredit any opposing perspectives about a contested topic. This form of misinformation spread is more curated to target the vulnerabilities people inherently possess (something expanded on under the Misinformation Vulnerability and Spread section) in order to achieve a malicious agenda. Consider the anti-vaxx movement and its intentional spread of misinformation surrounding vaccinations. Anti-vaxx activists were recorded at a fundraiser event intentionally propagating misinformed claims (Szeto et al., 2020). Encouraging their followers to spread disproven claims like; vaccines are detrimental to a person's health (impacting their DNA, vitality, and longevity) along with vaccines causing autism in children (Szeto et al., 2020). These efforts, in the guise of forewarning and protection, can cause parents to be weary of taking part in vaccinations, putting themselves and their children at risk of preventable illnesses (Benecke & DeYoung, 2019).

That is not to say a single person is unable to intentionally spread misinformation given a large enough platform with an audience, take for instance Alex Jones' coverage of the 2012 Sandy Hook school shootings, where for years he made claims of the shooting being a hoax and the surviving students and parents, that advocated for stricter gun laws, were hired actors (Williamson, 2022b). It was not until 2022, after years of targeted harassment from believers of Alex Jones' theories, that the victims were successfully able to take Alex Jones to court successfully. During which Alex Jones' defense team accidently leaked all of his text history to the prosecution. These text messages also revealed Alex Jones' team warning him

about “posting a false report about the coronavirus … calling the report “another Sandy Hook” for spreading disinformation about an event” (Williamson, 2022a). This blatant exchange of texts shows how intentful this disinformation campaign was and the actions of believers highlights its success. This example is closely related to the fake news category wherein the spread of misinformation is done so within the guise of news media content. Fake news can be both intentional (as in the previous example) and unintentional in its spread of misinformation. Unintentional spread often occurs during times of uncertainty and developing events, where information is reported on before it has been verified. An act originating from the need for news outlets competing to capture and cater to the largest audiences. Such instances can mislead the public rather than inform them, organically generating other forms of misinformation like rumors and urban legends.

Similar to the inherent nature of news outlets, dispensing information to their audience in a digestible narrative of events, urban legends and rumours are also spread through storytelling. Though fictional and unverified, they spread with the intent to entertain (a core component of misinformation discussed later on). Urban legends are passed down culturally and develop and grow through the passage of time with each telling, unverified information and rumours tend to surround current events. Though the contained information may have some semblance of truth, until verified it can contain false narratives that elicit similar effects as misinformation (ex. fear, confusion, hatred, etc.) which can lead people to more dangerous forms of conclusion making, like conspiracy theorising.

“A conspiracy theory is a belief that two or more actors have coordinated in secret to achieve an outcome and that their conspiracy is of public interest but not public knowledge. Conspiracy theories (a) are oppositional, which means they oppose publicly accepted understandings of events; (b) describe malevolent or forbidden acts; (c) ascribe agency to individuals and groups rather than to impersonal or systemic forces; (d) are epistemically

risky, meaning that though they are not necessarily false or implausible, taken collectively they are more prone to falsity than other types of belief; and (e) are social constructs that are not merely adopted by individuals but are shared with social objectives in mind, and they have the potential not only to represent and interpret reality but also to fashion new social realities" (Douglas & Sutton, 2023). Intentionality with conspiracy theorizing becomes difficult to determine as some believers are victims to conspiracy theories while others intentionally propagate them for personal profit (Ballard et al., 2022). Spread intentionally, conspiracy theory spread takes on similar forms as disinformation campaigns, discussed earlier. But conspiracy theories can also grow unintentionally during times of distress and uncertainty, which can then be hijacked by malicious actors with other agendas.

Events like natural disasters become hotbeds for conspiracy theories as a way to explain uncontrollable and unpredictable events (van Prooijen & Douglas, 2017). Consider the Maui fires of August 2023 resulted in conspiracy theory narratives growing. From an amalgamation of extravagant thinking and an alignment of coincidental factors lead to accusations of the fires being the intentional result of government super weapons testing and malicious actors intending to usurp Maui citizens' lands (Huang & Jingnan, 2023). Government space laser testing was one conspiracy theory that formed from baseless conclusions but often reemerges when wildfires occur (Doan & Delzer, 2025). Others stemming from correlational factors such as Oprah Winfrey hiring a personal team of firefighters to protect her property right before the start of the fires, something climate scientists predict is a yearly threat, was being touted as evidence of her involvement in its spread. These conspiracy theories ended up being popularised online enough to hinder fire recovery efforts, as Maui's citizens chose to disregard the recommendations of authorities and returned to what was left of their properties to prevent them from being taken (Huang & Jingnan, 2023).

Misinformation campaigns can also use covert components to make themselves seem as underdogs fighting against an oppressive system, giving themselves a veneer of being a grassroots ideology, being promoted and popularised by an underclass, a concept known as crowdturfing. A term derived from astroturfing, which refers to when campaigns hide their source of sponsors and supporters to present a guise of a people-led startup, crowdturfing falsifies the crowds used to campaign for a cause. Though crowdsourced (coming from people within a community or movement) they are hired (rather than volunteered) as concerned participants popularising ideas that may contain misinformation to promote the agenda or ideology of an organisation. Leading the unaware populace to believing the campaign is not an organisational effort, but instead one that was popularised by people within their community. Though there was a time where malicious actors could hire people to create fake accounts for this task, it is now easier to hire organisations that make the use of bots. This is most popular on social media sites where groups can be created with anonymous members to initiate smear campaigns, spread propaganda, and/or popularise misinformed ideas and give them credibility through the buying of followers and likes (McAfee, 2013). One of the most popular examples of this was during the 2016 election where Russian bot accounts were found to be sharing manipulated content online, running disinformation campaigns, organising physical political rallies in swing states, and polarising members of either party, to sway voter opinions and manipulate America's democratic elections (Abrams, 2019).

Recent advancements in technology now allows for people to impersonate voices of anyone with only a 30 second clip, giving rise to 'vishing' or voice phishing scams. People have already been targeted by such voice replicating systems. Reports of the elderly receiving calls from what seem to be family members asking for financial help are misled with the use of voice cloning AI, are growing in number (Dudha, 2023). Many online creators are now

offloading their content creation to AI, claiming a 30 second clip of voice and video is all it needs to train and produce online video content (Schlott, 2024). AI continues to produce errors, unlike a search engine that retrieves relevant information from online spaces, AI Large Language Models (LLMs) show a tendency to produce false, incorrect, or misleading results, while presenting them as legitimate, verified information (IBM, 2023). Presenting further opportunity for misinformation to be spread and encountered by vulnerable individuals. This becomes a compounding issue when

Russian bots were detected spreading misinformation and pro Russian propaganda on social media sites like Meta, TikTok, and X (formally known as Twitter). Leaked documents reveal those identified misinformation profiles make up only one percent of the total number of profiles in effect (Menn, 2023). This form of misinformation spread is not limited to political efforts but is also used by influencers and hate campaigns. Trolls (bots or authentic users) are accounts that explicitly spread misinformation, hate speech (abusive content that targets a specific group of people spewing threats or prejudice), or provocative content online in the efforts to cause turmoil in public discourse. The sole intent for trolls is to disrupt any constructive discussion about a topic and elicit extreme emotions resulting in increased tensions between opposing sides while rousing online users to exhaust their energy arguing aimlessly against bad faith arguments as a form of entertainment (Wu et al. 2019).

Bots and trolls can use spam (the sharing of unsolicited information with the aim to overwhelm the recipients) very effectively as a form of spreading misinformation in environments like social media, that already have an abundance of content. Spamming certain misinformation content online through various bot accounts can not only popularise a certain message, but can also give it credibility to unsuspecting users, distracting from topics that deserve attention and preventing any formation of constructed efforts for a cause (Broniatowski et al., 2018).

Misinformation Vulnerability and Spread

Research consistently shows some groups of people to be more susceptible to misinformation than others. For example, older users of social media were shown to share seven times as many articles from fake news domains than younger age groups (Guess, Nagler, & Tucker, 2019). Though it may be easy to conclude this as a result of ageing related cognitive decline, researchers note that this does not fully explain their susceptibility to misinformation. Other researchers emphasise the role older adults embody as being newcomers to the age of social media while possessing poorer digital literacy, leading to difficulties noticing the various forms of misinformation they encounter (ex. manipulated images, sponsored content, etc.) (Brashier & Schacter, 2020).

Political affiliations have also shown to influence the likelihood of someone falling for or sharing misinformation, findings suggest conservative leaning individuals are more likely to share articles from fake news domains than liberals or moderates (Grinberg et al., 2019; Guess, Nagler, & Tucker, 2019; Roozenbeek et al., 2020). While it may be easy to conclude that there exists a clear political bias that can be used to determine who misinformation will influence, further research suggests it may be a result of *lazy thinking* or the lack of analytical thinking (Pennycook & Rand, 2019). "More analytic individuals were also better able to discern real from fake news regardless of their political ideology, and of whether the headline was Pro-Democrat, Pro-Republican, or politically neutral; and this relationship was robust to controlling for age, gender, and education" (Pennycook & Rand, 2019). This notion aligns well with evidence that suggests higher media literacy and critical thinking individuals correlating with a greater resiliency towards believing in misinformation (Daunt et al., 2023; Jones-Jang et al., 2021; Roozenbeek et al., 2020). Since media literate individuals are able to analyse and are more likely to critically view the content they encounter makes them more suspicious of radical claims made within misinformation.

Improving media literacy skills show to nullify the negative influence that factors such as age and biases hold over a person's susceptibility for misinformation. Creating a more media literate public can be achieved through increased attention and usage of Massive Open Online Course (MOOCs) that can provide such training.

It may be too simplistic to think that falling for misinformation is a result of being uninformed or uneducated. Anyone can become prey to misinformation because it does not rely on logical reasoning to propagate, but rather emotional arousal and personal biases among other psychological factors (Ecker, et al. 2022; Horner et al., 2021; Roozenbeek et al., 2022; Roozenbeek & van der Linden, 2019; van der Linden et al., 2017). Consider what occurred during the COVID-19 outbreak amongst doctors in online spaces. Those considered the most informed on medicine and to whom the public trust to refer to for accurate vaccine information were recorded spreading doubt and debunked claims on Doximity. Doximity, a social media app much like LinkedIn which specifically caters to doctors, was littered with misinformed claims. The app provides no anonymity since users are required to register using their practitioner licence, a certification that requires years of higher education to achieve. Which makes claims like the following even more disquieting. "To mandate a vaccine that has already killed over 4,000 is akin to murder" amongst other debunked claims made by Fox News host Tucker Carlson were parroted under the comment sections of scientific vaccine articles (Levy, 2021). Doximity, unlike the typical public social media site, populates user's feeds with their medical field related research articles. During this time articles related to vaccines and masks showed high comment engagement, where claims of masking children being ridiculous to "a form of abuse" were found amongst other conspiracy theory claims (Lyons, 2021). The presence of such claims in the face of overwhelming scientific evidence and public health organisation guidelines showing masks as an effective preventative measure against the spread of COVID-19, all while there not yet being a COVID-19 vaccine approved

for children under 12, accentuates how the spread of misinformation is not hindered by a degree.

The Causes of Misinformation Spread

Before the advent of global communication people would have had to rely on the written words of scholars and the word of mouth of storytellers to attempt to piece together a coherent understanding of events. With the popularisation of technology giving the ability to record and share in real time the events that are unfolding gave people the notion that the truth of things was now more tangible than ever before. Anyone that had questions about events that took place and wished to relive them could simply replay the recordings of the events or the testimonies of the people present and have a better understanding of the truth. Though, it is understood such a notion is naive at best, not only because recordings can be doctored and witness testimonies remain unreliable, but also because events that have clear documentation have come under the line of questioning. When Jewish photographers like Henryk Ross and Mendel Grossman documented the atrocities of the Holocaust they did so with the intent to prevent future generations from denying its occurrence and making the same mistakes that lead to giving rise to Nazi ideology. Yet the existence of Holocaust denialists and their claims that the Holocaust is a myth, fabrication, or exaggeration continue to reverberate on social media sites (Suciu, 2023). Contrary to the existence of the large amounts of media recordings and data available as evidence around a particular topic or world event it is those same events that are often contested and give rise to the most ludicrous of conspiracy theories. From the Holocaust, to the JFK assassination, to the effectiveness of vaccines, no amount of recorded evidence has been enough to prevent conspiracy theories and misinformation from garnering an audience and spreading through the same channels used to share information (more prominently through social media sites). Why is that? How

can misinformation monopolise communication and information networks to weave their way into everyday conversations and so easily associate itself with any topic?

Narratives are another simplification method human brains use to be able to digest and recall large amounts of information containing multiple facets. Narratives allow people to effortlessly compact events in chronological order that provide answers to questions like what, who, where, why, when, including any takeaways that apply to the listener like lessons learned, all while maintaining an understanding of the various complex relationships held by all those involved. A narrative as defined by Lee, et al. (2020) is any "audiovisual movies, spoken stories, and written stories—consist(ing) of multiple interrelated and temporally unfolding events which are rich in semantic and emotional content" (p. 111). This definition, used by Lee et al. (2020) in a publication on "What narratives tell us about the neural bases of human memory", provides a good base of understanding how narratives exist in various forms of media and consist of complicated events that can elicit an emotional response from the interpreter. Put simply, narratives are stories that consist of events, characters with goals or motivations, and possess a structure; a beginning, middle, and end. Much like a story, however a narrative differentiates itself by eliciting questions like how were the events told, the choices made in its telling or presentation, and what are the implications (implying an underlying motive behind its exposition). The same story can be told in different ways and present completely differing narratives. Human brains do more than store the events in chronological order but also the relationships between the characters involved along with one's own emotional responses to those narratives. All of which play a role in solidifying a narrative to memory. A more effective narrative tends to also elicit an emotional response/resonance from the audience, either by the events themselves being threatening in nature or the characters involved being sympathised with by the listener. Assigning a story to seemingly random events and structure information in a meaningful way, also allows

complicated information to spread between groups of people. Narratives have been a key tool because of their effective mode of transference from person to person, containing complicated bits of information that influence decision making. Because of its close link to memories and learning it has been used as an efficient method of passing down complicated moral lessons to spread through a large population and even through generations. Stories of myths, gods, and legends told to children are often used as conduits for instilling moral lessons and caution at an early age. These characteristics are common within many of the modes through which misinformation spreads, particularly urban legends, rumours, and most prominently, fake news and especially conspiracy theories. A narrative explanation of events can provide a certain level of comfort during times of distress. Knowing that one can explain the reasoning behind a situation is a small way people attempt to assert a sense of control in unpredictable or uncontrollable environments.

Psychological Impacts of Misinformation

The media consumed on a day-to-day basis has the ability to reaffirm or challenge an individual's beliefs. It is the aversion to contrary ideas and comfort in the affirmation of one's own perspectives that can make one vulnerable to the impact of misinformation on worldviews (expanded upon under Worldview Backfire Effect). The more frequently a certain idea is repeated, the greater the likelihood of the ideas and notions being seen as truthful, a concept known as 'the illusory truth effect' (Hasher et al., 1977; Hassan & Barber, 2021). As Ecker et al. (2022) succinctly summarises, "This illusory truth effect arises because people use peripheral cues such as familiarity (a signal that a message has been encountered before), processing fluency (a signal that a message is either encoded or retrieved effortlessly) and cohesion (a signal that the elements of a message have references in memory that are internally consistent) as signals for truth, and the strength of these cues increases with

repetition" (p. 14). This repetition can occur at a greater level in online spaces where information has opportunities to spread uncontested and be hidden away within private groups. These private groups are populated with like minded users that provide no resistance to the claims made and gives misinformation an opportunity to grow and fester like mold in undisturbed environments. Within these groups of isolated like minded individuals surrounded by unchallenged ideas, discussion network homogeneity begins to take form, where the network of people connected to users share similar ideas and talking points, increasing the likelihood of the spread of misinformation (Wojcieszak, 2010; Yan, 2021). These private spaces provided by social media sites can accumulate groups of individuals who all share similar beliefs and ideas which are reinforced through the content that is shared. The curation of the content continues to reaffirm group biases, creating 'echo-chambers' where counterpoints and alternative viewpoints are limited but misinformed content is repeated and reaffirmed. A similar comparison can be to the groups that are formed around political parties or those who rely heavily on one specific news network, the homogeneity in one's media diet or associated political party can create similar 'echo-chambers' which can lead to greater polarisation created from the agendas enforced by each (Broockman & Kalla, 2022; Garimella, et al., 2021). Once misinformation has instilled itself within a person's belief systems and therefore their worldview, correcting them can be extremely difficult without a considerable amount of resistance and potential for a backfire effect to take place (discussed further in Teaching to Misinformation and Worldview Backfire Effect).

Though multiple studies reaffirm the notion that higher educated individuals are less likely to be impacted by misinformation (Hwang & Jeong, 2023), misinformation has shown not to rely on avenues of logical reasoning to be believed or spread, something that will become clearer throughout the literature review. Misinformation has shown to use existing cognitive shortcuts like pathways (cognitive biases, personal worldviews, familiarity effect,

emotional resonance, etc.) that quicken the acceptance of misinformation, while others work to maintain those misinformed beliefs (confirmation bias, association with identity, groupthink, etc.).

Confirmation Bias

It may be tempting to accuse those who fall for misinformation of being unable to conduct their own research; however, not possessing the correct media literacy skills can lead many towards answers that confirm their initial misunderstandings. Confirmation bias is the tendency for people to seek or overvalue information that confirms their preexisting beliefs and ignore or misrepresent information that contradicts them (Myers & DeWall, 2015; Nickerson, 1998; Peters, 2022). Though it has been hypothesised to be a necessary adaptation to ensure cognitive consistency and maintain a strong personal identity (Haidt, 2012), such resilience to contrary views can lead to alignments with ideas that are not backed by factual evidence. A study of people attempting to conduct their own research showed an increase in the belief in the veracity of misinformation rather than a decrease (Aslett, et al., 2024). This finding implies there is confirmatory bias in the research individuals conduct, one that aims to reaffirm one's own beliefs rather than challenging them. Statistics on media consumption show disturbing trends. Specifically, 58% of people obtain their news from social media; 80% of middle school teens can not differentiate between sponsored content and real news articles online; and 45% of teens expressed being overwhelmed by the amount of information they encounter online (Lindner, 2023). Other surveys conducted show that participants who self-identify as *critical thinker[s]* but lack the training in science and media literacy were 63% more likely to fall for conspiracy theories (Reboot Foundation, 2022). The lack of proficiency in media literacy or understanding of the scientific method results in people being swayed by their prejudices and biases; these media consumers are more likely to accept presented narratives that align with their prior beliefs. Or worse yet, when faced with

information that runs counter to their initial understanding, people may find it easier to not seek out alternative opinions and stop caring to find the truth. When taken to the extreme, "The problem is not that some people might believe something that's not true. The problem is that [eventually] most people might stop caring if anything is true"(Siva Vaidhyanathan, Director, University of Virginia Center for Media & Citizenship, Guggenheim Memorial Library, 2024).

Worldview Backfire Effect

"A worldview is a collection of attitudes, values, stories and expectations about the world around us, which inform our every thought and action…A worldview is how a culture works out in individual practice" (Gray, 2011). This definition effectively encompasses the variety of factors that shape the outcome and influences of one's worldview, specifically how it implies the reciprocal nature of influence between information and its interpretations that shape people's understandings. Oftentimes the ideological beliefs come to define a sense of self-identity which can become threatened when refutations or counter-evidence is presented, that opposes these deeply held beliefs (Trevors et al., 2016). There exists a cognitive need to organise the complex nuances of the world into simplified categories, in order to make the rapid processing of both social and physical environments easier, which can inadvertently lead to misinformed associations, oversimplification and generalized ideas like stereotyping. This creates fertile ground for social bias, prejudice, and discrimination (Zhang et al., 2023).

A worldview backfire effect is a form of cognitive bias that occurs when people encounter information that threatens the foundational beliefs on which they construct their worldviews, resulting in polarisation rather than a correction to those understandings. Nyhan and Reifler (2010) observed such a backfire effect when they had participants read mock news articles that contained a misleading claim from a politician or a misleading claim, and a correction. They noticed that of the participants that identified themselves as far right from

the center, ideologically, experienced the greatest amount of backfire effect from the correction. "...conservatives who received a correction telling them that Iraq did not have WMD (Weapons of Mass Destruction) were more likely to believe that Iraq had WMD than those in the control condition" (Nyhan & Reifler, 2010. p. 315) In contrast the non-conservatives were found to have responded as expected to the correction, decreasing in their agreement with the misleading statement. Nyhan & Reifler (2010) explain that if the ideologically right leaning participants simply distrust the media they could simply ignore the corrective information. However, the fact that they polarized further towards their initial views suggests something greater than distrust. Nyhan and Reifler (2010) suggest this is a result of goal-directed information processing, which, similar to confirmation bias (Myers & DeWall, 2015; Nickerson, 1998; Peters, 2022), states that humans tend to evaluate information with a bias favouring their pre-existing views. Such polarisation in the face of information that is counter to one's political ideology is consistent with other studies (Bail, et al., 2018; Taber & Lodge 2006). Resistance to change is predictable but concerns heighten when the traditional methods used to break down misinformation end up polarising a person further towards reinforcing misinformed beliefs.

Other studies on knowledge revision and the backfire effect suggest the cause of such a backfire effect being related to self identity being threatened, more specifically the emotions that occur when it is (Eccles, 2009; Trevors, et al., 2016; Nauroth et al., 2014, 2015). "To accept the argument of a refutation means to reject some valued aspect of self-concept. Thus, it is speculated that refutations are perceived as identity-threatening and trigger ego-protective responses that motivate individuals to restore a sense of self-worth" (Trevors, et al., 2016, p. 342-343). The reaffirmation of personal identity and the avoidance of negative epistemic emotions (emotions that do not elicit curiosity and enjoyment) are

recommended approaches to decrease the chance of a worldview backfire effect does not occur (Ecker et al., 2022; Trevors et al., 2016; Nauroth et al., 2014, 2015).

Cognitive Dissonance

Cognitive dissonance theory echoes many similar sentiments about emotional responses to corrective information, suggesting that people feel unpleasant tension and discomfort when their beliefs do not match their actions (Festinger, 1957). For example, when members of a cult predict a doomsday to occur and perform actions in order to save themselves from destruction (actions that may have cost the members financially, lost opportunities, freewill, etc.). When the predicted day comes to pass uneventfully, the result can be a lot of mental turmoil. Cognitive dissonance would have members question what all their efforts were for, causing some members disillusionment from the beliefs of the cult while others may find it easier to appease the dissonance by concluding that the practices of the cult saved Earth from a doomsday. Consider the recorded instance of Robert Fitzpatrick, a follower of Harold Camping who predicted Judgement day to occur May 23, 2011 at 6pm, who spent his life savings promoting awareness for this apocalypse theory. Fitzpatrick was proven wrong, surrounded by cameras and non-believers, when May 23 came and passed (Haddon, 2011). Such cognitive dissonance lead to Camping locking himself away for some time and changing the date to a later one, while Fitzpatrick, who had invested over $300,000 into the campaign, said in a 2021 phone interview that he had no regrets and that "I think that's what the Lord wanted us to do and me to do," (Gafin, 2021). This allegorical example shows how much easier it is to cherry pick facts, opinions, and ideological stances that reaffirm one's worldviews rather than changing them.

Cognitive dissonance theory claims that people aim to avoid information that contradicts their deeply held beliefs (Festinger, 1957). Encountering information that conflicts with their belief systems and contradicts their worldviews requiring them to defend

their perspectives can lead to a polarising effect that strengthens their own belief systems no matter how reliable, logically sound, and scientifically tested an argument or evidence put forward may be (Bail et al., 2018). The role narratives play in the spread and retention of misinformation and conspiracy theories can be adapted by corrective messaging to reach those who do not respond to statistical evidence. Using anecdotal examples along with statistics and narrative involvement in scientific messaging is crucial. As argued by Lazić and Žeželj (2021), who suggest communicators "use the advantages of the narrative format to present medical and epidemiological evidence, and bring such evidence together with stories" (p. 27). Arguing that this method would increase corrective information's persuasiveness and comprehension. Lazić and Žeželj (2021) also suggest that scientific evidence should be presented before personal and cultural narratives to maintain an ethical approach to preserve agency and autonomy for non-scientific individuals.

Role of Emotions in the Resistance to Change

Emotions play a key role when it comes to navigating social interactions. Not every interaction, opinion, and fact encountered can be analysed systematically, so there is a reliance on emotional intuition, biases, and prior understandings (worldviews) of the world to make sense of them quickly and with little effort. Brain scans also show that people make decisions subconsciously (emotionally) and then work to justify them later (logically) (Haidt, 2021; Lerner et al., 2015; Soon et al., 2008). This can be a challenge when it comes to correcting instilled misinformation with factual and logical arguments. Cook (et al., 2017). Miller (2020b) and Lazić & Žeželj (2021) all suggest an approach with a consideration of the emotions of those echoing misinformation talking points, while affirming their worldviews. Haidt (2021) also recommends appealing to the emotion before introducing any logical argument as it has shown to open people up to ideas that are counter to their beliefs. Designing an approach that targets Ethos (an appeal to character) and Pathos (an appeal to

emotions and ideals) before engaging through Logos (an appeal to logic) can be more effective and built into the design of counter information campaigns.

The Role of Narratives and Emotion in Fake News

The impact narratives have on news sources and how it can hinder reliability is explored, before analysing how narratives aid conspiracy theories in their creation and believability. News coverage has the challenge of distilling complicated issues into tangible stories for their audiences, however, much like any business they have an obligation to increase their own sales and profits in lieu of their competitors. When events occur it is expected of news outlets to provide independently verified facts and potential cautions that may accompany them. News reporters and writers do so by reporting on stories that answer the questions the public may have about events. Covering events as a storyteller might, they have characters (individuals impacted by situations), a clear narrative of the events that have taken place, and the takeaways (understandings that apply to the readers) that the reader can place themselves in. As a result of the public's instilled trust in the news they consume being truthful, news stories elicit emotions from the public, may they be fear, concern, curiosity, etc., that can provoke people into action. Take for example when news stories first spread covering cases of how Covid-19 was spreading through groups of people and the effectiveness of social distancing, many may have been inclined to keep their distance from others resulting in dampening the speed of spread amongst people. In this instance narratives were used to influence people's behaviour in a beneficial manner. However, it must be remembered that narratives do not work in tandem with the truth. Information spreads using narratives as a mode of transmission whether or not the information they carry is factual or fictitious, beneficial or destructive, to those who receive it. Conversely, consider the impact that news narratives surrounding Covid-19 vaccinations (including anti-vaccination posts that mimicked news stories on social media) had on the larger public, when stories about the

uncertainty of the effectiveness of vaccines were popular it hindered global efforts to vaccinate the public (Fowler et al., 2022; Ngai, Singh, & Yao, 2022).

Misinformation Spread and Social Media

Social media has played a large role in the dissemination of misinformation, built into its design is to engage its users but holds no accountability in the information being shared being truthful or not (Del Vicario et al., 2016). Guess, Nyhan, and Reifer (2020) found that during the 2016 elections, between Hillary Clinton and Donald Trump, less than half of all Americans using social media were guided towards untrustworthy websites. Facebook was shown to be the top offender. Comment sections alone have been identified as being responsible for the development and spread of conspiracy theory circulation through the formation of echo chambers, online spaces where opinions are homogeneous and are spread uncontested (Yan, 2021). Considering the rapid spread misinformation can have on social media, may lead one to question why scientific information does not spread as effectively. It should come at a great concern to anyone that misinformation and anti-vaccination content receives more online attention (in the form of reactions, comments and shares) then pro-vaccination content and scientific information (Lazić & Žeželj, 2021; Xu, 2019; Xu & Guo, 2018). Especially when evidence shows that people tend to turn to social media specifically for health information (Marar et al., 2019; Wang et al., 2019). One MIT study done on 50,000 participants to determine the intentions behind misinformation shared on Twitter (rebranded as 'X') concluded that social media users are distracted from concerns about the accuracy of the news content they choose to share, nor do they show a firm belief with its messaging (Pennycook et al., 2021). Pennycook et al. (2021) suggest this is a result of how social media is designed to incentivise engagement rather than accuracy. Users also tend to share information they do not believe in, incentivised by the immediate social

feedback engineered into social media sites. This ambiguity in intention leaves viewers more vulnerable to misinformation like rumours, satirical articles, trolls, etc. This opens up opportunities for misinformation to be exposed to unsuspecting users.

An assumed propellant for misinformation narratives dominating online spaces and user attention was the difference in messaging used by scientific information virus pro- and anti- vaccination content. Pro- and anti- vaccination content that used emotion based narrative approaches (with anecdotal examples) have been shown to outperform scientific information's method of stating plain facts (Xu & Guo, 2018). Even then, anti-vaccination content trumped pro-vaccination content, the difference in messaging being that anti-vaccination content uses more negative emotion terminology. Negative emotion terminology, words and statements that are inflammatory, cause fears and anxiety (statements alluding to eminent danger or heightened caution), show disagreement or prejudice towards groups of people, have been shown to spread further online than most other forms of messaging, "the use of negative language was associated with a greater number of retweets…"(Schöne, Parkinson, and Goldenberg, 2021).

Conspiracy Theories and Online Spaces

One of the theorised causes of misinformation/conspiracy theory spread online is its nature of being more *interesting* or *eye-catching* and having the potential to be a good topic of conversation to gauge other people's opinions about (Valaskivi, 2022; Xu, 2019; Xu & Guo, 2018). However, during times of great uncertainty, especially in places where information is spread unhindered, people are more prone to fall for misinformation as it is very effective at alleviating the gaps in understanding that form through inconsistent messaging (Miller, 2020b; Faraji-Rad & Pham, 2017). Conspiracy theories rely greatly on a narrative approach to spread and therefore often have overlapping archetypes like stories of old, which contain characters (large companies, shady political organisations, and/or a

rebellious underdog group) who perform actions (amass profit, cover up information, and/or fight against oppressive regimes) and contain themes of the victimhood. A minority group of people encountering *truths* that are hidden by the oppressive ruling power to maintain their control over the population. An example of this is evident in the arguments put forward by Flat-Earth theorists, who discredit any evidence and explanations put out by governmental or scientific authorities and put forward their own testing methods that are often contrary to the rigorous nature of scientific testing. Resulting in the conclusions that fit their theories, like personal observation, for their listener to apply and reaffirm their beliefs. They also take on a persecuted (victimised) stance when encouraging the listener to unite with other believers to fight against this perceived oppression (Lazić & Žeželj, 2021). These approaches often play into the emotional appeal of being a conspiracy theorist, where believers and followers feel a sense of meaning, importance, and purpose (Abalakina-Paap et al., 1999; van Prooijen, 2022; van Prooijen & Douglas, 2017).

Conspiracy theories capitalise on the uncertainty created after socially significant events and embed themselves within the gaps formed through inconsistent information (Faraji-Rad & Pham, 2017; Miller, 2020b). They instil themselves within the belief systems of the susceptible, claiming to have the answers that others are unwilling or unable to accept fear (Miller, 2020b). Conspiracy theories embed themself within the belief systems to such an extent that any information that attempts to counter these beliefs is dismissed in favour of grandiose stories (Flaskerud, 2021). It is much easier to believe the world is controlled by a legion of bad actors than it is to satisfy the cognitive dissonance created by the unpredictability of a global pandemic. It is easier to refrain from acting (taking a vaccine shot or encouraging a loved one to do so) than it is to promote taking a shot which has its legitimacy questioned and its long term adverse effects unknown by those in your vicinity. Easier to distrust novel methods of vaccine development than to take the time to understand

its function. Thus, misinformation and conspiracy thinking infiltrates through an emotional appeal (fear, uncertainty, anxiety, etc.) and capitalises on the incomprehensible, to edge its way into the doubts created within gaps of understanding and solidify into more radicalised belief systems through a narrative of misinformed events.

Teaching to Combat Misinformation

When it comes to teaching misinformation, instructors must stay cautious as to not expose their audiences to misinformation without properly priming them prior to their exposure. The provided forewarning allows the student to view the following information (misinformation content) through a sceptical lens alleviating the chance for the examples to be taken as factual or truthful. Proceeding by debunking the harmful claims and walking through some of the questions that may arise that can leave feelings of uncertainty when left unanswered, creating a gap in understanding that could potentially be filled by other misinformation content. One of the more pervasive characteristics of misinformation is that it has shown to instil itself within the information gaps that are formed during times of crisis and uncertainty (Faraji-Rad & Pham, 2017; Miller, 2020b).

Especially the gaps formed through inconsistent messaging, as seen during the beginning of the Covid-19 pandemic concerning masks. The CDC went back and forth between enforcing masks as a preventative measure and saving them for emergency healthcare workers (Netburn, 2021). Though the rationale behind this was one rooted in logical reasoning, it only came off as uncertainty and inconsistency, leaving the public questioning their effectiveness and the credibility of the recommendations made by the CDC, while empowering the voices of anti-maskers and anti-vaxxers (Laurent-Simpson, 2023). There also exists the issue of misinformation being extremely difficult to correct even after it has been exposed to its falsehoods. Studies have found the presence of an “illusory truth

effect" that prevents misinformation from being easily debunked or replaced by corrective information (Hasher et al., 1977; Hassan & Barber, 2021). This effect can be seen when people encounter misinformation frequently resulting in the misinformation seeming more truthful as a result of memories showing a bias for repeated information, even though that information has been debunked (Ecker, et al., 2022). Thus, researchers have developed methods of priming and debunking misinformation that keep in mind these potential downfalls in order to address misinformation whilst preventing it from gaining further ammunition to grow within the minds of individuals. Prioritizing accurate information, minimizing the repetition of false claims, and repeated varying debunking strategies have been hypothesized to minimize this effect (Paynter et al., 2019). One study found that pre-exposure warnings that alerted participants that some of the claims they are about to be exposed to would be false (a form of inoculation) to significantly reduce the presence of the illusory truth effect (Jalbert et al., 2020).

Teaching Against Misinformation

Considering the variety of forms misinformation can take, the countless ways it can influence a person, and its unavoidable nature in online spaces, makes the likelihood of students within a classroom already having been exposed to misinformation about any instructional topic, highly likely. In a 2022 survey conducted by Saunders (2022) 67% of the 86 teachers that responded reported that they at some point had to address an issue of mis/disinformation within their classroom. Another survey found that most responding teachers did not have many experiences with students bringing up mis/disinformation in class discussions or on assignments but did have concern with their sources (Slaughter, 2023). Slaughter (2023) describes a teacher's experience where their conversation with a student about whether or not Trump is a credible source to use to persuade someone who disagrees with them on a topic, the response was "Frankly I don't care what they think, they can get on

the truth train or get run over" (p. 74). Though Slaughters (2023) states this instance is an uncommon one, it shows how misinformation finds its way into classrooms through politically charged discussions and topics. More importantly, how they can arise accompanying topics that are polarizing or have been politicized and intertwined with identity (Eccles, 2009; Trevors, et al., 2016; Nauroth et al., 2014, 2015).

When it comes to teaching misinformation, a core focus is to not unintentionally expose susceptible students to the misinformation and end up creating further confusion resulting in a greater alienation from the truth. While teaching counteractive methods for misinformation spread, students are likely to be exposed to numerous falsehoods, some they may have already believed and others that may yet be new to them, thus instructors must stay wary of the illusory truth effect as an ever looming presence during this process (Hasher et al., 1977; Hassan & Barber, 2021). The three core elements to teaching preventative measures for misinformation that will be used to gauge the coverage of the three Massive Online Open Courses (MOOCs) are the preventative (inoculation), the remedial (debunking), and the covertly resilient (worldview backfire effect).

Inoculation. A method much like vaccination, inoculation can be seen as a preventative measure of psychological resilience built through controlled exposure to misinformation. The term inoculation refers to rendering something that is harmful into something that is harmless, analogous to the process of vaccination. The social-psychological theory of attitudinal inoculation (Papageorgis & McGuire, 1961) requires that the audience be forewarned about their exposure to misinformation, given factual information and context about the subject, then finally exposed to a reduced form of misinformation that can be easily debunked (van der Linden et al., 2017). This can come as a primer, where factual information about the subject is explained that will later help in the debunking process, following a warning prior to exposure to a piece of misinformation that is simple enough to be debunked

easily. Exposing the contents of the misinformation for its various fallacies and then finally debunked using factual information. The process of inoculation attempts to reduce the believability and spread of misinformation through controlled exposure to a weakened form of misinformation prior to ever encountering it unwarranted outside the classroom. When someone is exposed to misinformation that has been shown to be debunked they are more likely to be more cautious when they encounter other unsubstantiated ideas and thus less likely to have misinformation be accepted without critical analysis.

This prebunking method has been shown to be effective when concerning some topics like anti-vaccination (Jolley & Douglas, 2017; Roozenbeek, et al., 2022). While debunking, the post exposure to misinformation correction method was more effective for other topics like misinformation related to fair trade (Tay et al., 2022). Developed correctly it can be used to work against multiple manipulation techniques misinformation uses to spread through social circles, which includes online spaces. Techniques like "emotionally manipulative language, incoherence, false dichotomies, scapegoating, and ad hominem attacks" (Roozenbeek et al., 2022) are methods through which misinformation increases its own legitimacy to those who are not practised in recognizing and decoding such logical fallacies. Inoculation theory suggests that people could be trained to spot such false arguments and be made less susceptible to spreading and embedding the misinformation into their personal worldviews (Papageorgis & McGuire, 1961; Roozenbeek et al., 2022; Roozenbeek & van der Linden, 2019; van der Linden, et al., 2017). Examples of this method were prevalent on social media sites like Facebook and Instagram for a short while during the height of misinformation spread in 2016. For a while users had to actively click and acknowledge a pop-up screen warning them the following content has been marked as misinformation with links provided to fact checking sites containing corrective information. Such procedures can be seen as a preventative measure, so that users of the social media site are not exposed to

misinformation without a forewarning, and heightening caution when and if the user chooses to view that piece of content. The consistent exposure to pre-bunking of popular misinformation stories had the potential to bring awareness to and train the general public against misinformation claims encountered in online social spaces (Roozenbeek et al., 2022; Roozenbeek & van der Linden, 2019; van der Linden, et al., 2017). However, as of 2025, Meta CEO announced it will abandon this fact-checking program despite research showing global effectiveness of fact-checking efforts (Porter & Wood, 2021; Watt et al., 2025).

This controlled exposure also aims to make one less susceptible to misinformation and spot misleading persuasive techniques used by other topics of misinformation. Cook et al. (2017) found that when participants were inoculated against misleading strategies (like "false balance", giving the contrarian minority perspectives equal coverage as the scientific majority) used by the tobacco industry to confuse the public about the scientific agreement on the harm caused by tobacco. Inoculated participants showed resistance against the strategy when it was used to bolster the topic of climate change misinformation. These results show that critical media literacy training may provide skills that are transferable to various forms of misinformation.

Inoculation consists of two components; 1) providing a warning of the existence of misinformation surrounding a topic and the methods through which it is being spread; 2) exposure to a piece of misinformation that has been debunked to be used as an example and provide arguments that expose the fallacy behind its logic (Cook et al. 2017). Though this strategy may not always involve teaching the specific steps on how to debunk a piece of misinformation and rendering it innocuous (harmless), it does provide the tools one can use to debunk popular misinformation. These tools can be used to practise debunking of other misinformation content.

Debunking. Debunking differs from inoculation in that debunking is a post exposure effort while inoculation aims to be a preemptive measure. When misinformation has already spread, a correction of that information in order to expose its fallacies or a correction of the facts stated, is referred to as debunking. Debunking has been the standard practice when dealing with misinformation, especially myths, rumours, and fake news. There are many approaches to debunking, the most common of which involve displaying a piece of misinformation and all its encompassing arguments then going about breaking them down exposing their incorrectness, their fault(s) in logic (identifying logical fallacies), their misrepresentation of facts or data, or simply providing an alternate perspective. These debunking strategies are commonly encountered in the news or even partaken in such debunking methods within social conversation, where contrary information about an event or popular myth is presented with the intent to sway beliefs.

Considering the resilient nature of misinformation, some well informed practices in combating misinformation have emerged. However, the effectiveness of these debunking strategies (inoculation and debunking) have shown to be variable. As studies reveal that debunking is not always enough to combat a piece of misinformation, as sometimes no matter if the misinformation has been debunked it still has a chance to persist, especially when it has been reaffirmed and associated with one's morals, belief systems, or worldviews (Ecker & Ang, 2019; Hassan & Barber, 2021; Nyhan & Reifler, 2010).

Ecker et al. (2022) summarise some of the best practices that have emerged for debunking strategies. The first and most important of which is to provide enough factual information that can present an alternative detailed explanation for why the piece of misinformation is incorrect (Chan et al., 2017; Ecker et al., 2022). As to avoid the "illusory truth effect" (truthful as a result of seeming familiar), it is ideal to lead with the corrective

information rather than repeat the misinformation claims (Hasher et al., 1977; Hassan & Barber, 2021).

Second, the intention is not to imply that misinformation must not be discussed. Misinformation should be referred to (after a warning is given) in order to highlight its fallacies and insure the correction adheres to the incorrect claims carried, though repeating misinformation unnecessarily should be avoided, as it could increase its familiarity to the listener (Clayton et al., 2020). It is also recommended to conclude by repeating the corrective information to prioritise and reinforce it above the misinformation (Schwarz, Newman, & Leach, 2016).

Third, ensure the sources used within the corrective information are highly credible and well known to ground corrective claims within a supported network of societal trust (ex. government bodies, medical institutions, ones with large social media presence, etc.). Though the credibility they carry may vary from person to person (for example, a minority of people may distrust government or scientific institutions as a result of a conspiracy theorising mindset), sources are still necessary to correct misinformation (Ecker & Antonio, 2021; Vraga & Bode, 2018).

Fourth, corrections should be paired with an appeal to social norms including injunctive, norms that people are expected to follow within social situations, (like wearing a masks at social gatherings not only to protect one self but others who might carry a contagion to more susceptible relatives) and descriptive, norms people believe are followed by others within the community and thus replicated by themselves (knowing others in the neighbourhood are recycling incentivises the individual to also consider recycling) (Schultz et al., 2007). Corrections should also include the majority expert consensus about the claims made within the corrective piece of information (99% of peer reviewed climate science

literature concludes that climate change is a result of human action) (Lynas, Houlton, & Perry, 2021).

Fifth, the language used while expositing corrections is also crucial and should be done so through the use of simplistic language, with illustrations that prioritise the listener's comprehension of the knowledge rather than a speedy delivery of the information (Dixon et al., 2015; van der Linden et al., 2014). Take an empathetic stance when communicating as to not evoke a defensive attitude that could lead to a complete rejection of any arguments put forward that is contrary to their beliefs (Cook et al., 2017; Miller, 2020b; Lazić & Žeželj, 2021).

Finally, avoid the worldview backfire effect that may come from worldview threatening corrections by reaffirming their identities and self-esteem (explored further in the following sections).

Literature on Teaching Content Surrounded by Misinformation

Rau & Premo's (2025) Systematic Review of Educational Approaches to Misinformation, reviews 107 articles describing education interventions to help individuals recognize and respond when encountering misinformation. The goal of this research was to "...identify educational interventions aiming to reduce the effects of misinformation (RQ1) and to examine empirical evidence about their effectiveness (RQ2)" (Rau & Premo, 2025, p.43). Synthesising the results and best practices from these studies Rau & Premo (2025) compare them to their developed idealized model on education intervention aiming to reduce the impacts of misinformation. The steps in Rau & Premo's (2025) idealized model includes accounting for a person's prior knowledge and beliefs about the topic being taught as well as prior exposure to misinformation or misinformation-detection competencies. Followed by some form of intervention is then taught in efforts to increase detection of future

misinformation while reducing misinformation's impacts on the student's beliefs. Finally, providing some form of assessment (single or multiple) should be completed by the student to determine the effectiveness of the intervention, ideally on both knowledge and beliefs. The idealized model of education intervention against misinformation emerges from the 107 articles reviewed and unsurprisingly matches the general debunking strategies like inoculation (Papageorgis & McGuire, 1961) and debunking while also emulating the traditional approach outlined to planning out any class. That being, inquire about a student's prior knowledge, teach novel information, then perform some form of assessment to gauge student understanding and comprehension of the new information. The idealized model of education intervention (Rau & Premo, 2025) differs as it emphasizes how research shows the importance of gathering information on both prior misinformation exposure and prior misinformation-detection competencies. Acknowledging that prior knowledge about a topic offers some protection against misinformation but "...expertise in a field can also influence a person's identity, which in turn influences how they process information" (Rau & Premo, 2025, p. 42-43). Misinformation's impact on a person's beliefs, emotions, and identities requires efforts made not only to inquire about them, but also address them prior to and throughout the intervention process, especially in more serious cases of beliefs intertwining with identity, such as conspiracy theory believers (Lazić & Žeželj's, 2021; Zembylas, 2023).

Massive Open Online Courses (MOOCs)

This section provides a brief background of MOOCs with the intent to establish their adaptability to the educational needs of the public in an information rich society. It shows how an education through MOOCs has the capability of reaching the same wide audiences whose curiosity may have led them on a path of misinformation and giving them the tools to combat them in the future. I begin by summarising the history of MOOCs and their rise in

popularity as a result of advancements in communication capabilities, followed by the current state of information literacy. The philosophy of free and open access to higher education was foundational to the development of Massive Open Online Courses (MOOCs). Over time, that philosophy continues to persist in the face of MOOCs' transition to profit-based models driven by commodification and mass job market appeal. Then, the features that make up MOOCs, where they are used today and the drawbacks that accompany them are explored.

MOOCs (2000s)

Open Education Consortium (OEC), later changed to Open Education Global (OEG) to encompass their global efforts, formed in 2008 as a worldwide non-profit organisation made up of over 250 members that include government entities, universities, colleges, cultural organisations, and various other groups all aligned with the goal of providing global access to high-quality education and training to everyone everywhere. (Open Education Global, n.d.a; Open Education Global, n.d.b). During the same year, the term Massive Online Open Courses (MOOCs) was coined by Canadian professors Dave Cormier and Bryan Alexander in response to an open online course design (Nova Southeastern University, n.d.). These organisations would offer university level accredited courses; unlimited participation; traditional resources like filmed lectures, readings, and work assignments along with unique forms of assessments; and interactive forms of networking that include dialogue with other participants and feedback from instructors, all for free (Open Education Global, n.d.c). MOOCs began to grow in popularity steadily such that the New York Times declared 2012 "The Year of the MOOC" with edX, a Harvard and M.I.T. non-profit startup, gained 370,000 new users while Coursera, an experimental startup that aimed to bring learners courses from top level universities, boasted reaching 1.7 million users in January of 2011 (Pappano, 2012).

The meteoric rise in popularity of the MOOC quickly altered the initial promise of "free and accessible credentials" to a "free to audit with paid credentials" where students

were now able to access the content but would only receive a completion certificate if they paid the requested amount, which could range from a $10 projects to $45 000 online degrees (Shah, 2023; Shah, 2021a). Sites offering online courses experienced an exponential rise during the 2020 pandemic where some host sites doubled in the number of new users joining while others more than tripled (Shah, 2020). The pandemic not only brought MOOCs greater attention but also increased the adoption and credibility of their certification in the eyes of governments and employers worldwide (Shah, 2021a). This rise in profits has led to two of the most popular MOOC providers to go public (Coursera) or be acquired (edX) resulting in both entities losing their non-profit status (Shah, 2021b; Shah, 2021c).

This commodification of learning has given a new meaning to open education: one which does not prohibit access but denies credit to those who cannot afford it. This denial of credit continues to benefit those financially stable enough to pay for the certification (along with the financial and social stability to dedicate the time and resources needed to completing the courses) when applying for a job posting against someone who may possess the better skill and understanding but not the capital to afford a certification for it. This situation raises important questions: why learn when your efforts will not be recognized by future employers? Why participate and interact with the course content when doing the bare minimum still guarantees a certificate of completion? Why seek knowledge that will challenge one's presumptions when there are cheaper, more pragmatic courses available that more closely align with the opportunities available in the job market? Abundance in the variety of courses available to users, uncertainty in employers holding all courses to the same credibility, and the individual’s own socio-economic stability, creates a filter that may, in the context of the current research, result in courses that aid in increasing media literacy being ignored unless actively sought out, especially if potential students do not see direct value for

their career goals, or might not wish to invest funds to take courses that might challenge their preexisting beliefs and biases.

MOOCs reaching those in society that would truly benefit from the knowledge available there (ex. those who could not afford higher education, citizens targeted by disinformation campaigns, individuals exposed to and impacted by misinformation) requires those members to have the economic stability to give time to learning. The oversaturation of courses with certifications that require payments as high as $95 per course perpetuates the cycle of higher education attracting only those who can afford it. The inaccessibility to MOOCs is not always a result of the prices placed on their completion certificate. Specifically, to partake in a MOOC requires the individual to sacrifice time, effort, and resources to support the student during their time spent learning (Goglio & Bertolini, 2021). Knowledge, particularly about subjects that do not show a clear tangible benefit in terms of job prospects or return on investments, becomes an optional choice students might make, dependent on their curiosity, motivation, job or academic requirement, or any other incidental factor rather than an educational milestone needed to participate within a world overrun with misinformation content.

Features of MOOCs

Massive Open Online Courses (MOOCs) are an organised form of learning that differs from the lecture or instructional form of content one might find on websites like YouTube, Reddit, etc. MOOCs are found on sites that allow for the hosting of online video lectures, networking opportunities for students to build on their learning, and modes of assessments like tests, quizzes, modules, and submissions, similar to traditional learning formats in higher education. MOOCs are advertised as courses taught by professors from prestigious and reputable universities, like Harvard and M.I.T., that allow for students to gain access to higher education opportunities, specific to their field, at a fraction of the cost of a

full degree. Though these courses are advertised as free, the attendee must pay a predetermined price to have the professors or teacher's assistants overlook their submissions and receive a completion certificate and be accredited for their learning. Courses tend to run on a prespecified timeline and students intending on having their work assessed must follow a deadline for submissions and course completion. Each course is composed of a varying number of modules or weeks, which involve a collection of lecture recordings surrounding a weekly topic and may also contain activities (interactive learning tools), external readings, discussion prompts, resources, quizzes, or assignments. Depending on the subject of the MOOC, the number of modules or weeks can vary. Though students have the freedom to advance through the modules at their own pace, deadlines for assignments ensure that groups of students who enrolled around a similar time advance at a similar pace to encourage a sense of community and guarantee rich discussion when those opportunities arise. As a result of being online, MOOCs are free to be accessed by potential learners worldwide. MOOCs have no limit to class sizes and can provide a flexible form of learning since all lectures are recorded with transcripts, students remain in control of the pacing of the lectures as well. MOOCs have shown to be an efficient form of learning and teaching since they are easily accessible for anyone with internet access, while enhancing the quality of learning (Alturkistani et al., 2018). It has been especially effective for the tech savvy newer generation of students who can navigate their way around e-learning modules (Zakaria, Awang, & Rahman, 2019). All assignments are online and depending on the course, forms of assessments can include written assignment, multiple choice tests, a variety of learning tools (ex. interactive modules), along with questionnaires, and weekly discussion boards.

Where and How are MOOCs Used Today?

The Harvard and MIT startup, edX.com, advertises MOOCs as "...use MOOCs to learn for a variety of reasons, including: career development, changing careers, college

preparations, supplemental learning, lifelong learning, corporate eLearning & training, and more" (EdX LLC, n.d.a). Being a lifelong learner and gaining knowledge is always beneficial when affordable (time, money, etc.) but there's a greater emphasis placed on MOOCs' ability to be useful for those wishing to acquire extra training or credentials hoping to signal to future employers or universities of their ability to be a self driven learner or distinguish themselves as a potential employee with extra job related training. One of the more radical aspects about MOOCs is their philosophy of free and open access to quality higher education, providing university level learning available to anyone with the tools to access it (working computer, internet connection, etc.). MOOC host sites like edX and Coursera advertise their courses as being beneficial to individuals seeking to transition careers (especially in the education and technology sectors), and distinguish themselves from other candidates in their field through additional certification. EdX has partnered up with universities to ensure that some of their courses and certificates can work as transferable credits with select universities, though it must be noted that the universities which accept single MOOCs as credits are not the well renowned ones that created the host site edX (M.I.T. or Harvard) but rather lesser known institutes like Arizona State University and Indian Institute of Management (EdX LLC, n.d.b). Renowned institutions like M.I.T., UC San Diego, University of Cambridge, etc. offer edX created trademark programs known as *MicroMasters* (3-7 courses long programs for $1,000 - $3,000 USD depending on the institution offering) and *MicroBachelors* (1-12 courses long programs for $166 USD depending on the institution offering). Depending on the choice of *MicroMasters* or *MicroBachelors* programs and the amount of credit and courses needed to complete them, some can require 7 months to 1.5 years to complete, demanding as little as 5-10 hours while others estimate 8-12 hours of self-paced learning per week. In the chance that a job requires its employees to possess a certain level of training that can be achieved through MOOC learning, they are financed by their workplace. While those

seeking employment with that company may want to fund their own certification to provide an advantage when applying for a job position.

The Drawbacks of MOOCs

The certifications received from Massive Open Online Courses (MOOCs) on the host website edX are promoted as being ideal ways for people to achieve affordable high quality learning with the goal to advance or alter their education and career trajectory. By receiving a completed certificate, edX states, you indicate “...to employers that you have taken action towards your personal growth, persisted through a rigorous educational experience, and have learned skills that many top corporations value” (EdX LLC, n.d.c). On first impression, certificates for courses hosted by prestigious universities with adverts implying career advancement can lead non-critical readers to instil value in the certificate and its ability to demonstrate the learning that took place. Suggesting that possessing this certificate will not only associate an individual with renowned colleges and universities but increase their number of credentials and place them ahead of other competing job candidates.

Such ideas can highly incentivise those struggling in their current financial or career position to invest their time and money into receiving this certificate as a form of self-development (investing in one’s own betterment and future). However, written amongst the frequently asked questions of the MicroMasters section on the edX website, answers to questions pertaining to the uses such a certification can offer, reveals the uncertainties that surround certifications from MOOCs as a whole. EdX states clearly that such certifications cannot guarantee admission or accreditation towards a university’s master program nor does the certificate assure an interview or job position with a company that recognizes the program (EdX LLC, n.d.d). Similarly, the certifications received from the completion of MOOCs do not guarantee advancement in one’s career as attending a secondary higher education would. In instances where the certifications are not recognized or validated by employers and

institutions, they only serve as a symbol of the holder's willingness and ability to learn independently, while still being left the responsibility to demonstrate their learning through interviews or portfolio submissions.

In 2016 the international entities United Nations Educational, Scientific and Cultural Organization (UNESCO) and Commonwealth of Learning produced a guide for the policy makers in developing countries as a way to raise the awareness that MOOCs may address their concerns surrounding "...affordable quality higher education and preparation of secondary school leavers for academic as well as vocational education and training" (Mariana & Venkataraman, 2016). Making Sense of MOOCs: A Guide for Policy-Makers in Developing Countries acknowledges that despite the popular usage of the term "open education" there exists no clear and concrete description of what the term means. Thus they define the purpose of open education as being: "...to increase access to and successful participation in education by removing barriers and offering multiple ways of learning and sharing knowledge" (Mariana & Venkataraman, 2016, p. 18). The barriers being referred to are the "social, economic and cultural barriers that deprive youths and adults of education and quality learning" (Mariana & Venkataraman, 2016, p. 14).

As a result of the driving philosophy behind MOOCs bringing higher education to a wider population, they are presented as being a crucial tool in achieving The United Nations' Goal 4 of the 2030 Agenda for Sustainable Development. One of the aims of Goal 4 is "...to provide equal access to affordable vocational training, to eliminate gender and wealth disparities, and achieve universal access to a quality higher education" (UNDP, n.d.). Noticeable throughout the guide Making Sense of MOOCs is the clear notion that during the time of its publication (2016) many open online courses still advertised free certification, and though they now require a low cost fee to validate learning with a certificate, the belief that MOOCs are a beneficial tool used to eliminate gender and wealth disparities continues to

persist. Being sustained by the understanding that anyone with access to the internet has free and open access to the knowledge that is there, it's only the certifications that are monetized. This expectation being that since the knowledge is free and available, people in lower economic circumstances must be making use of it in bettering their socio-economic position within society. MOOCs must be being used to provide a competing chance against the economically privileged who can afford higher education.

These comforting beliefs are challenged when a 2015 study on emerging patterns in MOOCs revealed that a "great majority of learners (attending MOOCs) are well-educated (70% with a first or second degree) and in employment" (Macleod, et al., 2015, p. 57). Data collected through a survey of over 34,000 individuals actively attending MOOCs in 2013 shows that they are from a majority English speaking country, predominantly made up of young males seeking to advance their career (Emanuel, 2013). Those who attend MOOCs reported doing so as a means of "advancing in their current job and satisfying curiosity" (Christensen, et al., 2013). Participation within a MOOC also shows evidence of reinforcing the advantages possessed by those who have already received a high level of education and providing them with a better learning outcome. Reported in a 2020 study looking into MOOC discussion boards, which are meant to be open spaces where students can hold discussions and build on the learning taking place, are dominated by the well-educated (socio-economically supported) with post secondary experience. Theorised to be a result of students with higher cultural and cognitive skills with higher educational experience "make(s) them more confident and more prone to interact in the online discussion forum, ultimately further advantaging them in the learning process" (Goglio & Parigi, 2020). Such results indicate that MOOCs tend to benefit those who have the time, motivation, economic stability, and access to the resources required to partake in them (i.e., fast and open access to the internet, functioning technology to access, etc.). These advantages are afforded by those

who already have both a social and economic support system, those who are able to have access to a higher education and the option to remain outside of the labour market. The advantages that MOOCs are meant to provide are inadvertently benefiting the privileged and not the target audience expressed in UN's Goal 4 (UNDP, n.d.).

Goglio and Bertolini's (2021) study on "The contribution of MOOCs to upskilling the labour force" comments thoroughly on the many issues that can arise between MOOCs and workplaces. Employers may use MOOCs as a way to screen employees filtering for those who present to be the most motivated, the ones with the most amount of job related certifications, while feeling assured knowing MOOCs can aid in removing the responsibility of training workers from the employer's hands and onto the candidate's (Goglio & Bertolini, 2021). Those who can afford to are more than willing to invest their own time, money, and efforts into training that might put them ahead of their competition. This becomes a compounding issue when employers are not consistent in their validation of the training given in MOOCs. Unless directly related to the line of work being applied for, recruiters can view marginally related MOOC certificates as being evidence of a person's intrinsic motivation to learn and their capability to learn from pre-recorded instruction. Since many MOOCs do not have a capstone project at the end, it can be difficult to show recruiters the application of the knowledge gained from the course. Unless the credibility of the learning within the course is already established between a company or an institution, it becomes difficult for recruiters to hold MOOC certificates to any value. Especially in the cases where MOOCs are not well known to all employers (McIntyre, 2018; Thompson, 2016). A study in QS (a provider of services, analytics, and insight to the global higher education sector) reported that 71% of the 4,654 employers who responded through surveys were unfamiliar with MOOCs (Quacquarelli Symonds, 2017). McIntyre (2018) theories that another challenge to the credibility of MOOC certifications also lies in the inability to verify the authenticity of the

certificate and the learning attained by its holder. Similar issues were reported in Goglio and Bertolini's (2021) study where interviewees reported being discouraged in paying for a certification on which in small letter is written: "the university cannot be sure that the student to whom we have given the certificate is really the student that attended the course" (p. 571).

The reputation and acceptance of MOOC certificates are also tarnished by the negative association society attributes to things being free and open access, as they are perceived as a lesser form of education in comparison to the education afforded within well-known and established institutions, ignoring the fact that the designers of the free courses are the very professors renowned institutions hire. Goglio and Bertolini's (2021) interviewees also reported avoiding mentioning MOOCs "...because they feared that MOOCs may be considered at a lower level and devalue their effort, compared to other types of training" (p. 572). The perception of the assessments carried out in MOOCs as being too simple to fail has also been levied against the credibility of its certification. MOOCs, by design, are made to appeal to a global audience, for those who may not be proficient in English or not possess higher education, requires their assessment styles to be more lenient. Other than the minority of MOOCs that require lengthy assignment submissions, the majority of MOOCs have been criticised for their format of being too passive, through their viewing of lectures, and too simple when assessing learning, through completing multiple choice tests (Stober, 2015). Most of the failure rates for MOOC enrollees are a result of varying factors both intrinsic and extrinsic rather than a simple matter of their assessments being too difficult. Courses taken for enjoyment or interest were usually not downloaded or included in applications and CVs, priority was given to certifications that linked to work and presented in CVs and LinkedIn profile (Goglio & Bertolini, 2021).

In summary, the challenges that media literacy MOOCs face to reach the audiences that would reap the most benefits from its knowledge are unique. Media literacy courses must

compete for legitimacy against courses upheld by employers and renowned institutions. Though the education is free it is not highly regarded within society as being up to par with what is received when paid for (i.e., a degree). Personal doubts about the return of investing time, money, and effort into attending a course through MOOCs may filter out media literacy education which could serve as a protective measure against the misinformation citizens encounter daily.

Chapter 3: Methodology

The goal of this thesis is to understand how educational courses can engage with topics surrounded by misinformation in a manner that is both safe (minimizing the potential harms as a result of misinformation exposure) and effective (increasing learners' media literacy skills). Following an extensive literature review, I explore how content that is targeted by misinformation can be taught to avoid the negative repercussions of misinformation exposure.

The nature of Massive Open Online Courses (MOOCs) presented an ideal context for this research. Open-access course design, that preserves participant anonymity, and had global reach offered an unique opportunity to observe how instructional strategies are implemented around misinformation-laden topics. Examining MOOCs that put media literacy education into practice provides valuable insight into the benefits, methods, and challenges educators encounter when balancing the dual tasks of teaching disciplinary content and mitigating misinformation's psychological and social effects.

This study adopts a qualitative, descriptive-analytic methodology to investigate two MOOCs focused on subjects frequently targeted by misinformation (vaccines and news media production). The analysis seeks to identify how these courses teach media literacy strategies around misinformation-laden topics while examining the pedagogical tools employed to enhance learners' engagement and information literacy.

Selection of the MOOCs For Analysis

Three MOOCs were initially identified for inclusion through a targeted search of major hosting platforms (EdX and Coursera). The criteria for the selection of MOOCs were guided by the following principles:

1) Accessibility: the MOOC has to be available online for no cost and all core instructional material (lecture recordings, supplementary readings, assessments, and discussion features) is accessible to registered users without a paywall. Most available MOOCs allow open access to their material but may request payment should the student like their participation to be assessed by the professors and receive a certificate of completion. This is inline with the philosophical commitment of this research to democratizing higher education and ensuring equitable access to knowledge, irrespective of accreditation.
2) Pedagogical Credibility: The MOOCs had to be designed by university-affiliated educators, ensuring academic rigor and accuracy of the materials presented. The MOOC must be hosted on a recognized distance education platform, such as EdX, to ensure platform reliability, consistent interface design, user anonymity, with evidence of actual learner participation. Being on a popular MOOC hosting website provides two assurances, one the site is managed, maintained, and is likely to have other students attending to give insight into the experiences of other attending students through anonymous participation and submitted assignments. Two, it also gives perspective into how widely available and popular MOOCs about misinformation around a topic and media literacy education are.
3) Relevance to Misinformation: The course's content focus had to center on a topic frequently targeted by misinformation (e.g., vaccination, news creation, or climate change) rather than misinformation and media literacy in general. This criteria is crucial because it guarantees instructors have to contend with students not only receiving a comprehensive understanding about any given topic, but attending with ideas about the topic that may be misinformed. This

requires designers to account for a thorough delivery of novel information, while mitigating the damages of prior misinformation exposure, and building resilience against future misinformation encounters.

The search for online courses teaching media literacy against misinformation led to some MOOCs on the host website EdX. The other popular MOOC host website during the time of search, Coursera, did not have any courses that directly tackled content surrounded by misinformation. A course teaching general media literacy skills were less valued as they had the opportunity to avoid misinformation targeted topics like vaccines or misinformation in news media. Initially, using this criteria, three MOOCs were found: *Making Sense of News, Anti-vaccination and Vaccine Hesitancy (AVAXX),* and *Making Sense of Climate Change*. Each addressed topic is subject to significant public misinformation and controversy. These courses have the difficult task of not only providing students an understanding of a novel topic but also managing prior misunderstandings or beliefs that persist around them. *Making Sense of Climate Change* offered some initial interest for its use of more active forms of assessment over simplistic quizzes and an engaging content idea of discussing climate change in the context of the fictional world of the Lord of the Rings series. However, due to its peripheral use of the engaging pop-culture analogy and overall similarity in instructional design to *AVAXX, Making Sense of Climate Change* was removed.

Data Collection Procedures

This study presents a qualitative analysis of two MOOCs that were available online at the time of data collection (~April - September 2024). Each MOOC was completed independently and participation followed the natural course stature of each platform, allowing for authentic learner engagement. Throughout the attendance of the courses, detailed field notes were recorded to capture:

- instructional strategies and sequencing of content;

- approaches to introducing and addressing misinformation content;
- forms of assessment and tasks promoting critical engagement; and
- technologies and teaching tools integrated within the courses.

There was also a focus on the methods used to teach such as assignments, assessments, student directed tasks, student interaction, etc. Special attention was also given to noting the tools used to teach a course effectively through an online medium, but also those that the students would be able to take away from the course (fact checking tools outside of the course, links to external teaching tools, etc.). Additional attention was devoted to how each MOOC balanced content delivery with interactive elements such as discussion prompts, peer evaluations, and reflective assignments. All recorded field notes were subsequently organized into two appendices: Appendix A (*Making Sense of News*) and Appendix B (*AVAXX*).

Data Sources

The notes gathered varied by depth and structure, reflecting differences in course content complexity and focus. Notes from *Making Sense of News* were primarily captured in concise, topic-based jot form. Whereas *AVAXX* involved more extended narrative reflections to address the greater conceptual density of its materials.

Originally, course content was to be analysed based on predetermined criteria such as complexity, clarity, criticality, and timeliness. However, this proved insufficient to capture the broader pedagogical distinctions between the courses. Since each course covered completely different topics with varying levels of complexity and the main overlap being their ability to teach protective measures against misinformation, comparing them on their content (in terms of tackling misinformation topics and the skills taught to counter them) and methods of teaching (tools, assessments, approaches, etc.) seemed most appropriate. The analytic focus was then refined to assess how each MOOC:

- structured teaching around topics prone to misinformation

- implemented practical skills for evaluating or debunking misinformation;
- designed assessments and engagement activities to promote active learning; and
- facilitated access to fact-checking tools or external media literacy resources.

While the two courses differ temporally (*Making Sense of News* was mostly active in the years 2015-2016 while *AVAXX* was active during the years of the pandemic; 2019-2020), the emphasis of comparison rested on methodological and pedagogical design rather than topical recency. The aim was to derive insights applicable to misinformation pedagogy broadly, rather than to judge which course remained most current. Special attention was given to how the misinformation content surrounding each courses' topic was addressed. For instance, if there were any myths that were deconstructed, was there any undisputed exposure to misinformation present, any debunking methods that were taught, and what debunking methods and tools were used for teaching.

Data Analysis

A comparative qualitative analysis was employed to examine each course's approach to teaching content targeted by misinformation. The analysis addressed several key questions:

- Was misinformation explicitly acknowledged, and how?
- How did each course describe the cognitive, attitudinal, or behavioural consequences of misinformation in their respective topics?
- Through what strategies was corrective information delivered, and how did these promote understanding or reflection?
- What forms of assessment were employed, and did they meaningfully gauge effective understanding or present evidence of corrective understanding in learners? (Was there an over reliance on one form of assessment or were there unique assessment tools or methods?)

- To what extent did MOOCs foster engagement, interactivity,and community building or have students engage in self-reflection?
- How did the design features of the EdX platform influence teaching strategies, assessment formats, or opportunities for discussion? (Since the host website for both MOOCs was the same and therefore had the same formatting in terms of user interface)
- How did each MOOC encourage learners to apply or communicate corrective information beyond the course environment?
- How did MOOCs prime for future misinformation exposure?

Responses to these guiding questions formed the analytical foundation for identifying effective pedagogical practices. Each course was therefore analysed individually, followed by cross-comparison to identify convergences, divergences, and transferable strategies. These comparative findings are elaborated on in detail in the discussion chapter.

Chapter 4: Results

Chapter 4 presents the results of the analysis of the two MOOCs: *Making Sense of News* and *Anti-vaccination and Vaccine Hesitation (AVAXX)*.

Making Sense of News

The five modules that make up the MOOC, *Making Sense of News*, cover the knowledge and critical thinking skills required to safely navigate news media we consume in the age of social media. The course covers the various forms of news media, how news is constructed, the credibility of sources cited by news reports, fairness in news coverage, and ethics in journalism. The grading is point based, requiring a minimum of 50 points (out of 120 points total), regular assignments (5 total) carrying a weight of 20 points and bonus assignments (two multiple choice tests) counting for 10 points. The completion of assignments is not required for a passing grade as long as 50 points are attained. Each module consists of short video lectures (only 2-5 min long) accompanied by a list of external resources to extend learning which range from reading articles or videos, along with a list of resources mentioned in the video, an asterisk indicating if a hyperlink may no longer be available. Short sections of interviews with experts are interspersed throughout the video lectures and modules but also available in full at the end of each module.

Community Building

The course begins with an introduction through a google map geo locator application where students are able to show where they are from and explore where their attending peers are globally. The first few assignments are assessed through peer review and discussion opportunities are offered at specific points throughout modules.

Module Descriptions

Module 1: Why Does News Matters / 1.1 Why news matters

The course begins by outlining the importance of news and concerns of how they play a role in our daily lives, doing so with a real life example of a picture being posted on social media leading to mass conversations about racism and news reports. How people within society influence news stories is also brushed upon. Following this are external links to further reading (a webpage explaining news cycles from a marketing point of view and a study on how “personal” the news cycle is becoming) and a discussion prompt on sharing “personal experience and observation about the power of distributing news.” Concluding with a short clip from a discussion between the main host, Masato Kajimoto, and journalism student Audrey Kabilova asking “why don't news media organizations, the serious organizations, capitalize on the social media platforms that everybody's using to propel the important stories rather than just using them to spread interesting or funny stories?” with a discussion prompt for students to ask any questions they might have about the content thus far.

Module 1: Why does news matter? / 1.2 Press Releases

This section explores one of the various forms of news media, starting with articles based on press releases, identifying the purpose of the article being to promote a piece of information about a subject and portray it in a positive image. A real world example is used to model how this happens and highlight the quick identifiers of promotion within press release based articles, something that may not be known to the general public. Asking questions like how these forms of articles should be read, viewed, and if they should be considered journalism. Suggesting that the reader should pay close attention to identifying who gave the journalist that piece of information, in other words identifying the reported sources to determine the article’s authenticity or genuineness. This module’s assignment is mentioned stating students will have an opportunity to seek out articles based on press releases. The next slide presents tips in finding press releases that students can use to find

articles for their assignment. Concluding with another clip from a Q&A session between Masato Kajimoto, and journalism student Audrey Kabilova about whose responsibility it is to double check sources, the journalist or the reader, along with a discussion prompt requesting students to discuss any questions they may have or any points for clarification. Numerous sections are created for varying topics. Some of these topics do not relate directly to the content of this module but still provide a space for students to congregate and share ideas.

Module 1: Why does news matter? / 1.3 Information neighborhoods

The module concludes by informing on the various forms of journalism and information media can be categorised based on its primary goal, method of communication, practitioners, and outcomes, which can help determine if it is journalism, entertainment, promotion, propaganda, or raw information. Students are then given a chart (pdf download) with these parameters and are asked to attempt defining each cell on their own before it is done so in the next video lecture. The following video lecture also expands on how these distinctions between these neighbourhoods are becoming blurred (ex. between journalism and entertainment).

Advertorials are expanded on next, presenting examples and even pricing information on publishing an advert as an editorial article. The big takeaway from this video lecture is to question the motives and methodologies behind the content people are consuming. Concluding with another Q&A session about the role of professional journalists in a time when anyone can share and spread news through social media, advocating people to demand better journalism. The discussion prompt about sharing any questions or clarification are repeated and the same forum with pinned discussion points is presented again. An explanation of this module's assignment is given (Students must find examples of news articles that intentionally blur the lines between information neighbourhoods) along with instructions on how to conduct an effective peer review. A rubric for reporting peer

assessment is provided. A Bonus Assignment consisting of 5 multiple choice questions concludes this module.

Module 2: What makes news? / 2.1 News values: What makes news

The first video lecture also uses the editor exercise to expand on how news is made for the public, and thus the public determine what might be successful, highlighting how people are more entertaining and more likely to read and share about conflicts and misfortunes. The factors that determine the significance of a news story are covered next, revealing proximity, immediacy, timeliness, and trend as being strong determinants of a story being reported. Below the video lecture is an expansion of the various cases that a news report may be published, mentioned within the video lecture. Concluding with a short Q&A about the priorities given to each case through which news is published. Discussion prompts about questions and points of clarification are repeated and the same discussion forum available throughout all the MOOCs is presented.

Module 2: What makes news? / 2.2 Editorial decisions

An editorial decision exercise has students charting various news stories in terms of their level of importance (y-axis) and interest (x-axis). Students are then given an opportunity to compare their answers with the two graduate student moderators and others within the provided discussion forum. The two graduate students model this behaviour in the accompanying videos discussing their answers.

Module 2: What makes news? / 2.3 News angles

News bias and selection bias are mentioned during the video lecture discussing which voices are reported on highlighting there may always be opinions and perspectives that go unreported, and the narrative structure of a news report may have unintended biases limiting what aspects of the story are discussed. Another short Q&A clip concludes this section discussing the role of politics in news media and the importance of readers being aware of

such influences. Discussion prompt is repeated. This module's final assignment is the same as the first assignment but this time it will be peer reviewed and answers will be shared, asking if student's choices have now changed as a result of the information they now know. Bonus assignment is a 5 question MC quiz worth 10 points.

Module 3: Who provides information? / 3.1 News Sources: Who provides information?

Strategies in identifying sources listed within a story are presented. For example, underlining the cited sources and then gauging each source by identifying who they are, their relationship to the event, what information they provide, why they are quoted in the article, do they give fact or opinion, how do they know the facts, and what is their interest in talking to the media. These source evaluation questions are provided below the video lecture along with a written form of the IMVAIN source analysis (Independent sources, Multiple sources, sources who Verify, Authoritative/Informed sources, and Named sources). An IMVAIN source analysis exercise is used having students read a short mock news article to have students evaluate the four sources mentioned within through the 5 IMVAIN source analysis filter, assessed through a multiple choice quiz (20 points). Following a short Q&A clip and a repeated discussion prompt the IMVAIN analysis assignment is repeated evaluating five sources from a mock news article.

Module 3: Who provides information? / 3.2 Opinions in journalism

The positives and negatives of opinion journalism are discussed in the first video lecture followed by a short reading on opinion journalism, concluding with a Q&A clip and a repeated discussion prompt.

Module 3: Who provides information? / 3.3 Debunking

How to debunk false information is covered next with respect to news media. This video lecture only lists three forms of false information: satire news stories being mistaken as factual reporting, hoaxes and lies through information doctoring or manipulation intended to

deceive its audience, and information taken out of context. Tips are also shared in determining the authenticity of a story, first is making oneself familiar to websites that may be known for sharing misinformation or satire articles, check the news organizations about page, and the third tip given is to “click around and see what other articles and pictures have been published on that platform.” specific for satire websites. The next section focuses on hoaxes and false reporting which instructs that even respected news channels can fall for hoaxes. Tips are given in checking for authenticity by looking into fact checking websites or seeing other news broadcasts reporting on that topic such as directing people to use key words or reverse image search to authenticate and verify information.

Among links of references and recommended factchecking websites an external link to the Verification Handbook (Silverman, 2014) is also provided, which is free and provides strategies to verify information online. A short list of rules are given to navigating information on social media along with additional external resource readings on verification of information. The rules to social media navigation include: (1) “Do not trust strangers (someone new) even if they look genuine, sincere, real and even "verified." (2) The number of followers, shares, likes, retweets, could indicate popularity but not credibility. (3) Click the account name and check the track record. Read what they said and shared in the past. Click through to see their networks as well (friends, followers, etc). (4) Be suspicious of newly (recently) created accounts. (5) Do not believe a single source or outlet no matter how much you trust that person or organization. Keep in mind that any social media account could be hacked. The Associated Press, BBC, the Wall Street Journal, and many other news organizations have been hacked in the past and disseminated false news stories. (6) Verify before you share.” Concluding with a professor and student assistant Q&A clip and repeated discussion prompt.

Module 4: Where is the evidence? / 4.0 Special Q&A (2015 and 2016)

Two short videos, one from the year 2016 (5 minutes) and another from the year 2015 (3.5 minutes), cover the most popular themes or questions that were raised within the discussion forums from modules 2 and 3 are brought up here. The 2016 video covers the discussion between the teaching assistant and co-host on how news outlets know what stories their consumers will want to read about the most from module 2. The popular question from module 3 in 2016 was about how news consumers can tell the difference between assertive or verified news. The 2015 Q&A video discussion asks the host if the IMVAIN approach to source analysis can be applied to opinion journalism and if it's possible to be effective news consumers through social media, suggesting that increasing the variety of sources is most beneficial.

Module 4: Where is the evidence? / 4.1 Fairness

Fairness in reporting and what is considered balanced coverage is demonstrated by using the example of the two stories Three Little Pigs and The True Story of the Three Little Pigs which tells the former story from the Wolf's perspective. Hypothetically questioning if a reporter made a news story reporting both the perspectives of the Pigs and the Wolf, whether or not that reporting would be a balanced coverage. It is stressed that this does not make the reporting fair, though it may seem balanced, as people are not able to determine who is telling the truth from the opinions reported. The inclusion of evidence that points to the truth is pertinent to determining if the reported story is fair as the opinions of the wolf and pigs only provides perspectives but no understanding of the events that truly occurred (ex. police reports, eye witnesses, etc.). The lesson emphasised that viewers should demand journalists to be fair to the evidence. Examples of how unfair reporting occurs are also given. The section concludes with a short Q&A clip and repeated discussion prompts.

Module 4: Where is the evidence? / 4.2 Truth

This section highlights that determining what is true / what really happened is difficult to conclude and report. Emphasising how truth changes with additional evidence or context what is not explicitly mentioned is that this is similar to how scientific evidence and theories develop and arrive at an agreed upon truth. Advice is given on how to not be a passive news audience and expresses the importance of the recipient of information to actively follow topics as they develop and demand further investigation. A short Q&A clip and repeated discussion prompts conclude this section.

Module 4: Where is the evidence? / 4.3 Evidence

The idea that not all evidence is equal is presented on a scale of direct and indirect evidence, charting for the viewer various forms of evidence (eyewitness, recordings, expert opinion, etc.) and their reliability is explained. The difficulty of constructing a story that communicates the truth about a situation requires inferences to be made. It is advised to use the IMVAIN analysis for sources found in reporting. Recommended to avoid jumping to conclusions and recommended questions like if the sources, journalist, and information could be trusted are provided. Ending with another short Q&A clip and repeated discussion prompts. In this module's assignment students are asked to read a mock article and answer 5 multiple choice questions about the content of the article, identifying and evaluating sources and evidence for credibility.

Module 5: When should we act? / 5.1 Bias

Bias is introduced through the most common claims about news organisations being biassed. These claims are discredited with counter logic based followup questions. For example, "XYZ news outlet is biassed" against which Kajimoto argues that one must have to believe every journalist working in the newsroom is abandoning journalistic fairness.

"The mainstream news media organisations are not telling the truth. News organisations don't know or are hiding it." Makes the assumption that the speaker therefore knows the truth and

therefore should have the evidence to support their statement. “This view is one-sided. What about XYZ and YYY?” Against this claim, Kajimoto reminds the student that news reports are the opinions of the sources and do not represent the coverage itself. Reinforcing it is the audience’s duty to seek out other perspectives by other journalists. Cognitive dissonance is mentioned during an explanation of how opposing beliefs and opinions can cause conflicting cognitions which can lead to self-justification, stereotyping, and biases. The video lectures also make mention of the underlying cognitive processing that influences information processing like, “We distort or forget incoming information when it doesn't match our view. We despise or attack the person who gives us the uncomfortable facts. We also tend to pursue and like the information that reflects and confirms our point of view.” These ideas are mentioned within the short video lectures and expanded upon below but lack any links to further reading or references to explore these concepts. These statements are used as a way to caution against confirmation bias from readers while acknowledging that news organizations can be biassed, but claims about them being biassed must be supported by evidence. Ends with a Q&A clip discussing how everyone possesses some level of confirmation bias and must be aware of its influence on our information consumption. The discussion prompt of sharing any questions is repeated with a discussion forum relating to the topic of bias.

Module 5: When should we act? / 5.2 Verification (or lack thereof)

The difficulty of verifying information during a developing news story is explored next, explaining how time constraints like, being the first to the story and reporters being assigned multiple assignments can cause rushed work that has not been thoroughly verified. Along with sources providing misinformation for their own agendas, facts being deceptive at initial glance, no access to information, and the need for expert opinion that is not available are the many reasons why unverified work can get published. The following slide has further reading material on instances where verification malpractice or intentional misinformation

was spread. A short Q&A clip discussing on whom the final burden of verification falls on (the reader) with repeated discussion prompts and a forum with no posts, indicating a lack of engagement.

Module 5: When should we act? / 5.3 News deconstruction

Steps of news deconstruction are informed on “1) Summarise the main points of the story; 2) Evaluate the sources: IMVAIN analysis. 3) Assess the evidence. 4) Assess the level of transparency. 5) Look for the context. 6) Look for missing key information. Are key questions (what, when, where, who, why and how) all answered? 7) Evaluate the fairness while questioning your own bias.” Each is expanded on with examples and recommended questions that a reader should ask while deconstructing an article. Ending with a clip from a Q&A session discussing the identification of native advertising articles. The discussion prompt about sharing questions and concerns is repeated with no engagement in the forms below. The assignment for Module 5 asks students to read through 3 very short articles and answer 2 multiple choice questions each (6 questions total) that require deconstructing the article for its messaging and evaluating the sources mentioned within.

Module 5: When should we act? / 5.5 Special Q&A: Studying journalism | Positive news

Consists of short clips from an Q&A season where the questions like “Do you need to study journalism to be a journalist?” and “Why is news mostly negative? Can we get happy news?” are discussed.

Module 5: When should we act? / 5.6 Next step: Ethics

The ethics of journalism are covered accompanied with examples of ethical hypotheticals that journalists have to face globally. Journalist staging or dramatising photos which can lead to readers believing an event was more popular than it truly was are informed on within this section. References and further reading below the video lecture include examples of unethical journalism.

Module 5: When should we act? / 5.7 Next step: Journalism studies

The course concludes by discussing the effects like the observer effect are talked about here, where the presence of observers, reporters, and cameras dictate how people behave, influencing what is being said which influences what is being reported. The Rashomon effect is also informed on, which refers to the idea that we humans experience and remember things very differently, even though we are at the same place at the same time experiencing an event together. The video lecture section aims to highlight how subjective experiences impact the reporting of any newsworthy event skewing what is communicated and how. The recommended reading section cites an article on false memory.

Teaching Methods (Assessments and Tools for Teaching)

Across the MOOC Making Sense of News various teaching tools and techniques of assessment were applied to aid instruction.

1) Tools for teachers to understand students
    - A course entrance survey is taken at the beginning of the course asking students what interested them in the course and how much time they intend to commit to the course work among other questions (location, level of education, age, field of profession or study, etc.)
    - Discussion forums are monitored by teaching assistants who bring up most popular topics and questions to professors in a Questions & Answers session held in two separate years (2015 & 2016) at the beginning of Module 4
2) Tools for students to understand content
    - External links to further reading and references made are placed below video lectures for easy student access, broken links are indicated using an asterisk

- Optional discussion activities are placed to encourage students to engage with the topics of the course
- Each module contains a few short Question and Answer video lectures between host and assistant are placed before a discussion prompt and forum
- Short reading sections are interspersed between video lectures often containing links to external further readings
- Module 1.3 contains a downloadable (pdf) worksheet to chart definitions for Information Neighbourhoods (Journalism, Entertainment, Promotion, Propaganda, Raw Information), the following page contains an exemplar of the grid with the correct information within the boxes
- Real life examples are used within the video lectures and links to external examples are provided below (videos, useful websites, references, etc)
- Assignment 1: Peer-assessment is used to evaluate first assignment: *Blurred Lines*- Students are asked to find examples of news reports that exemplify publications that transcend multiple information neighborhoods (Journalism, Entertainment, Promotion, Propaganda, Raw Information). Examples of assignment submissions are provided along with a grading rubric for students to assess their peers' assignments. Criteria requires one point for including a source, understanding the concept of information neighbourhood, and 1, 3, or 6 potential points for various degrees of concept examination.
- A key lessons are summarised at the end of each module with a short video lecture and list
- Bonus assignments at the end of each module are 5 multiple choice quizzes

- Editorial exercise in Module 2 asks students to take the role of an editor and select top 5 stories to use as publication from various mock news example stories (most important being the top story)
- Module 2 contains an activity that asks students to chart six mock news story topics on a chart of importance (Y-axis) and interest (X-axis)
- Assignment 2 asks students to take the role of an editor (a repeat of the editorial exercise that opened the module) and select 5 top stories accompanied by an explanation to why students gave some stories more importance over others, an example submission is provided along with peer-assessment rubric. Criteria requires 2 points to be given if the story *slug* and headline are provided and 4, 6, 8 points are given depending on the quality of discussion.
- Source Evaluation Checklist pdf is provided in Module 3.1
- IMVAIN source analysis is assessed through an exercise requiring the reading of mock news articles and multiple choice questions
- Assignment 3 is a IMVAIN source analysis activity (a repeat of previous exercise) using a mock news article and multiple choice questions about each mentioned source
- Module 4 makes use of external literature (children's stories, other publications and references) to teach fairness in reporting
- Assignment 4 is a multiple choice quiz using a mock article analyzing sources and stated facts
- Assignment 5 is another multiple choice quiz using multiple articles (3 articles with 2 questions for each)

3) Tools for Building Student Community

- Before the first Module an interactive world map (using a Google Maps tool) allows students to tag where they are attending from and introduce themselves to the rest of the attendees. Students are able to include a picture, along with a short introduction on what interested them about the course and something about themselves. Students are able to see introductions from all others who have attended the course before
- Discussion sections often have questions correlated to the content of the Module's even though the discussion prompt is repeated
- Word cloud is generated using students top answer for a lead story exercise at the beginning of Module 2 (story about the bomb being the lead story selected)

Anti-vaccination and Vaccine Hesitancy (AVAXX)

AVAXX consists of six modules each with an end of module multiple choice / true or false style quiz containing 15 questions each. The former half of the course focuses on the history, creation, regulation, and the socio psychological factors that influence vaccine hesitant or anti-vaccination beliefs. The latter half deconstructs twelve vaccine myths and seven anti-vaccination persuasion strategies, concluding by teaching strategies to recognize and dispel anti-vaccine persuasion techniques to communicate effectively with vaccine hesitant individuals. Topics are explored through the modules via short video lectures (8-12 minutes) and small reading sections, but they are expanded on through external resources, embedded activities, and long form interviews (25-50 minutes) with experts in their respective fields.

Clarity

Each module begins with a short summary of the content being covered and a list of the learning goals expected to be achieved by the end of the week. Most lecture videos are

accompanied with a short summary and a list of all references mentioned. Each video lecture explores vaccination hesitancy through at least one or more case studies, historically significant events, or scientific study that reinforces arguments in favor of vaccines. Dr. Aechtner, the designer of the course, hosts at least one interview each week with an accredited expert or advocate in the field of vaccines, longer in length (25-50 minutes) and exploring the topic of the week in greater depth. The short (15 question) multiple choice quizzes at the end of each module contain questions specific to the topics covered and are easy to pass even if the videos are viewed at a leisurely level.

Module 1: Understanding vaccination and anti-vaccination

Anti Vaccination and Vaccine Hesitancy uses the topic of vaccines to explore misinformation in depth. After initial thoughts on vaccines are collected through an anonymous open poll, Module 1 begins by exploring the various groups that tend to fall under vaccine denial, outlining the distinction between those who completely deny the effectiveness of vaccines, those who are hesitant and fearful of the effects from some or all vaccination, and finally those that believe in the efficacy of all vaccinations. Through the support of evidence from studies looking into people's stances on vaccinations, Dr. Aechtner argues that those who deny vaccinations make up a very small portion of the population. While most people tend to trust vaccinations, it's the noise created by the minority opposers that lead people to think vaccine hesitancy ideas are more popular than they truly are.

The module then explores the various types of vaccines and the illnesses they have been used to prevent. It discusses potential reactions (side effects) that can come from vaccines and those that do not. Dr. Aechtner connects this with real world instances where incidental correlation can occur leading new parents to become vaccine hesitant. As a reaction of rational fear for their child's wellbeing, new parents whose child gets sick weeks after receiving a vaccine shot can lead them to correlate it to be a direct side effect of the

vaccine. This is immediately debunked, first through its logical fallacy by teaching the scientific basis of correlation versus causation, then later through statistical scientific evidence, and exploring a double blind study. Various vaccines, like the MRNA vaccine, are looked into for how they work and the rarity of developing negative reactions. This is followed up by the medically informed structures present that rigorously investigate vaccine safety, as well as the steps and trials required for vaccine approval. This occurs all while sympathizing and identifying instances which may cause anyone to fall into vaccine hesitant ideologies. In an accompanying video interview, Dr. Aechtner expands on these topics with Ian Frazer, a renowned immunologist and co-inventor of technology that was used to develop vaccines for human papillomavirus HPV, which is currently used across the world to help prevent cervical cancer. Throughout this interview, the necessity of vaccines are reaffirmed with the arguments of presenting proactive health benefits on a personal, societal, and economic level.

The module continues its exploration of vaccines by expanding on the contents of vaccines, covering the various ingredients and the role they play in its delivery, longevity, and the fight against infections. This then leads into an interview with a Queensland Health nurse educator and vaccine advocate, Rebecca Vallee. Her personal story as an immunocompromised person is used as a way to explore the topics of herd immunity, concerns about ingredients, and science based evidence on vaccines, something very pertinent to the Covid-19 vaccine. Their interview also explores the concerns and issues raised by those who are vaccine hesitant, and how to best engage with hesitant individuals while addressing their concerns during the conversation.

The following video lecture expands on vaccine safety but highlights the role the narratives that surround vaccines have on how they are perceived by the public. Using this as a primer for the viewer, Dr. Aechtner proceeds to teach about the side effects of vaccines and

the hesitancy it causes for parents when their infant exhibits various symptoms after receiving a vaccine. Such hesitancy is remedied through the exploration of a significant study attempting to understand this correlation. Through a doube-blind study with 581 sets of twins where one received a Measles-Mumps-Rubella vaccine and the other a placebo. Researchers found that within 1-6 days after the injection, both twins exhibited identical symptoms, which showcases that vaccines were not the cause of the symptoms. Additional claims about not enough studies using placebo groups or saline solutions, along with other hesitancies about how vaccine safety is addressed in society, are tackled and debunked using an additional reading section that contains a list of 20 long term studies on vaccine safety. It's important to note that these studies have been independently produced, from various scientific organizations from around the world and how that reflects the accuracy of their conclusive results presenting vaccines being safe and beneficial. The module references a method of determining authenticity of claims called *consilience of evidence,* further explored in Module 3. The module finishes with a poll and feedback activity where questions surrounding the public's opinions about vaccinating children, vaccine trust, safety, and efficacy are polled and then explored through referenced studies containing their statistical evidence. Each referenced statistic is provided with a citation and a link to the study should students want to explore them.

Module 2: Why do people have vaccine hesitancy?

Module 2 aims to help understand the reasons behind low vaccine uptakes and the various factors that influence vaccine decision-making, which includes both personal beliefs and experiences and sociocultural beliefs. Module 2 also explores how the groups individuals associate with online and within society influence their opinions about contentious topics like vaccinations. The course begins with looking into the impact social networks have on vaccine perspectives, and how similar networks formed online amongst like minded people with

similar biases can create echo chambers that can reinforce vaccine hesitant perspectives. The course goes on to highlight how these groups are primed for misinformation since some may not know where to receive a well rounded understanding of vaccines, and instead members turn to other members rather than credible research done by experts of the field. Though this is true for the uninformed, video lectures of Module 2 dismantle the idea that the lack of information is the cause of the anti-vaccination movement, called the information deficit myth. It presents significant studies comparing knowledge about vaccines between average people who support and oppose them, concluding that those who oppose vaccination demonstrate similar, if not more knowledge about vaccines. Expanding that there exist a multitude of reasons which include political, cultural, and psychological factors that influence people's opinions about vaccines. The lecture then alludes to the worldview backfire effect, presenting studies that show the presentation of factual information counter to one's beliefs can result in a defensive polarization towards initial misinformed beliefs.

There is also a breakdown of the various reasons for low vaccine uptake citing access barriers, fear and risk calculations, questioning vaccine effectiveness, skepticism, media, personal experiences, and sociocultural beliefs and values. It moves into where people turn to for vaccine information, like the internet, friends, relatives and social networks. The module then dives into the psychological factors that influence belief through the Cultural Cognition Thesis, the idea that when it comes to contentious topics like vaccination, people support whichever opinion affirms their core values that define their identities.They may keep believing what they assumed to be true rather than changing beliefs based on new found information. The role the groups individuals associate with is presented as being crucial in shaping our worldviews. This is furthered when a cultural cognition worldview survey is conducted to allow students to uncover their own unlabeled ideological associations.

These factors are looked into further in the following interview with Mathew Hornsey, a University of Queensland professor whose research analyzes the rejection of science. Their conversation dives into how Hornsey's research reveals that education plays a small role in the rejection of vaccination, while personality (particularly those who are more disagreeable/contrarian), disgust sensitivity (fear of needles or aversion towards blood), and (greatest of all) belief in well known conspiracy theories, determined a higher likelihood of being anti vaccination. Hornsey suggests that people may be developing a set of beliefs and worldviews as a way to avoid triggering their anxiety and are designed to give them a legitimate excuse to avoid things like needles. The discussion also explores how various beliefs, like distrust of government and big pharmaceutical companies, can support one another to form greater resilience against what those organizations support. This is followed by a short reading section that looks at how moral values play a role in beliefs, social groups, and the choices made by individuals within society and the research that supports this.

Module 2 begins its conclusion, much like Module 1, by exploring information communication, such as understanding how media uses persuasion messaging through the Elaboration Likelihood Model (ELM) (Petty & Cacioppo, 1986). Specifically how persuasion cues presented in the model can be used to make audiences more receptive to vaccination messaging. A chart is used to show how persuasive messaging encounters psychological filters that may promote or prevent the likelihood of the listener requesting more information about a subject. Filters like the listeners ability to process messaging, It then discusses the role religion plays in vaccine hesitancy, informing unfamiliar learners about potential religious ideologies that might influence attitudes towards vaccinations. The Module concludes with an interview with professor Jolanda Jetten, a professor at University of Queensland, with research in social identity, group dynamics and the psychology of health. Throughout the interview, they expand on the topics covered in Module 2, such as how the

groups people belong to and associate with have large impacts on their health both positive and negative.

Module 3: Vaxx myths and persuasion Part A - Distrust and Confidence

Module 3 and 4 both cover vaccination myths and persuasion techniques. Module 3 aims to have students be able to recognize two central anti-vaccination persuasion themes; distrust and confidence, along with four persuasion cues found in anti-vaccination arguments; the scarcity principle, source cues, social consensus, statistics and technical jargon. Finally Module 3 aims to help identify 5 anti vaccination myths: (1) Vaccines are major money-makers for BigPharma, government, and doctors. (2) Low infections make vaccines unnecessary. (3) Better hygiene and sanitation not vaccines. (4) Natural immunity is better than vaccinating. (5) Research and experts discredit the scientific consensus.

Module 3 focuses on scientific consensus denial that are at the core of many conspiratorial, misinformation, and disinformation arguments, whether it be climate change, news media, or global events. It is emphasized that the themes of distrust and confidence are used to challenge pro-vaccine information and arguments. It does so by sowing distrust in established sciences and redirecting that confidence towards personal experiences, non-experts with anecdotal stories, and the few anti-vaccination specialists, who are upheld as being more credible than researchers currently working in the field. These counter experts support anti-scientific claims and help bolster conspiratorial or misinformation claims. These themes are then connected back to how they influence the overall reasons for low vaccine updates mentioned in Module 2. Conspiracy narratives are used by anti-vaccination media to build on the distrust for the government and medical authorities to further anti-vaccination claims. Well studies and evidence based causes behind people believing in conspiracy theories like fear, loss of independence, a need for explanation, along with many other psychological reactants are also addressed.

This is then followed by an interview with the head of Public Health in the College of Medicine and Public Health, Paul Ward. Their conversation dives into the trust people hold for medical professionals, institutions, and the factors that influence it. They make reference to how this trust was impacted during the Covid-19 pandemic, and discuss how socialization plays a role in the decision making around vaccination. They go on to examine how misinformation over media and within groups leads people down anti-vaccination under the assumption that they are doing the right thing for their children.

The module then explores prominent vaccine distrust myths in more detail: vaccines are major money-makers for BigPharma, government, and doctors; low infections make vaccines unnecessary; better hygiene, sanitation, and nutrition, not vaccines; natural immunity is better than vaccinating. It includes a distrust persuasive cue “the scarcity principle”. The myths are explored through a short reading section and are not each given their own video lecture. Each myth is accompanied with various counter arguments that dismantle its core narrative for its logical fallacies and is supported with examples and research. For the myths that may contain some rational argument behind its existence, those arguments are addressed and explored, separating the rational from the illogical and fearful. The second half of Module 3 explores the confidence myth which involves the discrediting of research and scientific consensus, and the persuasion cues found in confidence arguments: source cues; social consensus; statistics and technical jargon. All of which are done so through a short reading section.

Module 4: Vaxx myths and persuasion: Part B - Danger

Module 4 continues coverage of vaccination myths but explores the themes pertaining to danger. Aiming to have students recognize the central anti-vaccination persuasion theme of Risk, three persuasive cues are distinguished: arousal of fear; the contrast principle and negativity effect; asking questions. Seven more anti-vaccine myths are also explored:

vaccines cause autism, vaccines cause allergies, vaccines cause autoimmune disease, vaccines cause the diseases that they are designed to prevent, vaccines contain dangerous toxins, vaccines can cause immune system overload, and vaccines aren't safe during pregnancy. Each myth with a recorded lecture is explored similarly, first the claims are outlined accompanied by corrective information, followed by an exploration of its history, and what factors caused it to come into existence. For example, Myth 6, dismantling the myth of vaccines causing autism and other disorders, results in an exploration of Wakefield's retracted paper on vaccines causing autism. It breaks down its claims, what actually causes autism, and why someone might be quick to correlate the administration of vaccines to the onset of illness. Myths 7 (vaccines cause allergies), 8 (vaccines cause autoimmune diseases), 9 (Vaccines cause the diseases that they are designed to prevent), 11 (vaccines can cause immune system overload), and 12 (vaccines aren't safe during pregnancy) are covered through short back to back reading sections. Each deconstructing their respective myth by exploring their origin, claims and logical fallacies, while making use of published scientific studies where required. After the 12th myth comes a short exercise in identifying persuasive cues used in an old article warning parents against the polio vaccine. The cues needing to be identified have been taught thus far; *the scarcity principle, source cues, social consensus, statistics and technical jargon, arousal of fear, the contrast principle and negativity effect,* and *asking questions*.

Next is an interview with an associate Professor Holly Seale, from the University of New South Wales, who is also the Deputy Chair for the Collaboration on Social Science and Immunization Network. Their conversation explores public perceptions of needing to get vaccines, organized outreach to promote vaccination, and other factors that influence vaccines received by adults. Strategies to promote vaccines and reduce vaccine hesitancy are also discussed, expanding on earlier content covered in the course, like the influence of social groups, personal experiences and fears over scientific evidence and consensus.

Module 5: Improving vaccine advocacy: Part A - General Guidelines

Module 5 focuses on the improvement of vaccine advocacy, by exploring the challenges faced when responding to vaccine hesitancy and introducing communication techniques that can help increase immunization behaviors. The beginning of the module covers addressing challenges that can be countered through material persuasion. For example, making receiving vaccination easier or providing monetary or non-monetary incentives for receiving vaccinations. While expanding on the various forms of incentives and enforcement methods that have been applied to increase vaccination, Dr. Tom Aechtner also stresses the negative impacts enforcement can have on public opinion of vaccines. He particularly highlights the influence of how a message is delivered over the specific scientific facts or details within a study. Module 5 begins with reminding learners that it is rarely the quantity of information that determines people's opinion about a situation but rather how that information is communicated which can dictate its perception. The largest concern through this module is vaccine advocacy communication and thus its primary focus is on perception of arguments. It encourages learners to discard the assumption that communicating factual knowledge and testable understanding about vaccines (or any scientifically backed argument) translates into persuaded individuals. It is rather important to uncover the sociocultural beliefs and values tied to community networks which actually influence people's attitudes and believers. The key role of respect, likability, and willingness to listen to individual's hesitations about vaccines is stressed as crucial to their openness to future arguments.

The HURIER Model of becoming a better communicator is used as a foundation to communicate vaccine advocacy of practicing better listening skills. The model accounts for the various filters (bias, values, previous experiences, attitudes, etc.) through which people listen to information. This model was chosen because effective hearing, qualified through

understanding, interpreting, evaluating, and remembering, makes up two thirds of the process of communicating effectively. The learner is then given a chance to explore what components of the HURIER listening profile (hearing, understanding, responding, remembering, evaluating, and interpreting) they are strong and weak in, followed by a discussion prompt on the results of the questionnaire.

Following the importance of listening, the mindfulness towards verbal aggression is highlighted. While sympathizing with the frustrations that can arise when arguing against misinformed points, avoiding attacks on people's character, competence, or ridiculing someone's background or appearance is strongly advised. The importance of being honest in acknowledging not only the limitations in your own knowledge, but also being candid of the truth in anti-vaccination arguments (ex. vaccination side effects), is expressed critically when communicating against misinformation viewpoints. Module 5 advises to acknowledge people's fears and connect with them emotionally rather than dismissing them. The need for pro-vaccine communication efforts in the face of so much counter-vaccination misinformation that exists online is readdressed before moving into strategies to modify behavior in favor of vaccination.

Module 5 also gives importance to the role personal stories and narratives in general play when it comes to reducing cognitive resistance towards scientific information. This is also demonstrated through the very paragraphs that inform about this strategy, within which are scattered many examples of short narratives to fortify new concepts. Increasing outreach is recommended through being culturally cognizant when communicating scientific data, clarifying that it involves not only addressing and understanding the variety of cultures the message will reach, but also representing them through the communicators and those whose stories are shared. Note that Module 5 has the least number of video lectures. It concludes with a short interview with Dr. Angus Thompson, a social scientist with UNICEF and

researcher in the determinants of vaccine acceptance. Their discussion begins with what determines vaccine uptake and the various strategies and research of their effectiveness, then travels into understanding why anti-vaccination misinformation media exists and gets politicized.

Module 6: Improving vaccine advocacy: Part B - Debunking and Sticky facts

Module 6 is all about debunking procedures: to whom debunking is effective, how to structure debunking efforts to be more effective, understanding pre-bunking (inoculation), and understanding the traits that make an idea long lasting in someone's memory (SUCCES: Simple, Unexpected, Concrete, Credible, Emotional, and Story). The video lectures amplify examples, demonstrating how difficult it can be to change the opinion of someone who is unwilling to accept any counter arguments. It presents the importance of targeting those who have not yet solidified their perspective yet. The next few video lectures cover two debunking strategies: repetition of facts (familiarity backfire effect is explored) and warnings and simplicity (inoculation/pre-bunking and simplified messaging).

The exploration of misinformation and how to combat it is furthered in the following interview with John Cook, the developer of the EdX course Denial101x - Making Sense of Climate Science Denial and a co writer of The Debunking Handbook. Cook introduces the concept of inoculation, forewarning people of the existence of misinformation around a topic, then introducing a weakened form of misinformation to debunk and lessen the likelihood of falling for misinformation in the future. They also discuss the importance of inoculation (pre-bunking), how to effectively debunk misinformation and other strategies to identify science denial techniques. Cook also expresses the importance of ensuring the misinformation is replaced with a fact that reconciles the confusion or cognitive dissonance that is left when a myth or piece of misinformation is debunked. The roles of narratives on memory and information communication are also reiterated during the interview.

The module proceeds to provide a four step foundation to crafting an effective debunking strategy. (1-Fact) Begin by acknowledging the facts or providing a factual alternative (avoid saying “this claim is not true”) to frame the message and provide further information that may be lacking in the misinformation content. (2-Warn) To give a notice about the myth before repeating it and avoid needless repetition of the myth/misinformation. (3- Debunk) Debunk the fallacies within the misinformation thoroughly, which includes explaining why the misinformation was thought to be correct, why it is wrong, and why the alternative is correct. (4- Fact) Restate the fact so it remains the last thing people process. Explicitly noting that the effects of debunking wear off even after refuting in detail. A short reading section follows the segment and covers pre-bunking (inoculation), which is explored through an external resource game called Bad News. Bad News is a short interactive game that exemplifies how misinformation and disinformation spreads through social media, more specifically how an individual might be incentivised to do so.

The rest of the course focuses on how to make facts stickier, in other words, how to communicate facts that remain memorable and replace the gap created through debunking the myth. Covered through 9 short reading sections and a short (8 minutes) video lecture, Dr. Aechtner uses the acronym SUCCES: Simple, Unexpected, Concrete, Credible, Emotional, and Story as a ground work to make a message stick. Simple requires the debunker to resist focusing on the specific details and tangential arguments but instead to communicate the most important core idea in as few words as possible. Unexpected refers to making the message surprising or counterintuitive to prior understandings as this can leave a long lasting impression in the mind of listeners. Concrete refers to using language that people can broadly relate to and understand rather than more abstract ideas that can have subjective meanings. Credible refers to finding a source with expertise and credentials to deliver the message along with communicating trustworthiness and honesty to help increase message acceptance.

Emotional encourages making the message itself emotional to appeal to the audience's self-interest and incentivise them to care. Stories encourage the use of narratives which act as a mental simulation for the audience to experience ideas, and can even be more persuasive than delivering systematic data and well-reasoned arguments.

Teaching Methods (Assessments and Tools for Teaching)

Among the modules' content, several key strategies were used that effectively addressed both misinformation content and teaching strategies. These include:

1) Tools for teachers to understand students
    - Pre-course survey to understand a little history about what the enrollee studies, what interested them in the course, and what they expect to learn, how much time and to what degree do attendees want to complete the course, and their personal learning goals
    - Module 2's video on the elaboration likelihood model (Petty & Cacioppo, 1986) and cues ends with a question on what topics were covered within the video, to help instructors gauge if the content covered was understood
    - Module 3 Myth #5 has an open poll asking if students "Have you ever heard that the MMR vaccine, or another vaccination, causes autism?" and "Have you ever heard of Andrew Wakefield?"
    - At the end of the course is a discussion prompt interested in learning what the attendees have learned through discussion with prompting questions like: "What did you learn in this course? What will you take away from the course? What was your favourite part of the course? What took you by surprise? What in this course made the biggest impact on you? How will you use this course in your life or your work?"
2) Tools for students to understand content

- Word Cloud activity in Module 1 to understand what prior knowledge enrollees hold about "*Why is vaccination so controversial among the general public?*"
- Uses external resource: an interactable timeline to show the history of vaccines (how they were developed, all the diseases they cured, the impact they had on the health of society and mortality rates, and where vaccines provide aid now) alongside the advent of vaccine denialist groups
- Pulldown info cards for quick notes to help understand various types of vaccines
- Open result pole for if enrollees believe vaccines to be safe showed (2% of attendees indicate 0 (not safe) and most under 8,9,10 (very safe))
- Another open poll in Module 1 about how many children have been vaccinated globally (responses fell into a bell curve) Each poll that asks researched questions is followed by a statistic with a referenced scientific study statistic, there were also prompts to engage in discussions on thoughts and reflections on the results
- Module 1 makes use of expanding on information through pull down menus containing additional exploration of significant studies
- Module 1 also uses pulldown menus when explaining the ingredients that make up a vaccine, elaborating on what that ingredient does to fight against viruses or aid in the vaccine's storage or delivery
- Module 2 covers the reasons behind vaccination decision making in two ways, first mentioned in a video lecture but is then followed by a short click through reading which expands on those reasons and also contains various study citations
- Module 2 has a worldview survey to help align student and uncover their ideological associations that demonstrate the values and morals attendees align with

- Module 2 uses a click through section to explore the roles morals play on our emotions and beliefs, Moral Foundations Theory
- Module 2 has drop down menus used to expand on religious beliefs in relation to vaccinations
- At the end of each week is a discussion prompt on what new thing was learned, anything that students found interesting, and any questions that arose from this experience
- Additional resources provided at the end of each week (all citations that were referenced)
- Click through info cards found in Module 2
- Module 3 Focusing on Distrust, has an external resource to a BBC news podcast with a firsthand story on why people fall into anti-vaccination conspiracy theories "One woman's escape from the rabbit hole"
- Module 3 uses a click and read section to communicate counter arguments against Vaccines Myth 1 " Vaccines are major money-makers for BigPharma, government, and doctors"
- Module 4 has an interactable news story written about Fake Polio Vaccine news story (from 1956) and uses it to practice identifying anti-vaccination persuasive cues with a few cues identified as an example through clickable interactions Also includes a discussion prompt "What did you think of this anti-vaccination flyer from the 50s? & What other persuasion cues did you find?"
- Module 4 has the HURIER listening profile questionnaire "Below are 36 questions to rate your own perception of your listening behaviours. Each question relates to one of the six elements identified in Judi Brownell's listening model: Hearing, Understanding, Remembering, Interpreting, Evaluating, and

Responding." With a discussion prompt that asks to discuss the results and what they might mean when it comes to listening "After completing the above activity, what component did you gauge to be your strongest listening skill area? What component was ranked the lowest? What do your results tell you about how you might be able to improve your listening skills when talking to a vaccine hesitant individual?"

- The end of each module contains the same discussion prompt followed by a list of the core readings and additional resources, and a short 15 question multiple choice / truth or false quiz
- Each module begins with an introduction and expected learning outcomes
- Module 5 has a questionnaire that charts where people's strengths and weaknesses lie on the components of the HURIER listening profile, results also show responses of others in the course for comparison. Followed by a discussion prompt: "*After completing the above activity, what component did you gauge to be your strongest listening skill area? What component was ranked the lowest? What do your results tell you about how you might be able to improve your listening skills when talking to a vaccine hesitant individual?"*
- Module 5 has an external resource of Bad News, an interactive game that teaches players how misinformation spreads on social media more specifically how spreading misinformation can be incentivised.
- Module 6 ends with an Advocacy Guide, summarizing the key takeaways from the course.

3) Tools for Building Student Community

- Discussion boards, first week share name location and reason for joining the course through an interactive map addition that allows students to see the attendees on a global map.
- Discussion prompts after poll about student opinion and statistical responses "How did your answers to the above questions compare with global responses and the responses of your fellow students? Was there anything that surprised you?"
- Module 1 uses opinion polls to allow students to reflect their opinion on questions about vaccines against their peers followed by scientific statistics that present the more accurate answer. Multiple chances of students questioning their own perspectives by comparing them to their peers (feeling both a sense of security through the anonymity provided by the poll and a chance to correct their initial reactions with one based in scientific evidence)
- Module 2 has students order reasons for low vaccine uptake that range from familial and personal beliefs to skepticism towards authorities, inconvenience, fears, and lack of information "... in order of those you think are most influential in reducing vaccination rates." (presents the average of the other members as a comparison)
- Cultural cognition exercise has attendees answer questions that would place them on a grid charting (Hierarchist, Communitarian, Egalitarian, Capitalist) and compares it with other attendees, also provides an explanation of where you were placed on the chart and what it means about you (includes discussion prompt to discuss where students fit)
- Word cloud activity in Module 4 Myth 6 "What vaccines have you heard cause autism?"

- Module 4 Myth 6 Poll “Have you ever heard that the MMR vaccine, or another vaccination, causes autism?” (Yes-82% No-18%)
- Module 5 Word Cloud activity on what word comes to mind when engaging in conversation with vaccine hesitant individuals (showed the largest response being “Frustrating” out of 44 words submitted total)
- Module 5 Word Cloud activity “In a few words, can you think of any other possible ways to nudge people to vaccinate?”
- Module 5 has an open anonymous result survey asking “If you were forced to choose, which of the following biases mentioned in the video do you feel you are personally most susceptible to?” RESULTS: Confirmation bias- 78%, Omission bias- 11%, Availability heuristic- 6%, Negativity bias- 0%, Narrative bias-6% (18 responses)
- Module 5 also has an additional discussion prompt about “In the preceding video, Tom asserted that the subtle psychology of biases influence everyone's thinking. “Use the following discussion forum to brainstorm with your peers ways that pro-vaccine advocacy can work with cognitive biases instead of trying to fight against them.”
- Module 6 World Cloud activity allows attendees to express what it's like to argue with people with firm misinformed beliefs.

Chapter 5: Discussion

Now that a brief summary of the content has been established, chapter 5 identifies the significance of the teaching approaches taken by each MOOC and whether they relate to effective teaching practices and approaches as covered in the literature review. Consistent with the results chapter each MOOC is analysed in terms of its content and then its approach to teaching that content (including tools used). It was crucial to maintain this chronological order rather than covering the courses thematically because it makes it evident how information is built upon leading towards more complex topics while also making it easier to see instances of repetition or reiteration to ensure a complete understanding for course attendees.

Making Sense of News

The primary focus of the MOOC *Making Sense of News* is on providing students the essential critical thinking skills needed to safely and effectively interact with social media and news content online. Thus, misinformation is not addressed as its own topic but instead is referred to at a peripheral-thematic level. By the end of the course, students are better able to understand the process by which news reaches audiences and how to engage with news media beyond simple exposure and acceptance. Misinformation is explored through the context of news media, by learning about the processes, ethics, and pressures that reporters and news media outlets have to contend with; attendees are able to discern how misinformation and disinformation can occur organically as a result of various events and factors.

Content of Making Sense of News

Module 1: Week 1: Why does news matter?

Making Sense of News starts by introducing the concept of information neighbourhoods, a concept used to help students differentiate between various forms of media such as journalism, entertainment, promotion, propaganda, and raw information by

identifying primary goals, methods of production, sources of production, and outcomes. This exercise introduces students to the practice of deconstructing the media they interact with and highlights influences that may have been overlooked like promotional pieces being mistaken for concurrent, contemporary, or popular issues. The critical takeaway of the introduction to information neighbourhoods is that most media does not easily fall into one category or another, and that the separating distinctions between them can be difficult to determine until closely examined; for example, promotion being paraded as journalism. Thus the final exercise of the first Module is to have students find and explain articles that explicitly blur the lines between information neighbourhoods. This exercise is effective at giving students practise at decoding and both identifying and suppressing the assumptions that are made upon initial viewing, preventing future knee-jerk reactions to misleading headlines. Identifying and deconstructing various forms of media is an approach that students can use in a variety of contexts serving as a good introduction for misinformation encounters.

Module 2: Week 2: What makes news?

The editorial exercise that opens and is repeated three times in Module 2 (discussed further under Methods of Teaching) serves as an excellent example of how this course, through the teaching of how news media is produced and how to engage with it, is able to elicit introspection and critical thinking in their students. The exercise places the student in the acting role of the editor, where they decide on what news articles are deemed worthy of being on the front page cover, which ones should be dispersed throughout the paper, or if they should be included at all. The topics they use as example news stories all have inherent importance, such as local crime, stock market crash, and political scandals among others. This allows students to develop their own forms of reasoning behind their selection. The pressures placed upon the editor (role given to students) and their (fictitious) news media station, provokes students to discriminate based upon factors they may not have considered

before. These could be flashiness, relevance, viewer retention, relatability, global impact, along with the need to outperform competitors. Amongst the example articles are stories about bombings, famine, conspiracy, etc., which requires the student to question which is most worthy of media attention versus which story will receive the most attention and therefore more profit.

The benefits of how this exercise was conducted are covered in more detail under the Methods of Teaching section, but its inclusion provides students with the training to critically analyse news media. This exercise increases media literacy, specifically new literacy which involves understanding the production and consumption of news by providing learners the skills to critically assess various forms of information. Higher news literacies have shown to increase in fact-checking tendencies and exhibit scepticism towards misleading content and preventing its acceptance and spread (Kožuh & Čakš, 2023). This exercise also helps unveil to students their own biases under pressure and how they might unintentionally suppress an important story in search of a profit. These could be political scandals in the face of more shocking and eye-catching news about terrorist bombings, which may cause them to question their morals when put in a position of influence. When students are given an opportunity to discuss and compare with other participants, they now have to justify their choices and have a chance to see what news stories others deemed most pertinent. This reveals how varied the selections of stories are depending on personal attributes and reasoning of the deciding editor. It brings to light how many stories are likely to be chosen based simply on the fact that its impact is easily perceivable (local crime being more tangible than rising global temperatures), or more likely to gain viewers as it impacts or panders to a majority group. This exercise presents to students how news media organisations as entities have needs and requirements that must be met for its survival. Knowing the various societal, social, political, and economic factors that influence the production and consumption of news are all aspects

of critical media literacy and can increase critical news evaluation skills (WeintraubAustin et al., 2002). False balance reporting is when news organisations suggest that two sides of a dispute have equally valid arguments though evidence suggests no such debate. This biassed journalism has shown to increase skepticism about both climate change (Boykoff & Boykoff, 2004 ; Corbett & Durfee, 2004) and the safety of vaccinations (Clarke, 2008 ; Dixon & Clarke, 2012 ; Smith et al., 2008 ; Speers and Lewis, 2004).

The majority of Module 2 covers specifically what factors determine the significance of a news story, the power editorial control holds, and insight into what stories are reported on which gives the students an overview of how news media is produced. This comes in the wake of an exercise that brings forth students' assumptions, misunderstanding, or biases about news media production. Students have now begun to critically look at their own understanding of how news networks function, that may have been based in misinformation. Any polarised ideas have had a chance to come out during prior discussion sessions and any uncertainty that was occupied by misinformed beliefs now must contend with new information, one that is more logically sound and better explains how misinformation can arise naturally.

Module 3: Week 3: Who provides information?

The course also covers the way believability works in terms of news, specifically how biases can influence the production and interpretations of news content. Biases' influence on public interpretations is expanded on later in Module 5, while Module 2 focuses on the biases behind the production of news. Its placement here is important, as Module 3 leads into speaking on sources and provides strategies on analysing the credibility of the sources cited in articles. It introduces questions that require evaluating sources, which ask the source's relationship to the event, if what is being quoted is fact or opinion, and what interests the source has in speaking with the media. This forces students to engage with the information

they receive on a deeper than surface level, increasing critical thinking and preventing personal biases from dictating the acceptance of information. As evidence suggests the increase in media literacy and critical thinking correlates with a lesser likelihood of believing in misinformation (Daunt et al., 2023; Jones-Jang et al., 2021; Roozenbeek et al., 2020) This also provides a great practice that is applicable to all forms of encountered information, which also primes people to not accept encountered information on initial viewing, which can be heavily skewed by psychological factors mentioned in the literature review (Roozenbeek & van der Linden, 2019; Roozenbeek et al., 2022; van der Linden et al., 2017). Some focus is also given to hoaxes and rumours, specifically how they can cause miss-reporting, providing real world examples that lead to misinformation spread. There is also instruction on how to perform a reverse image search on Google, which may not be common knowledge to all attendees, adding a tool they can use to fact check on their own. A skill that may seem obvious to frequenters of online spaces, but not to those more vulnerable to misinformation exposure, specifically, the older generation who are shown to be a target of misinformation and more likely to share it (Guess, Nagler, & Tucker, 2019).

Though not explicitly stated, inoculation methods like familiarising oneself with minor forms of misinformation are recommended and exercised. The debunking section of Module 3 advises students to explore satire articles and satirical forms of media as a way to be acquainted with the exaggerated form of critique and reduce the likelihood of unintentionally falling victim to them in the future (Roozenbeek & van der Linden, 2019; Roozenbeek et al., 2022; van der Linden et al., 2017). This shows a form of inoculation done through exposure to misinformation that is debunked or, in this case, intended not to be taken at face value. They may also take the form of a fabrication, exaggerated truth, or a caricature, all of which require the reader to explore further if they do not inherently understand the joke or critique. This section concludes with recommendations of navigating social media that are

still applicable today. Recommendations which warn against trusting single sources for information, verifying information prior to sharing, and not relying on likes, comments, and shares to inform about the credibility or believability of the information are strategies still effective today. Though we know that implicitly seeing certain topics repeated will increase their believability, viewing them after they have been debunked has shown some impact in dismantling the "illusory truth effect" (Jackson, 2019).

Module 4: Week 4: Where is the evidence?

Module 4 focuses on evidence, its reliability, and how it can be used to influence the audience's perspective. *Making Sense of News* uses The True Story of the Three Little Pigs by Jon Scieszka to show how evidence presented can alter how a story is interpreted. By using a variation of the well known story of the Three Little Pigs, students can easily relate to how their understanding of a story can change depending on whose perspective is focused on. When presented from the wolf's perspective, the audience empathises with the wolf, justifying his action of eating the pigs. The story itself can be used to expose readers to the many subtle ways a narrative can be manipulated to assure readers empathise with the author. For example, the title of the story claiming it is the true telling, the consistent mention of making a cake for his grandmother, or even how the illustrations are used to present one subject in a positive light and the other in a negative. All are crucial lessons that could have been addressed in the module, however it is only used as an example of unbalanced presentation of the narrative. Though it does extract effective meaning when explaining how the audience cannot extract the true telling without being given the objective presentation of objective evidence, witnesses, and police reports. The underlying lesson being that readers demand more information from reporters and investigators before passing judgement.

Module 4 excels at demystifying the notion that the truth is a stagnant and complete narrative that is either reported effectively or intentionally skewed, which can make people

distrustful of updates or corrections to misreporting. Through its focus on evidence, this module helps familiarise students to the understanding that the truth is difficult to determine, and that the narrative we understand as being truth can change based on newly uncovered or interpreted evidence. Though not explicitly stated, this is a critical lesson required of students being introduced to the scientific method, and is a critical component of better media literacy, one that requires them to be active participants that seek further information and are flexible enough to accept new contrary evidence. Various forms of evidence and their reliability are also addressed. Its mentioning of the ineffective nature of eyewitness testimony is also critical for reducing people's susceptibility to misinformation, as it is often the primary form of its evidence presentation, and its reliance on anecdotal, eye witness, and other less reliable forms of evidence to be believed.

Module 5: Week 5: When should we act?

Module 5 covers biases by discrediting many examples of biases that occur with new media, primarily focusing on arguments that state one new organisation or another are biassed. Though there exists no specific section on communication there do occur many instances where components of communication are mentioned. For example, Module 5’s biases section confronts many common arguments that are typically encountered when dealing with individuals whose worldviews have been polarised to the point where they see sources of opposing arguments as biassed and untrustworthy. Many of the arguments are common when dealing with victims of the worldview backfire effect and conspiracy theorising though other than providing a logical counter argument there is no reference to how those logical arguments may face resistance in believability. Leading with these logical arguments Kajimoto makes mention of the psychological phenomena that may interfere with the acceptance of these arguments or corrective information, like cognitive dissonance and confirmation bias (Festinger, 1957; Myers & DeWall, 2015; Nickerson, 1998; Peters, 2022).

The module addresses how psychological variables influence what information is believed or accepted. It challenges the student or preemptively accounts for anyone that may have had resistance to the arguments made earlier with the potential to identify if any of these psychological phenomena were experienced. Although it is great that students are leaving this section now introduced to these new concepts, there are no sources or further reading links provided under this video lecture. This restricts the student from pursuing more knowledge about confirmation bias, cognitive dissonance or other similar psychological phenomena that occurs when conflicting beliefs or information are met. With its grazing of such complicated psychological phenomena the course fails to ensure students are effectively able to communicate despite their occurrence.

Methods of Teaching Making Sense of News

Making Sense of News, like other MOOCs, will sometimes have short descriptions under video lectures along with any other additional materials and further reading resources. *Making Sense of News* is not only the shortest course by content, but also short in terms of the length of the video lectures. No lecture exceeds longer than 6 minutes making its content extremely easy to consume and process with short reading sections dispersed in between.

Making Sense of News differentiates itself from *AVAXX* through its shortness in delivery. All of its lectures are short and concise making the content easily accessible, quick to get through, and easy to understand. Like *AVAXX* all reference content is available directly under the video and at the end of each Module should students want to explore further.

Module 1: Week 1: Why does news matter?

The activity of filling out the Information Neighbourhood chart begins by giving students an opportunity to fill in the answer they know or already possess, which is then in some cases shared and evaluated by other attending peers. Students are asked to fill out the

information neighbourhoods chart in Module 1 based on what they best think defines each category before being guided through video lectures to correct or refine their answers. This allows students to express their responses to themselves, a form of self assessment where the student can be given corrective information without feeling the need to defend their initial answer.

The Bonus Assignments at the end of Module 1 are five multiple choice questions that carry two marks each. This is not only a great way to cater to those students who prefer a more standardised form of assessment to excel, it also still allows other forms of attaining the minimum number of points required to pass the course. The questions themselves are related to the key terms or concepts brought up in the Module, which is an effective and easy way to reinforce specific learning. This relieves the importance placed on assessment and grading and puts the focus on learning new information.

Module 2: Week 2: What makes news?

Module 2 has students work through the editor exercise a total of 3 times each time increasing the student's work, knowledge, and exposure to audiences. The first iteration has students choose 5 stories they deemed more attention worthy than the rest without requiring an explanation for their choices. They can then choose to share their choice of lead story by inputting its key word into a word cloud that illustrates the most popular choices. This provides students both a choice to participate anonymously while still being able to compare their answers with others without feeling the need to defend their choice. Creating an environment where students feel safe enough to share their answers based on any assumptions or misunderstandings is crucial in preventing the worldview backfire effect. It prevents the defensive attitudes that accompany identity based or emotionally charged conversations (van Kessel, Jacobs, Catena, & Edmondson, 2022). This allows students to compare their responses behind a shroud of anonymity where their responses won't be judged

or marked, but simply indicate to them if their ideas or understandings are shared by their peers.

This approach is effective because students are given a chance to attempt the exercise (that will later be an assignment for marks) in a safe environment where their choices aren't impacting their grade while being entirely reliant on the information they possess coming into the course. For some students the word cloud is useful in indicating how alike many responses are while generating curiosity for those whose responses were less popular. This approach is inline with the recommendations found in literature for topics that may cause people to fall victim to the worldview backfire effect. Ensuring their worldviews are not made to be defended, reducing the possibility of repeating misinformation, and simply delivering knowledge without unintentionally causing cognitive dissonance to take hold can aid in keeping people more receptive to new and rational information (Bail et al., 2018; Lewandowsky et al., 2012; Swire-Thompson et al., 2020; Taber, & Lodge, 2006).

This gradual exposure to sharing one's choices while still having the capability to compare them continues as students take on another role of an editor in the following video lectures in Module 2. The second iteration of the exercise occurs during the video lectures where students take the role of a website editor as they are guided through an editor's decision making and the factors that influence them. Similar to the first, students are given story excerpts, however this time they must place them on a chart with the X- and Y-axis being labelled interest and importance, respectively. Students' answers can then be compared with those of the two student assistants moderating the course. Again allowing students to reflect on their responses without the need to defend them.

The third and final editor role play exercise occurs as a graded Module assignment, after the delivery of a few more short video lectures informing on more news determining factors. Students are once again asked to sift through mock news stories and select the ones

they deem most newsworthy. However, this time they are required to also state the reasoning behind their choice and are asked to develop a headline for their top two stories, ensuring students too can experience the practice of sensationalising that occurs to news in an attention based economy. Students are also responsible for grading two of their peer's responses, which adds to the element of editors relying on the impressions of others to determine the success of their choices. The gradual introduction and exposure to the assignment ensures student participation and allows students to refine their answers and reasoning behind them by the time the assignment is graded. The video lectures after the first iteration inform students without asking for an original understanding that must be defended based on prior misinformation ensures students aren't unintentionally reinforcing misinformed ideas. Finally, by asking students to form arguments that defend their choices after informing them on the scientific facts, as they did for the final iteration, allows them to put their newly acquired knowledge into practice.

Module 3: Week 3: Who provides information?

Module 3 introduces the IMVAIN analysis through both reading and short video lectures accompanied by a mock news article requiring students to perform the IMVAIN analysis on four sources (20 points total) responding through multiple choice questions (5 questions per source). Under each pre-identified source is a multiple choice question about the source's IMVAIN attributes. Following a short discussion prompt this exercise is repeated as the accompanying assignment with the Module, requiring students to evaluate more sources mentioned in a mock article. Though this is a quick and easy way to check for learning it may have been more effective if the sources were left unidentified in the official assignment accompanying the Module. This extra step on the student's behalf would ensure students are getting the practice of independently identifying sources through the varying ways a source is referenced within an article. Additionally, it would have also benefited the

students' learning to allow them an opportunity to explain the reasoning behind the binary choice they are offered or even a way to indicate the reasoning within the article, pointing to exactly why they found a source to be self-interested, authoritative, or uninformed. It would resolve the feeling of repetition while also increasing the challenge level of students as the course progresses and better indicating the learning that is taking place.

Module 3 is also where debunking is introduced, where "false news" is categorised under three possibilities, satirical stories based on real events, hoaxes and lies intentionally manipulated to mislead audiences, and information taken out of context (mistakes). Other than the video lectures' mention of examples elaborating on these categories and recommended steps to debunking them, like performing a google search for more information, fact checking/debunking websites, and reverse image searches, there exist no accompanying exercises or assignments for students to reinforce learning these steps. Though they are accompanied by recommended steps to put into practice on social media there aren't any substantial takeaway exercises from this section. A simple exercise of having students compile various disinformation media, instances of misreporting under a discussion board, or even a multiple choice quiz reinforcing some key steps to debunking online articles, would have greatly benefited the lesson since debunking is a critical aspect of media literacy.

Module 4: Week 4: Where is the evidence?

Module 4 begins with a "Special Q & A" for the years 2015 and 2016. Short form interviews with the hosting professors (two 5 minute interviews in 2016 and one 3.5 minute interview in 2015) where a co-host asks them pertinent questions or interesting topics that came about in the discussion boards throughout the previous 3 Modules. These interviews, though short, serve a very important role within an online course and more importantly one that deals with topics around misinformation. For the MOOC itself, much like a classroom, the conversation serves as a moment to highlight key points and ideas brought up by

attending students. Incentivising engagement with the discussion boards (which promotes community building) while also acknowledging student conversations, directing attention towards critical points of discussion. This discussion becomes pertinent when it comes to topics that cover misinformation. It gives teachers an opportunity to correct any misunderstandings that may have occurred within the discussion board comments. As it comes to topics surrounding misinformation, students are likely to have had prior exposure to misinformation surrounding a topic being covered and these topics can arise during the process of teaching (Saunders, 2022; Slaughter, 2023)

Module 4's assignment is essentially a multiple choice quiz requiring students to read another mock news article and answer questions pertaining to the key teachings of the prior video lectures (five questions). Though having a short multiple choice questionnaire may seem simplistic in this case, the questions asked requires the student to search for the facts within the mock article which elicits critical thinking and engagement with the work, all while making the assessment seem easier as it seemingly requires less effort on the student's part.

Module 5: Week 5: When should we act?

The final assessment in Module 5 repeats the assessment method of multiple choice questionnaire, where various short passages that have been taken from real news reports and altered for the assignment and assess the various claims they make. This repetition of assessment doesn't provide any unique benefit not discussed before other than being a simple form of assessment for both the instructor and student to complete.

Though this course may seem simplistic in its length and content, it serves as a great introduction to understanding how news media is produced and how misinformation can arise. The content that the course covers about misinformation and disinformation is not as

thorough as the other MOOCs but still addresses some basic media literacy knowledge that would leave students better prepared to encounter misinformation in their daily lives.

Making Sense of News Discussion Summary

Making Sense of News focuses on the aspects of news creation and communication but also provides students with a better understanding of how misinformation can arise both intentionally and organically through the process of news generation. It provides students with skills to understand and decode media (news deconstruction through media literacy), teaches skills of news and claims verification, and informs on psychological factors that influence the spread and acceptance of misinformation claims (like biases, influences of worldviews, and identities). *Making Sense of News* also provides students with source analysis techniques and resources better preparing students for future encounters with misinformation media.

In comparison to the *Anti-Vaccination and Vaccine Hesitancy* (*AVAXX)*, *Making Sense of News* excels in its assessment format. As it contains more occasions where students are required to apply the content being taught onto examples where they are able to demonstrate their learning better than a multiple choice quiz would be able to. *Making Sense of News* makes use of engaging discussion opportunities, word cloud activities, short answer responses, short multiple choice quizzes, student answer sharing to further understanding, and role play exercises to help students fully grasp the content being taught. The variety of assessments ensures the course not only stays student centered but also increases the opportunity for communal learning.Much like a traditional classroom where students are able to develop and share and build on their ideas amongst one another, all while having enough ability to demonstrate their understanding to the professors hosting the MOOC.

Anti-Vaccination and Vaccine Hesitancy

Anti-Vaccination and Vaccine Hesitancy (AVAXX) excels in teaching about media literacy against misinformation in ways *Making Sense of News* does not. Specifically, *AVAXX* effectively teaches about both the topics within the course , while giving students effective strategies to understand how misinformation in general works. Where *Making Sense of News* gives students tools to conduct fact checking of news content, *AVAXX* provides both explanations for the persistence of misinformation surrounding vaccinations, how they have been and can be discredited, and most importantly how to effectively communicate corrective information while avoiding the downfalls that misinformation exposure has on people. The content covered includes aspects of communication that are not thoroughly covered by *Making Sense of News,* like the potential counter arguments a communicator might receive from individuals who have had misinformation impact their worldviews and identities or how to mitigate for ideological backfire effects like the worldview backfire effect.

Content of Anti-Vaccination and Vaccine Hesitancy

Module 1: Understanding Vaccination and Anti-Vaccination

The first video lecture in Module 1 introduces vaccines and summarises the history of vaccine opposition and how it connects to vaccine enforcement measures. The presenter, Dr. Aechtner, recontextualizes how anti-vaccinationists are perceived by revealing how small a minority vaccine deniers comprise in the general population. The binary thinking of being either a vaccine advocate or denialist is deconstructed, and a variety of opinions that people hold about vaccines are explored. Presenting various vaccine stances frames the issue as a spectrum rather than a dichotomy between two (extreme or contrary) opinions. This approach results in individuals with hesitations or uncertainties about vaccines from being funneled into the category of vaccine denialists. Associating them with those who firmly advocate

against vaccinations and their efficacy can further expose the uninfluenced or conflicted to targeted misinformation.

Considering this danger, there is an effort made in the *AVAXX* MOOC to establish clear distinctions between those who trust most if not all vaccines, those who trust most vaccines but hold concerns about the newer mRNA vaccines, and those who completely deny the efficacy of all vaccines (clearly presented in the MOOC as the minority group). This distinction also helps reduce the isolation that can be felt by those who may have vaccine hesitancies but have not fully rejected vaccines. Whether their resistance may be a result of fear, concern, or lack of knowledge about vaccines, the danger of failing to address concerns is that contrary opinions or hesitant questions may be suppressed in the face of social rejection.

In a much worse case scenario, as a result of these concerns never being acknowledged or addressed, they may lay dormant for misinformation propaganda to monopolise. Not knowing where to turn for corrective information can leave people vulnerable to finding safety and reassurance amongst other uninformed, fearful, vaccine hesitant individuals in the anonymity of online spaces where they are more likely to be swayed by the volume and persuasiveness of misinformation propaganda. Research has shown that people tend to turn to not only online sources, but social media specifically, for health information (Marar et al., 2019; Wang et al., 2019). The acknowledgment of various perspectives also reduces the isolation that is felt amongst individuals with concerns or hesitations about vaccines. Knowing that their concerns will be addressed throughout the course may also encourage participation, fostering an opportunity to learn and bolster against misinformation.

The next video lecture covers the history of vaccines and tells the story of how the first vaccines were developed and how their advancements helped societies fight against

illnesses that had previously been incomprehensible and difficult to combat. The video lecture goes into depth about how the body and its immune system fight pathogens and how vaccines aid in that process by acting as a preventative measure for future infection. This is inline with the recommendations outlined by Hassan & Barber (2021), which state to lead with corrective information and minimize the potential for "illusory truth effect" (Hasher et al., 1977). It also echoes the suggestions made by Ecker et al. (2022) and Chan et al. (2017) which state to provide an alternative detailed explanation that can fill in the gaps in understanding or replace the misinformed beliefs to form an effective debunking strategy. A click-to-expand short reading section is used to summarise various types of vaccines, how they are created, and the diseases they combat. Among these is an mRNA vaccines' section that details how the mRNA vaccine works and explicitly states "The mRNA does not combine with the DNA of a host cell, as it does not enter the cell's nucleus where the DNA is kept, and it also degrades after the coded protein has been made". This statement has the potential to subdue the many rumours and fears surrounding the mRNA Covid-19 vaccine, specifically those about the vaccine altering the receiver's DNA, mentioning this is critical to replacing the misconceptions left by misinformation surrounding mRNA vaccines.

AVAXX aids in dispelling a popular mRNA vaccine myth by addressing a widespread and recent example of misinformation that will likely be familiar to all students of the MOOC. This strategy seems intended to reassure those who may have been hesitant but open to having their opinion swaying based on more information. Although this strategy has the potential to be very effective, not explicitly addressing this popular myth while still informing on mRNA vaccines by situating it within a click through reading section that may be ignored by some readers, is a lost opportunity for dispelling a popular piece of misinformation effectively. Such pieces of information would be more effective if they were reinforced through video lectures that explicitly address misinformation surrounding mRNA vaccines,

with multiple reiterations throughout the course or in the form of assessments that would help draw attention to and reinforce the factual information and ensure students leave the course better informed. Thus, one key consideration when designing a course where the topic overlaps misinformation content is that more effort must be made in assuring that students understand the details most relevant and useful in dispelling the bulk of the popular misinformation surrounding the topic being taught and that this information is integrated meaningfully into the content in ways that students' attention will be drawn to it and they will need to consider the information critically (or actively dispel a myth).

Module 2: Why do People Have Vaccine Hesitancy?

Module 2 contains a reading section discussing where people might turn when looking for factual information about vaccines, advising people to turn towards healthcare professionals over online sources. However, the issue with this recommendation arises when people lack access to healthcare professionals to whom they can turn to to address their questions or hesitations. Even then, there is a chance that healthcare professionals may also be impacted by misinformation claims spread online (Levy, 2021). Misinformation has a tendency to spread quickly online due to it possessing easily understood language, being more "eye-catching" and unlike misinformation, scientific information is rarely as interesting a conversation topic (Valaskivi, 2022; Xu, 2019; Xu & Guo, 2018). As a result of the proliferation of misinformation on social media and other trusted media platforms, many people were lacking in both accurate information and the critical media literacy to protect against online misinformation, leaving them vulnerable to its impact and spread. Though citizens turning to professionals when it comes to healthcare advice seems the most obvious response, the potential for misinformation to make viewers question the truthfulness and trustworthiness of healthcare officials and misinformation's ability to show a similar influence on the experts in the field, presents the need for all individuals to be provided the

necessary media literacy skills and practice to identify misinformation and its impacts through being able to challenge logical fallacies and be better fortified to encounter misinformation.

Module 2's video lecture discredits the idea that those who are against vaccines are uninformed about them, specifically expressing that the Information Deficit Model of science communication is false. It insists that simply providing factual, scientifically backed information is not likely to change people's minds as decisions and beliefs are a product of multiple variables, and simply gaining more information about a subject is not enough. It asserts that many subjective aspects are likely to influence our beliefs about contentions topics more than corrective information. Amongst these are many subjective aspects like identity, social networks, and personal values. This aspect is unique to this course as opposed to the first course, as much focus is given to establishing how belief systems are shaped and how they impact the decisions we make. Specifically, *Making Sense of News* holds a greater focus on how facts are reported on and understood by the public. That MOOC shows a greater concern with how this transference of knowledge occurs and how process can lead to the facts being altered or misconstrued. In contrast, *Anti-Vaccination and Vaccine Hesitancy* focuses on how the interpretation and acceptance of information is influential to an individual's perceptions. Specifically, it teaches the notion that information believed or acted upon is not necessarily a result of that information's ties to reality or how factually accurate the information is, but rather that information is filtered through subjective perceptions of the consumer. In other words, *AVAXX* puts forward the philosophy that individuals determine the legitimacy of the information based on subjective filters.

Factual accuracy and the backing of scientific rigour is not the only determining factor that impacts the acceptance, rejection, or interpretation of information; emotions and perceptions also play a large role, especially when the new information is contrary to prior

beliefs (Trevors et al., 2016). By learning about how these unconscious systems govern one's beliefs and understandings, users of the MOOC are less likely to be swayed by emotional appeal. Expanding further on the influence individuals' worldviews and perceptions have on how ideas are perceived, the Elaboration Likelihood Model (ELM) (Petty & Cacioppo, 1986) is introduced to help visualize and explain the factors that determine the likelihood of persuasive messaging being explored and engaged with or accepted by an audience. The ELM (Petty & Cacioppo, 1986) presents how factors like motivation to process, ability to process, the presence of peripheral cues, and nature of cognitive processing (initial attitudes, argument quality, etc.) all play a role in if there will be a cognitive structural change in response to persuasive communication. This model serves as a good framework to visualize how all persuasive messaging encounters certain filters that are a result of a person's worldview and biases. It is used to explain how certain persuasive messaging has the ability to bypass these filters, relying on audience's "mental shortcuts" and "cues" (such as trustworthiness of the messenger, personal biases, social identities, religious beliefs, etc.) that require less mental effort to be believed. This model helps explain how anti-vaccination messaging has a higher likelihood of being believed as a result of being able to take advantage of these mental predispositions, such as appealing to religious beliefs and invoking religious exemptions to oppose vaccination mandates.

Modules 3 and 4: Vaxx myths and persuasion: Part A - Distrust and Confidence & Part B Danger

The focus of *AVAXX* then transitions to the ways through which anti-vaccination messaging is communicated; specifically, introducing the most common themes present in their messaging, teaching about the cues present within the most popular arguments, and concluding with having the learner identify five popular anti-vaccination myths. This content is split equally between Modules 3 and 4. Module 3 focuses on the themes of Distrust,

Confidence, and Danger present in ant-vaccination messaging, which gives the learner specific clues to identify when they are encountering misinformation messaging. These themes are generally echoed in all forms of misinformation and, by informing students on the consistent themes present within most messaging, they can be better prepared to encounter it in the future regardless of the context to which it is being applied. The video lectures elaborate on how these themes work together to funnel audiences into a greater likelihood of believability, explicitly stating how anti-vaccination media is often loaded with persuasive messaging that pro-vaccine messaging lacks (Lazić & Žeželj, 2021 ; Xu, 2019 ; Xu & Guo, 2018). There are reminders to keep in mind any vaccine distrust claims or stories that students may have encountered previously because they are likely to share some of the themes that will be examined in detail later. This reminder cues students to engage with the ideas and questions that they have brought with them into this course, which can include those that are not specifically related to vaccines as these themes are applicable to misinformation claims in general.

In the video lecture "Focusing on Distrust", Dr. Aechtner uses the claims made by Flat Earthers to explain a typical argument of distrust, one that values personal subjective experiences over that of scientific evidence. By making use of and deconstructing various forms and content of misinformation, *AVAXX* is able to generalize its teachings and lessen the credibility of multiple pieces of misinformation. This strategy discredits the very foundational themes on which conspiracy theories rely, which include distrust of governments, distrust in scientific authorities, and providing a sense of control, leaving attending students more aware of these tactics when they are applied in other forms of misinformation media. In other words, anyone who might find anti-vaccinationist rhetoric convincing may reconsider their position when they come to realize it uses the same tactics used by propaganda from a lesser respected conspiracy. This strategy is beneficial because research suggests that conspiracy

theories like those surrounding Covid-19 form a ‘monological belief system’, where belief in one conspiracy about the virus makes it likely the individual believes in others (Miller, 2020a; Swami et al., 2011). This generalized coverage of the themes present within multiple forms of misinformation aids in both dismantling this ‘monological belief system’ while targeting a wide range of learners who may have been influenced by various forms of misinformation. *AVAXX* also triumphs over *Making Sense of News* in informing on the more subtle reactions that are present in the worldview backfire effect, like the idea of psychological reactants, which refers to the set of motivations felt by anyone who experiences that their freedoms are under threat (Gray, 2011; Zhang et al., 2023).

The myths addressed by Modules 3 and 4 are done so in detail, accompanied by concise points that challenge the logical fallacies present. Each myth begins with the rationale behind what makes it so believable, acknowledging common misunderstandings, fears, or thought processes that may lead someone to fall victim to these myths. The module then delves into the scientific evidence that disproves the myth, which is supported though citations that students can follow to reinforce and expand their learning. The content here is presented in a very efficient way, where a theme is taught, then a myth that makes use of that theme is debunked. This method of ordering allows students to see themes used in popular myths, helping them build connections between the two. This approach helps train students so that when they encounter myths, they can quickly identify the core theme and stay vigilant to potential manipulation.

Module 5: Improving vaccine advocacy: Part A - General Guidelines

Now that the learner knows the common tactics used in misinformation media, has been exposed to multiple popular vaccine myths, and has been given an opportunity to read through their deconstruction, the focus changes to effective communication. Modules 5 and 6 of *AVAXX* target effective communication strategies better than *Making Sense of News* when

it comes to how the message will be perceived by the audience. Module 5 reinforces that the communication of factual information does not guarantee a change in a person's beliefs and focuses on what strategies can be applied to change a person's beliefs about vaccine safety. *Making Sense of News* only considers how audiences will be misled by misreported facts while *AVAXX* takes into account the impacts the messaging will have and how it will be perceived or accepted by the receiver. There is clear acknowledgement of how vaccine enforcement measures may make people believe that policymakers are encroaching on personal rights and medical autonomy, eroding the trust people hold in government and medical systems. A recent example occurred during the Covid-19 pandemic, where a caravan of protesters bannered under the name of "The Freedom Convoy", protesting the enforcement of vaccines and Covid-19 safety protocols as an infringement on personal freedoms (Little, 2022 ; Tasker, 2022). Modules 5 and 6 address the idea that data and objective facts are not effective tools against the emotional appeals that anti-vaccination content employs. Module 5 presents five guidelines, many of which are audience-centered and focus on being an effective listener: be respectful and audience focused, avoid verbal aggression, be honest and open to questions, and acknowledge people's fears. The HURIER Listening Profile (Brownell, 1996) (Hearing, Understanding, Remembering, Interpreting, Evaluating, and Responding) is recommended for effective communication. The HURIER Listening Profile encourages effective listening skills that highlight the importance of comprehension over that of expressing one's own points, which is in accordance with WHO recommendations and guidelines for responding to (World Health Organization, 2017).

Many of the recommended steps in Module 5 overlap the recommended approaches for preventing the Worldview Backfire Effect. Great consideration is shown to the audience's emotions and attention to how the message is being perceived and interpreted. The efforts to prevent the triggering of a defensive response from the listener are in line with the

recommended approaches on preventing the Worldview Backfire Effect (van Kessel, Jacobs, Catena, & Edmondson, 2022). Strategies like avoiding verbal aggression, being respectful and audience-focused, alongside being open to questions and responding to concerns are all intended to ensure that the listener does not unintentionally become defensive and remains open to the reception of a more evidence-based argument, with an emotional narrative to adhere to memory. Teaching about the potential defensiveness that communicators might face trains students to be effective communicators who are able to guide factual and evidenced-based understanding past barriers of biases and misunderstandings.

When addressing the cultural cognition thesis, there is clear guidance given to avoid the potential backlash referred to as the "cultural identity-protective backlash" which is similar to the worldview backfire effect. Cultural cognition thesis postulates that individuals' perceptions of contentious topics are influenced by cultural values, the groups they identify with rather than scientific evidence. Similarly the worldview backfire effect is seen when an individual's worldview (which is informed by cultural identities and social groups) is threatened. Both result in the same identity securing self-defence mechanisms that oppose any information that does not conform to their group identity or worldview. There is also an explicit reminder to affirm personal choice, which was shown as a concern earlier in the MOOC. In order to be more effective at teaching students to effectively communicate against resistant misinformation, this section should have mentioned strategies like the reaffirmation of personal identity, a recommended approach to assuring the WWBE is not triggered (Ecker et al., 2022; Trevors et al., 2016; Nauroth et al., 2014, 2015).

Module 6: Improving vaccine advocacy: Part B - Debunking and Sticky facts

Module 6 focuses on identifying the target audience and structuring more effective debunking efforts. It also includes making corrective communication more memorable and receptive to the right audience, and exposes students to the idea of pre-bunking and

inoculation. Both terms used to reference the forewarning and preemptive debunking of misinformation before an individual is exposed to it naturally. Flat Earthers discrediting their own field collected data as a result of it not aligning with their prior beliefs (confirmation bias) is used as an example of why not to target the fervent vaccine deniers. Students are presented with examples of how fervent denialists will find excuses to have data align with their preconceived notions or discredit the data entirely, exposing a pattern of inconsistency and reinforcing the notion that empirical data will not sway closely held beliefs. Reiterating Module 1's lesson on how small a minority the extremist believers are compared to the large majority whose opinions can be swayed, reminds students who their target audience should be when constructing debunking messaging. In order to be more effective students should have been given more opportunities to develop debunking strategies or debunking messaging on their own to put these teachings into practice. Having students attempt to target a specific theme in misinformation messaging or create content targeting the right audiences would have benefitted the students and allowed them to practice developing these skills in a safe environment.

Module 6 makes mention of the precautions required before exposing individuals to misinformation. *AVAXX* informs students on the *Familiarity Backfire Effect* (FBE) which occurs when repeated exposure causes something to be perceived with more approval simply because it seems familiar. This is similar to the *Illusory Truth Effect*, which states that specific ideas can seem true as a result of being exposed to them frequently (Hasher et al., 1977). FBE has the potential to occur through the unintentional exposure to misinformation, even in the efforts to debunk it, can make that piece of misinformation seem more believable through incidental repetition. Though Dr. Aechtner makes mention of the lack of strong evidence for FBE being an issue, he does make mention that repetition of myths unnecessarily can also be detrimental to discrediting them (Ecker et al., 2020 ; Ecker et al.,

2023; Hassan & Barber, 2021). The suggested steps of repeating corrective information multiple times to reinforce them and both starting and concluding with facts is inline with the research on the FBE (Paynter et al., 2019 ; Skurnik et al., 2005). This research suggests that the details of a refutation are likely to be forgotten while the familiarity of the myth remains, requiring frequent debunking efforts and repetition of correctional information (Paynter et al., 2019).

Inoculation is also mentioned, exposing students to the idea of pre-warning as a preventative measure against misinformation; a structured approach to debunking is also provided. These include, teaching students to direct their debunking efforts towards those who have not yet made up their mind (fence-sitters), repetition of facts over misinformation, and maintaining a simple easy to grasp alternative that fills any gaps in understanding left by misinformation which are all recommendations echoed in research (Chan et al., 2017; Ecker et al., 2022; Hassan & Barber, 2021). The gap in understanding that can form when a myth is debunked is also taught about, in this MOOC, their tendency to form when events are still developing (Faraji-Rad & Pham, 2017; Miller, 2020a). Advice in the second video lecture on debunking recognises this gap forming through the debunking of myths and advises that effective debunking fills the gap with alternative explanations or "a credible substitute narrative". This advice highlights the importance to the story that is behind the reinforcement of facts. Suggesting that even an explanation for why someone might be spreading the misinformation can be more effective as studies show that communicating a narrative is likely to be remembered over factual records and data (Lee et al., 2020).

Methods of Teaching Anti-Vaccination and Vaccine Hesitancy

After the introduction of the instructors and moderators, the course allows students to meet their peers on a Google Maps world map, with which students can introduce themselves

on a global scale. Students can leave a comment speaking a bit about themselves and why they are taking the course. This initial introduction to the course centers around community building and creates the necessary comfort required to discuss topics that are emotionally inflammatory or too closely associated with personal identity (Ecker et al., 2022; Trevors et al., 2016; Nauroth et al., 2014, 2015). One downfall of this format is that there is no way to reply to posted introductions on the Google Maps tool itself, but students are still given the option to introduce themselves in the discussion section where a back and forth conversation is possible. Similar to other courses, students are asked to complete a survey that asks the motivations behind taking the course and the intended amount of hours expected to dedicate to the course and its activities.

Module 1: Understanding vaccination and antivaccination

Module 1, much like *Making Sense of News,* begins with a word cloud activity that asks students their initial thoughts on why they think vaccination is considered a controversial topic. The word cloud allows students to express answers anonymously, helping gauge the general understanding the students bring to the course, but the MOOC is static and the upcoming teaching does not change in response to these answers. Many answers reveal misinformation, lack of education, and fearful emotions, all concepts that are eventually addressed throughout the course. A word cloud generators at the beginning of Modules serves as a great "minds-on" (cueing) activity to have students begin to ponder the topics the Module will soon cover. However, many of the responses to the word cloud reveal opinions and concerns held by students about the topic, which remain limited to the fragmented responses expected by a single short answer entry. For example, a response to the question"Why is vaccination so controversial among the general public?" contains a variety of responses from "misunderstanding; lack of education; personal beliefs; to conspiracy theories". The presence of such a variety of responses hints at a potential for a critical

discussion about the questions being asked. Given the nature of the EdX platform where each page includes an area on the side to open discussion, the designers of *AVAXX* would benefit from leaning into this potential for expression by prompting students to open up discussions of their own to better express their thoughts and reasonings. Since MOOCs are pre-recorded lectures the responses are never addressed by the host professors nor are students given an opportunity to answer the question again at the end of the Module showing to both themselves and others how opinions have now developed through the knowledge provided within the Module.

The history section of Module 1 *Anti-vaccination and Vaccine Hesitancy (AVAXX)* makes use of a timeline tool that enables users to explore the history of vaccination from the earliest vaccine development for smallpox in 1796, to the development of the mRNA Covid-19 vaccine in 2020. Listing 30 diseases that have been eradicated as a result of vaccine development presents a strong argument in support for vaccines. Each short description explains who created the vaccine, how it came into being, and what long standing disease it cured. Considering many of these illnesses have been widely vaccinated and thus their impacts are not readily present in the minds of contemporary audiences, it would have been beneficial to include a description of the damage and devastation those illnesses had been causing on populations as a way to understand how beneficial an impact the development of their vaccinations was.

The various forms of short form assessment *AVAXX* uses are located/placed at the end of most of their video lectures. For instance, Module 1 used a drag and drop sorting system to reinforce the components that fall under the adaptive or innate immune system, with only four draggable options. The sorting exercise reinforces which type of cell is adaptive or innate but does nothing to connect or transfer to how vaccines work or how these cells play a role in fighting diseases. This activity is also simplistic to the point that it can be solved

through trial and error, potentially leaving nothing memorable for students to leave the exercise with and quickly recall. Following this initial assessment is a short reading section that elaborates on the various types of vaccines, the differences in their production and the way they combat viruses . This approach varies how information is delivered to the learner, keeping learning novel and providing a break between video lectures and a lengthy interview with an invited expert.

The designers of the course make use of a short check-in anonymous poll asking students to report how safe they believe vaccines are. The polls are a great way to gauge the general beliefs that are persistent within the classroom when done before the lesson, especially for a lesson topic that has been politicized, is surrounded by misinformation, or is closely related to personal identity. However, this poll is not utilized effectively as it could have been. This occasion is the one and only time this question is asked, nor is there a prompt for students to discuss their thoughts or opinions on the question before and after the delivery of content. This design choice leaves no way to know if these opinions have been swayed with new information or if people attending had already held the belief that vaccines are safe. Seeing others change their opinions on vaccines is likely to aid in others reconsidering their own perspectives. Knowing the developing opinion of students as they progress through the course would be critical information for the designer of the course, and teachers in general, in order to increase their lessons' effectiveness. This same page also provides a video lecture explaining how vaccines are tested for safety and efficacy along with some short reading sections about the role the placebo effect plays in the distrust for vaccines, how vaccine safety is monitored through large governing bodies, and finally a large list of long term studies that show the long-term safety of vaccines. The support that providing a large list of longitudinal studies has is unmatched by video lectures, as it makes defending misinformed arguments difficult in the face of so much overwhelming evidence. Anyone with counter

arguments has the opportunity to view the studies themselves and openly dispute any claims in the discussion tool available on each page of the Module.

The next section is unique to this course, as it is full of anonymous polls that ask students their perceptions and beliefs about how vaccines are perceived and used globally, each poll question is accompanied by a short feedback paragraph that reveals the actual statistics along with a citation to the study being referenced. The use of polls in the classrooms suggest good reception from students, increasing participation and engagement with the content, along with overall satisfaction (Mediero, Lastra, & Palacios, 2021). The developers conclude the module with prompts for discussion and a list of the core readings of topics referenced throughout the module along with additional informative sources. This list of readings provides an opportunity to expand on the content discussed throughout the Module but the Module fails to provide a clear list of references for the concepts mentioned within the video lectures. The video lectures themselves have citations for novel theories or models (ex. “Ref 1-3” written in brackets appearing on the bottom right or within the transcript when a model is being referenced within a video lecture) but fails to provide a corollatory list where the student can access further information about the concept then and there. This issue works counter to the earlier point where large lists of resources were provided as a chunk at the end of each Module or accompanying large written texts giving students an opportunity to explore the topics further. The inconsistency of these references for their video lectures leaves students lost in terms of finding the models or sources being explored. Comparing this to the MOOC Making Sense of News, many video lectures are accompanied with links to references made within the videos.

The discussion prompt itself is generic, simply requesting students to discuss any new learnings throughout the week, anything they found interesting, and any questions they may have. This prompt is repeated at the end of each Module, and its questions are not specific to

the themes covered. Such prompts rely entirely on the student to bring about points of discussion which could be voided by simply stating something students found novel rather than eliciting critical conversations surrounding the topics covered. A short (15 questions) multiple choice and true or false quiz is held which revisits some of the important takeaways from this module.

Module 2: Why do people have vaccine hesitancy?

Module 2 begins with a poll that asks students to rank various reasons for low vaccine uptakes and their answers are then compared to the average ranking of all attending students. This small poll prior to a video lecture expanding on the various reasons that impact vaccine uptake does little in terms of direct teaching of new information, but serves as a way to prime students into thinking about the primary reasons that vaccines may be rejected. The video lecture under it only expands on the listed reasons giving each category for simplification but does not in itself rank them. The comparison in ranking order with the average response of that of the class serves as a good “minds-on” (i.e., introductory focusing) cueing activity, an effective way for students to ponder the various reasons behind low vaccine uptake prior to the lesson. This activity challenges students to think about both what others perceive as important in deciding whether or not to take a vaccine and what they themselves believe would influence their decision and perception of vaccines. Short click and read sections are dispersed after each short video lecture. The first of the two activities to this course is the inclusion of short surveys that allow students to connect with the ideas brought up within the content. Module 2 introduces a cultural cognition worldview exercise, a survey that helps students understand what their worldviews are and how they reveal biases or belief systems that may have been unconsciously followed but never acknowledged. The activity provides an opportunity for the student to connect to the content being covered while reflecting on the various ideologies that exist and which they find themselves identifying with.

Providing the additional statistics of the classmates allows the student to see if their perspectives are the norm or fringe. Being able to see peer responses is beneficial because the popularity of misinformation is often overestimated and over-represented online (Sutton & Douglas, 2022; Lazić & Žeželj, 2021 ; Xu, 2019 ; Xu & Guo, 2018) and comparing their responses to peers could help students to understand this point better. Polls held on social media sites are also likely to present similar extreme results and so this may lead people who hold more rational beliefs to feel isolated or believe they are a part of the minority. The implementation of these polls is intended to allow students to recontextualize those beliefs in an environment conducive to rational thinking, like the class. They are presented with a place online that is not highly influenced by extremist views.

Modules 3 and 4: Vaxx myths and persuasion: Part A - Distrust and Confidence & Part B Danger

Modules 3 and 4 are arranged to teach about one of the themes or persuasive cues, explore them in detail through lecture and interview, before exploring a set of popular myths. These myths are then deconstructed as an example of how these themes and cues could be encountered in various forms. However, there is a significant change in the method of teaching here, since all of the myths covered in Modules 3 and 4 are all done through reading sections except for Myth 6 - Vaccines Cause Autism and Myth 10 - Vaccines Contain Dangerous Toxins in Module 4 which are covered through video lectures. Both modules together address a total of 12 myths (3 myths in Module 3 and 7 in Module 4), significantly decreasing the number of video lectures and increasing the amount of reading required by students. Though this is beneficial in covering the large quantity of myths that are present surrounding the topic of the MOOC, the sudden departure from video lectures to lengthy back-to-back reading sections can be discouraging to learners that had previously been engaging with the video lecture style content. Additionally, none of these myths are

readdressed in the quiz at the end of the Module to assure students have understood their false nature, leaving them inconsequential.

Considering that Modules 3 and 4 covered various myths and deconstructed them, a 15 question multiple choice quiz as assessment at the end of the modules seems ill-fitting because it implies there is one correct answer and requires less critical thinking. This format presents a missed opportunity for students to attempt discrediting a myth for themselves or scouring the web for persuasion cues and themes being used in messaging. Having a more active participation component to the deconstruction of myths would encourage students to practice and run into potential resistance that they would encounter outside of the class. There is also a missed opportunity to engage students in deeper discussion at the end of Modules 3 and 4. The same discussion question is repeated at the end of every module resulting in lesser engagement. Prompts asking how these new understanding of the persuasion cues and the existence of consistent and predictable themes in misinformation messaging impacted them would increase student engagement with the content. Asking students to share their experiences with myths they believed and may now be looking at more critically would also aid in fostering an environment where people are safe being incorrect. Students would be more comfortable with reevaluating their beliefs that lead them to trust the wrong conclusions. By keeping the discussion prompt exactly the same at the end of each Module it becomes easier to ignore and thus less important to engage with.

Module 4 uses an old example article claiming “the polio vaccine is fake” to allow students to practice identifying various persuasive cues on their own. However, this is not an assessed activity, and so is entirely dependent on the student if they wish to engage with the course to that level. A few cues are identified but there is no way for a student to check if they were able to locate all the persuasive cues used within the article. With a simple discussion prompt that implores students to share their findings, the assignment overall can

serve as a great tutorial to prepare students for an upcoming assignment that has students practice uncovering these cues in more modern propaganda. The article itself is old, uses a myth that has long been disproven, and is less contested during the time a student is able to take the course. As a result of these factors, the claims and persuasion tactics used are less likely to be effective, attending students would not deem polio as a threat and are less likely to have experienced polio vaccine related misinformation in the past. It is important to use the safe environment a class provides students with to practice the newly learned skills of debunking against more current content and strengthen the inoculation against misinformation as intended by the designer of the course. Even a prompt asking students to find and share their own examples that they may have encountered, compiling them into a discussion section where students can comment on one another's posts would increase engagement with the themes while bringing attention to more contemporary myths that are widely believed today.

Module 5: Improving vaccine advocacy: Part A - General Guidelines

Module 5 is where students may realize that the course itself is designed to fit the guidelines they promote which include: Discard the Knowledge Deficit Model, Be respectful and audience-focussed, Avoid verbal aggression, Be honest and open to questions, and Acknowledge people's fears. There are many moments throughout the MOOC where *AVAXX* acknowledges common fears that people may possess while acknowledging and addressing the very real concerns, all in the efforts of curating the content to their audience. The course itself stays focused on communicating with those members of the audience who are still hesitant without delving into the depths of misinformation. This approach avoids catering to those on the extreme ends of the belief bell curve and less likely to change opinion, while avoiding giving those beliefs' unintentional credibility. The implementation stays mindful of not triggering the worldview backfire effect in students who may have personal associations

with the content being discussed, avoiding aggression and defensiveness. A large portion of the MOOC is dedicated to providing information to prime a student for encountering misinformation prior to exposure. When it comes to discrediting the myth, they are deconstructed for both their logical fallacies and their emotional appeal. Both components that often reside at the core of many misinformed beliefs. Dismantling those leaves little for staunch believers to argue against. The MOOC also highlights the importance of narratives in messaging by using narratives throughout the course. Narratives are made use of throughout the MOOC whether through interviews with experts in the field of vaccines sharing their personal experiences or links to articles about people who have been deeply influenced by online misinformation finding their way back out. Narratives make the content of the course relatable to many attending students who may have experienced similar impacts of misinformation for their family members (Lee et al., 2020).

Module 5 focuses on the listening component of communicating and introduces the HURIER Listening Profile (Brownell, 1996) of effective communication. HURIER, being an acronym for Hearing, Understanding, Remembering, Interpreting, Evaluating, and Responding, all making components of good listening behaviours. Hearing involves focusing attention, discriminating between background noise and concentration on the speaker. Understanding involves comprehending what the speaker is attempting to communicate, including asking questions and listening while limiting interrupting. Remembering involves recall, the ability to commit what one is hearing to memory. Interpreting involves taking the context of the message into account to better understand its meaning, a process which involves empathising with the speaker's perspective and interpreting nonverbal cues (what is not explicitly being stated but communicated). Evaluating involves making a judgement once the full message has been delivered and understood completely while being aware of the influences of personal biases. Responding is informed by the previous five points and

involves both a spoken and nonverbal component through body language. This model is not only elaborated on but students are given an opportunity to answer a questionnaire that allows them to gauge which of these skills are their strengths and weaknesses. This questionnaire produces a Radar Chart, depicting the student's strengths in Hearing, Understanding, Remembering, Interpreting, Evaluating, and Responding. Accompanied by a Bar Chart for each skill comparing the individual student's response to the class average. This is another opportunity where students are asked to reflect on their personal attributes in connection to the skills mentioned within the course. Following is an engaging discussion prompt asking students to assess their strongest and weakest listening skills, and discuss how they might improve in communicating with vaccine hesitant individuals. This prompt activity gives students even more to take away from this course than just the facts that discredit the myths. The prompt encourages growth in personal communication skills that will impact their ability to communicate during emotionally charged conversations, such as those that occur when another's strongly held beliefs are challenged. This exercise has the ability to impact the less addressed social factors that lead to radicalized thinking, like ideological homogeneity that occurs in online spaces like echo chambers (Wojcieszak, 2010; Yan, 2021), by keeping communication methods open between individuals with contrasting personal beliefs or identity-related disagreements.

The discussion section at the end of Module 5 asks students to compile a list of ways in which using persuasive cues might benefit or hinder pro-vaccine advocacy. Though this was an easily missable discussion prompt that was sandwiched between two paragraphs within a short reading section, its strength resides in encouraging students to think critically of both the positive and negative impacts that a persuasive vaccine campaign might have. More specifically considering any other potential backfire incidents that accompanied the mandatory enforcement measures of the past. There is also a large amount of reference

literature supporting arguments for and against behaviour modification techniques addressed within the Module, which once again shows how both sides to an argument are considered and addressed. Another discussion prompt occurs when discussing biases asking students to compile how pro-vaccine advocacy can work with cognitive biases instead of fighting against them. These prompts encourage critical thinking and require students to consider multiple perspectives.

Module 6: Improving vaccine advocacy: Part B - Debunking and Sticky facts

Module 6 expands on Pre-bunking and Inoculation Theory (Roozenbeek et al., 2022; Roozenbeek & van der Linden, 2019; van der Linden, et al., 2017) and in doing so references a game created by two University of Cambridge psychologists that has shown to be effective in increasing the ability for students to spot and resist misinformation after gameplay. Students are provided with a link to play this game (Bad News) for themselves and discuss it along with prompts to consider any creative ways they can think of to pre-bunk vaccine misinformation. This is a unique connection to the course, the game itself is accessible to anyone online and the gameplay consists of a multiple choice / choose-your-own-adventure style of interaction where players are asked to generate misinformation (choosing from provided options) as a means of better understanding how it functions. The mechanics of the game present the link between malicious actions taken online, like impersonating various authority figures, and describe their influence on others who inhabit the same spaces. The game funnels players into making the choice of spreading misinformation through the form of "tweeting" it out to people online using various forms of manipulation tactics, like Impersonation, Emotion, Polarization, Conspiracy, Discrediting, and Trolling. The game demonstrates how information can be manipulated and targeted to vulnerable individuals, along with showing how social media becomes an accelerant to this aiding in the spread of misinformation. The game used in this exercise, Bad News, itself has literature suggesting

that teaching digital media literacy and fake news recognition through gamification or online games is effective (Basol et al., 2020; Maertens et al., 2021).

Module 6 uses an acronym based model to help students quickly recognize six traits to make ideas ‘sticky’, easy to remember and retain against future misinformation exposure. SUCCES: Simple, Unexpected, Concrete, Credible, Emotional, and Story is covered in short reading sections expanding on each component and is concluded with another 15 question multiple choice quiz. By not allowing students to apply this acronym to generate messaging of their own is a missed opportunity. Module 6’s focus on effective communication and debunking, however there are no relevant activities that practice debunking that might make the lesson memorable or provide key takeaways for students. Even the section titled “Debunking Activity” is simply a world cloud generator section. A more effective activity involving student participation where students actively put into practice the skills they have learned throughout the MOOC would have provided both better training in debunking and an effective assessment of the student’s understanding of debunking strategies. A simplistic multiple choice quiz fails to provide the same practice with critical thinking that a participatory debunking activity could have.

Anti-Vaccination and Vaccine Hesitancy Discussion Summary

Rau and Premo’s (2025) Systematic Review of Educational Approaches to Misinformation found that most educational intervention recommendations include finding out about a student's prior knowledge about the topic being taught which includes prior exposure to any misinformation, followed by teaching an intervention technique that helps recognize or discredit misinformation, and finally some form of assessment that insures the information that was taught was learned. In accordance with this *AVAXX* succeeds as it tests for prior knowledge at the beginning of each Module where students are asked some form of question that primes them to take the topics being covered into consideration. *AVAXX* also

provides various techniques to combat misinformation while dismantling various myths that exist surrounding the topic of vaccination. *AVAXX* also conducts assessments at the end of each Module (through a multiple choice quiz) to ensure some form of learning is taking place. When looked at more critically however, *AVAXX* primes students using word cloud activities, while the topic of misinformation would greatly benefit from a discussion. *AVAXX* also covers a large number of myths that are popular but it does so through lengthy reading sections, while models and methods of debunking are taught through video lectures. The multiple choice assessments keep the course easy to approach for students globally but ensuring students have learned the techniques, modules, or debunking strategies for misinformation surrounding the topic would benefit from more critical assessment opportunities. Having students actively debunk popular myths that are prevalent today using the teachings of the module would keep the course from becoming static.

In comparison to *Making Sense of News*, *AVAXX* excels in the models used that allow for greater student introspection. The HURIER listening profile is not only talked about within video lectures but students are given an opportunity to take a questionnaire and uncover their own strengths and weaknesses in skills like hearing, understanding, responding, remembering, evaluating, and interpreting. *AVAXX* also contains lengthy interviews with experts full of personal anecdotes and professional recommendations that increases both memorability and credibility to the content being taught. While *Making Sense of News* also contains access to lengthy expert interviews they are cut up into parts and dispersed throughout a Module for where its content ideally aligns with the topic being taught. While both MOOCs address the idea of worldviews, the biases they carry, and their impact on the information that is perceived. *AVAXX* gives a greater consideration given to the component of communication, specifically encountering opposition against scientific points of view and

underlines the importance of considering more than the focus on communicating scientific information but also appealing to the person's identity or group associations.

Table 1: Comparison of MOOCs Making Sense of News and Anti-Vaccination and Vaccine Hesitancy

Making Sense of News	Anti-Vaccination and Vaccine Hesitancy
Content	
Focuses on media literacy and critical news analysis	Focuses on public health, misinformation, and psychology
Teaches how to identify credible news sources, provides fact checking practices and sources	Explores historic, social, and psychological reasons behind vaccine hesitancy
Helps understand how news is produced and where misinformation can occur unintentionally	Emphasizes effective communication strategies (accounting for WWBE, being an effective listener, inoculation theory)
Ethics of journalism	Teaches about the psychological reactions to information counter to one's beliefs
Emphasizes fact-checking and bias detection (through activities)	Uses the gamification approaches (Bad News)
Short lectures and interviews (with longer versions (25-30 minutes) optionally available under bonus material)	Lengthy interviews and lectures
Downfalls	
Repeated activities	Repeated discussion prompts
Less emphasis on communicating to worldview backfire effect, prior misunderstandings and ideological dispositions	Less emphasis on assessment of misinformation detection techniques

Assessment	
Multiple choice quizzes World clouds Creative assignments (mock editor role) Optional bonus multiple choice quizzes	Multiple choice quizzes World clouds Occasional engaging discussion prompts

Chapter 6: Key Findings and Conclusion

With misinformation media proliferating in online spaces and little to no protective measures in place to prevent users from reckless exposure, users are left defenceless against persuasive misinformation content. Repeated misinformation exposure not only increases its believability but also causes resistance when corrective evidence is being communicated (i.e., illusory truth effect, worldview backfire effect, and avoidance of cognitive dissonance) (Ecker & Ang, 2019; Ecker et al., 2022; Festinger, 1957; Hasher et al., 1977; Hassan & Barber, 2021; Nyhan & Reifler, 2010). Studies have shown the Knowledge Deficit Model, the idea that a lack of knowledge about a topic is the determining factor on whether someone is likely to fall victim to misinformation, to not be supported by scientific evidence (National Academies of Sciences, Engineering, and Medicine, 2017). Insight about how misinformation spreads reveals its reliance on exploiting people's innate human attributes (cognitive biases, trust in authority, emotional responses like fear and uncertainty, etc.) that have developed as a way to compartmentalise the large sums of information people encounter daily. One effective defensive measure against misinformation has shown to be an increase in critical media literacy, which aids as a filter through which information can pass and be decoded in efforts to discern fact from fiction.

Governments require well informed media literate citizens not only to create a stronger democratic republic, but to prevent ideological attacks through targeted misinformation campaigns, led by adversaries within or without the country. Hence providing

free and accessible education, specifically critical media literacy skills, for all is imperative, leading multiple countries of the United Nations to place in their agenda for 2030, Goal 4 "...to provide equal access to affordable vocational training, to eliminate gender and wealth disparities, and achieve universal access to a quality higher education" (UNDP, n.d.). Massive Open Online Courses (MOOCs) are able to provide free access to structured higher education through university level courses to the masses. By nature of being designed by university professors, MOOCs have a greater reputation for accuracy in the face of the misinformation already present in online spaces. Though the courses offered through MOOCs have subsequently oriented towards ventures that profit both MOOC hosting websites (extracting payment for certifications) and their users (by providing extra accreditation for specific job advancements), their potential for providing critical media literacy knowledge to anyone curious enough to learn seems promising.

Overview of the Study

This study was conducted to critically analyze how two MOOCs, designed to teach topics that are largely impacted by misinformation (vaccines and news media), are able to do so while avoiding the negative influences that misinformation exposure can have on individuals through the illusory truth effect and resilient confirmation bias (Hasher et al., 1977; Hassan & Barber, 2021; Myers & DeWall, 2015; Nickerson, 1998; Peters, 2022). The prevalence of misinformation within society and online spaces increases the likelihood of students already being exposed to misinformation that overlaps topics teachers are tasked to teach (ex. climate science, media literacy, scientific approach, etc.), especially when these topics are subject to contentious societal debate. In these cases, students are likely to bring their prior understandings into the classroom, which may include misinformation about certain topics and unintentionally expose such ideas to their classmates or impact the reception of the lesson. Such issues make designing a course surrounding a topic that is

tainted by misinformation difficult. Online resources like MOOCs offer potential to deliver the much needed media literacy required to counter and protect against future misinformation exposure; they also offer additional perspective on how course delivery can be managed around such sensitive topics.

To understand how misinformation can be countered effectively and how it is being implemented online, two MOOCs were analysed for their approaches to teaching content that has misinformation surrounding it. *Making Sense of News* and *Anti-vaccination and Vaccine Hesitancy* (*AVAXX*) were attended and evaluated for their approach to how their content taught against the prevalent misinformation surrounding their topic and the methods they used to efficiently teach critical media literacy against misinformation while mitigating its negative impacts. *Making Sense of News* had a more passive instructional approach to how misinformation is targeting their topic of news, where assignments centered around understanding how misinformation can be generated through a multitude of variables. Meanwhile, *AVAXX* was more active in addressing the myths surrounding its content, oftentimes dedicating entire modules to addressing and deconstructing the prevalent ones. *AVAXX* also highlighted the social, psychological, and political impact misinformation spread can have and informed the learner about communication strategies for corrective information to a greater degree. *AVAXX* also exposed attending students on the potential resilient arguments they may encounter and informed on how certain misinformation downfalls (ex. worldview backfire effect, illusory truth effect, etc.) can be mitigated.

Notes were taken regarding the forms of assessments used to demonstrate learning, actions taken for community building, and methods to encourage active participation. Focus was also given to the tools used to teach (ex. video lectures, drag and drop menus, discussion prompts, etc.), including those that students can take away from the course for future reference, like links to fact checking websites. How the courses approached the

misinformation present in their respective topics and how these were debunked was also analyzed. The key findings from this research provide insight to future course designers who intend to teach a course topic that has been targeted by misinformation. Though some of the key findings apply to the design of online courses delivery, recommended approaches to content design can also be applicable to teaching face-to-face lessons as well. Table 2 presents a detailed comparison of the types of misinformation addressed and key strategies, as well as the pedagogical considerations included in the two MOOCs analyzed for this study.

Table 2: MOOCs Making Sense of News and Anti-Vaccination and Vaccine Hesitancy Detailed Comparison

Categories	*Making Sense of News*	*Anti-vaccination and Vaccine Hesitancy*
Misinformation		
Scope of Misinformation Coverage	Broad - covers misinformation generated through journalism, politics, and general news media production (considers public interpretation)	Narrow- Primary focus is on misinformation present around vaccinations. Includes myths, psychological and social effects of misinformation belief
Types of Misinformation	Fake news, disinformation, clickbait, media bias	Conspiracy theories, vaccine misinformation,
Misinformation causes covered	Misreporting	Psychological predictors, group think
Misinformation Countering Strategies		
Communication	Details how to accurately report news to avoid false reporting and unintentional misinformation	Provides strategies on how to communicate against misinformation talking points
Tools and Strategies Taught	Source evaluation, fact-checking, bias detection, media framing analysis	Science communication techniques, myth debunking strategies, psychological factors that influence

		misinformation belief
Pedagogical Strategies for MOOCs		
Target Audience Preparedness	Equips learners to critically evaluate news media	Prepares learners to address health misinformation and effectively communicate corrective information
Case Study Use	Makes use of real-life news stories and headline analysis	Analyses vaccine related campaigns, social media posts, and historical events related to vaccines
Practical Application	Source comparison activities and bias identification	Communication strategy planning
Assessments	Quizzes, discussion prompts, media analysis tasks, scenario based exercise	Quizzes, discussion prompts, self reflection surveys, drag and drop activities
Instructor Expertise	Led by journalism and media literacy expert (Hong Kong University)	Taught by public health professional and vaccine communication researcher (University of Queensland)
Community Interaction	Discussion board prompts focus on interpreting diverse new stories	Discussion prompts focus on sharing views on vaccine misinformation and hesitancy (many repetitive prompts)

Review of Key Findings

This study successfully identified the issues currently faced by the education system when attempting to teach content that has been targeted by misinformation. The roles played by personal biases, subjective interpretations, and the persuasive strategies employed by misinformation content to influence believability were also exposed. Challenges facing educators about prior misinformation exposure resulting in resistance to correction and avoiding unintended exposure during the education process that can negatively impact the teaching of specific subjects were also uncovered. A number of educational approaches and

pedagogical tools for online delivery that aid in this process were also identified and are summarised in the following paragraphs.

Course Delivery Considerations

Teaching in online spaces, particularly through open online courses (MOOCs), presents unique challenges compared to teaching a traditional course with online components. A limitation inherent to many online courses is their tendency to become static once initial instructions and resources are uploaded. Specifically, without continuous interaction and monitoring by the instructor, the "live" quality of the learning environment diminishes. Instructors within traditional classrooms have the ability to be flexible and modify content in accordance with student feedback through assessments and discussions. Relying solely on pre-recorded lectures risks the information presented becoming outdated as the surrounding body of knowledge grows. While much of the foundational content in these lectures retains its pedagogical value, the lessons that specifically address techniques for debunking misinformation can become outdated and the external resources can become inaccessible. Such was the issue with the older MOOC (*Making Sense of News*) where some of the links to referenced articles were broken or expired.

Other causes of course stagnation include insufficient student attendance, participation, or progress, which can hinder collaborative learning activities such as discussion forums, peer assessments, and word cloud generators. Some solutions that were identified in the MOOCs analyzed included updating links and resources regularly (e.g., each term or year of instruction) to ensure accessibility and continuity, restructuring assessments to reduce dependence on concurrent student participation (e.g., implementing multiple-choice quizzes or removing peer assessment), and incorporating periodic Q&A videos or lecture updates to address any emergent topics from within the course. *Making Sense of News* was able to maintain a sense of student interactivity through instructor efforts rather than

eliminating student interactive assessments like discussion sections. Choosing to respond to students within discussion threads, periodically highlighting student contributions by elaborating on student generated discussion points, and updating modules to indicate inaccessible URL links, rather than relying entirely on a multiple choice quiz form of assessment, can reaffirm student-instructor connection while increasing student engagement and retention of the courses' material.

Designing assessments that build upon prior student work can also increase the longevity of a MOOC. Assessments that encourage students to compile found resources or, in the case of misinformation, gather popular misinformation debunking or fact-checking strategies can create growing repositories of student generated knowledge. Such iterative activities not only serve as an effective form of assessment, but also become a hub where future students can find aid and expand upon the practical application of misinformation analysis skills.

Balancing Pedagogical Approaches

Course designers should consider the balance between student-centered and teacher-centered approaches when constructing MOOCs. When designing for a course topic that is targeted by misinformation, it may appear efficient to present a large volume of misinformation myths through condensed reading segments. As was noticed in the MOOC *AVAXX* where consecutive reading sections debunking popular vaccine myths were presented, halting the video lecture learning experience and debunking myths without any student engagement, student reflection, or later assessment. However, this format of learning can hinder the critical reflection required for debunking efforts to work, since long reading sections that are not assessed can be skipped entirely. The debunking of the popular myths should also be reinforced by assessments that require a demonstration of reasoning or application of debunking strategies to assure the myth has been deconstructed completely.

Attending students potentially being strong believers of the misinformation being countered makes establishing confidence and credibility of the MOOC essential. Providing clear and consistent referencing for accompanying video lectures, reading sections, and supplemental materials reinforces the arguments raised and encourages transparency. It also helps minimize potential instances of the corrective content being challenged by attending students, whether it is expressed by the students or not. The presence of clear citations empowers students and capitalizes on their curiosity with corrective information while reinforcing source checking practices. Inconsistencies in citations can cause confusion and leaves student doubts unaddressed. *AVAXX* encountered these issues when references corresponding with numbers within video lectures were not present in the accompanying resource list, making source checking difficult for learners to locate. To address such issues, future course designers should ensure that all referenced materials are easily accessible on the same page as the relevant video lecture, or, if the preferred format of design is to use a general resource list, provide clear cross-referencing to assist students in tracing cited material and furthering their knowledge.

Fostering Community and Engagement

Building a sense of community is vital to maintaining student engagement for learners attending MOOCs. Community building opportunities like discussion prompts, group assignments, and student generated information compilations can aid in generating a shared sense of progress, much like in-person classrooms. The MOOCs employed similar introductory activities allowing students to locate one another geographically via interactive tools (e.g., embedded *Google Map*) where they would be able to post a short message to their peers. Prompted by instructors, students are asked to share a short introduction about themselves and their reason for joining the course. These introduction methods leverage the global and diverse nature of online participation, emphasizing shared curiosity and

experiences across cultural boundaries, something unique to the open online classroom settings. Additionally, peer-assessment tasks and collaborative forums (e.g., word clouds, sharing short answer responses, discussion prompts, etc.) strengthened the social aspects of learning. Online courses provide students the advantages of anonymity, encouraging honest expression of their uncertainties or misunderstandings without fear of judgement. Future designers can use such advantages to their benefit by providing an opportunity for students to express hesitancies and reevaluate beliefs in a space that is conducive to unlearning misinformation concepts.

Content Considerations for Misinformation Topics

When it comes to content considerations specific to misinformation topics, it is valuable (and standard practice) for teachers to have a well informed understanding of their students' prior knowledge before designing or teaching a topic. However, in the case of MOOCs attended by a multitude of individuals with varying amounts of misinformation exposure, gauging students' understanding and modifying the course accordingly can become very difficult. One way to alleviate this is to address the most popular misinformation myths surrounding that topic early in the learning activity. This was a recurring pattern in *AVAXX*, which tackled the misinformation present in its topic more directly, beginning with some minds-on (cueing) questions that evoked misinformation in some way (ex. discussion questions about prior knowledge of the myth "vaccines cause Autism") then immediately addressing the myth, (ex. why people believe it, how it came to be, its inherent logical fallacies) through a video lecture and supplementary material. It is also important to address content pertaining to popular misinformation ideas directly through the primary mode of teaching respective to that online course. Yet, when critical information that dispels a popular myth is relegated to skippable sections like dropdown menus, attending students can miss crucial corrective information. Addressing popular misinformation talking points or content

directly leverages? the inherent interests of the attending students while preventing the transmission of misinformation ideas to students who have yet to be exposed.

For the lesser-known misinformation themes, instructors can provide opportunities (through discussions, assignments, or tasks, etc.) where students can share their concerns or beliefs and have them addressed by the instructors or other students through discussion responses, peer-evaluations, etc. Turning a potential misinformation outbreak into a learning opportunity or a debunking practice for all. Making use of discussion forums can aid in debunking efforts as forums allow for an anonymous open discussion that can be viewed and participated in by future attending students.

Another effective content suggestion that emerged from these courses was the use of narrative elements, such as personal stories from experts or individuals previously misled by misinformation, can increase personal engagement, relatability, and retention of knowledge. Students are more likely to remember personal stories of others, experts or not, who were also misled by misinformation but were later disillusioned. Narrative-based instruction also mitigates psychological resistance mechanisms such as the *Worldview Backfire Effect* (Ecker et al., 2022; Trevors et al., 2016; Nauroth et al., 2014, 2015), which occurs when corrective information challenge identity-linked beliefs, resulting in further polarisation of perspectives. When beliefs intertwine with identities and group associations, they can become difficult to change and are likely to strengthen in resolve if challenged, polarising the individual towards their prior beliefs and reducing the likelihood of corrective information eliciting any change on the individuals' beliefs and stance on the issue. To prevent this resistance, it is recommended that instructors reaffirm personal identities and frame correction as an inquiry into understanding truth and evidence rather than as an attack on personal identity (Ecker et al., 2022; Trevors et al., 2016; Nauroth et al., 2014, 2015).

Delivery and Assessment in Online Learning

The scalability of MOOCs often leads to an over reliance on automated assessments, particularly multiple-choice quizzes, due to ease of implementation and immediate feedback mechanisms. Anonymous polling was one frequent strategy adapted to increase student participation and engagement with the content prior to expanding on the topic (Mediero, Lastra, & Palacios, 2021). Other tools like surveys and quizzes can serve to prompt the user to self-reflect and connect to the course's content. For instance, *AVAXX* made use of personality quizzes and surveys that provided students with insight about their beliefs and philosophical alignments. Accompanying discussion sections allow students to explore their ideas, and such opportunities give students exposure to their own personal biases or ideologies that may have never been considered previously.

The effectiveness of discussion sections relies highly on the prompts that are designed for them. Discussion prompts that require students to reflect on and engage with course content rather than simply stating any novel idea they learned weekly can greatly influence student participation. A strong discussion prompt urges students to consider ideas critically, acknowledge multiple perspectives, and engage in emotionally charged conversations, concepts that are required when dealing with correcting misinformation. Assignments in *Making Sense of News* made use of ranking options then had students engage in discussions justifying their choices to others, tactfully exposing personal biases. The MOOC succeeds in recreating real life conversations within the safe confines of moderated discussion boards.

Online Course Delivery Considerations (Methods and Tools)

Creating a course that is online and open to all, like a MOOC, means it must also be made with the consideration of it being accessible to all participants in terms of understanding, difficulty, and assessment for learning. Video lectures followed by a

multiple-choice form of assessment and discussion prompts seems to be the easiest format for any MOOC creator to implement and assure the students receive information, are assessed for its retention, and given feedback on their learning through results. This practice, however, limits student expression by providing a much narrower view into the student's understanding. Having students reiterate the corrective counter response to a piece of misinformation from a predetermined set of answers does little to demonstrate their understanding and may even leave students worse off considering people may be likely to remember the false information over its correction (Skurnik et al., 2005). Course designers can leverage the online nature of MOOCs by embedding activities that require students to locate and evaluate misinformation in real digital contexts. Effective misinformation education requires more rigorous and applied assessments that ask students to identify, analyze, and rebut misinformation using the evidence-based approaches taught. Rather than simply reciting the corrective information, students must demonstrate their understanding of the fundamental misconception, misrepresentation, or logical fallacy that are foundational to the misinformation content.

Course designers can leverage the nature of their course being online to provide students with lessons that capitalize on online access. Specifically, when teaching content that has been frequently targeted by misinformation, online designers can design assignments that require students to gather and debunk the misinformation that is prevalent in the online spaces they inhabit. Instructors can use their discussion feeds as a centralised location to compile online resources that students have found over the many iterations of the MOOC. By formulating assessments and tasks that are open-ended and promote engagement with the online misinformation content surrounding a given topic (news, vaccinations, etc.), educators and course designers are able target the most current form of misinformation available, all while making the content uniquely applicable to each attending individual's online

experience. This design provides students an opportunity to confront misinformation in an environment that is conducive to critical thinking while fostering curiosity and allowing opportunities to raise questions about their gaps in understanding. Considering how gaps in understanding often become footholds for misinformation to seem believable (Faraji-Rad & Pham, 2017; Miller, 2020), allowing students a chance to express and reconcile them through lectures and assignments, can leave students better prepared for future misinformation exposure. Course designers can also bring attention to and make use of the variety of online tools and places to gather reliable information by integrating their use within their assessment format. This practice both strengthens correctional efforts and instills better practice for students to use online spaces to combat misinformation. Designers can also make use of gamification elements or game-like resources available online to not only enrich the learning experience, aid in media literacy training, and make lessons memorable, but also provide students with alternative spaces to engage that are not predominantly used.

Limitations and Further Research

This study examined a limited sample of two MOOCs to explore effective pedagogical approaches for teaching course topics surrounded by misinformation. Although this narrow scope allows for a detailed qualitative analysis, it also constrains the generalizability of the findings. A more robust comparative design, such as examining multiple MOOCs covering the same topic but teaching different styles and levels of critical media literacy instruction, would provide a clearer understanding of how varying pedagogical approaches affect learning outcomes. However, the current scarcity of MOOCs dedicated to teaching content targeted by misinformation with the explicit intent to educate on critical media literacy limits the feasibility of such a comparative analysis.

This study is additionally limited as a result of its reliance on a single researcher's qualitative evaluation of the courses' application, content, and design. Future studies may benefit from utilizing a sample size that consists of a variety of age groups with diverse levels of educational backgrounds and exposure to the misinformation topics, and perhaps a pre- and post-assessment measure to measure degree of learning. Such an approach would offer a more accurate representation of how accessible, inclusive, and effective these courses are in countering misinformation. Broader fieldwork, incorporating participant feedback through interviews, focus groups, or surveys, would enhance the reliability and validity of the findings. Successive studies should adopt more systematic and empirical methods to evaluate the effectiveness of MOOC design, particularly concerning learners' engagement and retention of media literacy skills, although this is beyond the scope of a Masters' thesis. Examining both the short and long lasting impacts of attending MOOCs combating misinformation would contribute to the development of best practices for designing sustainable, evidence-based online learning environments.

Conclusion

This thesis is a direct reaction to the persistent absence of effective regulatory frameworks that prevent misinformation spread and exposure to people frequenting online spaces. Despite mounting evidence that digital platforms perpetuate and amplify misinformation content without any intervention from governmental or regulatory bodies, users continue to face heightened vulnerability and are expected to carry personal responsibility for navigating these hazards (Broockman & Kalla, 2022, 2023; Garimella et al., 2021; Wojcieszak, 2010; Yan, 2021). Digital spaces exposing their users to misinformation content around political issues has been well documented, further highlighting the risks faced by users (Abrams, 2019; Guess, Nyhan, & Reifer, 2020). Notably, leading technology

corporations such as Meta, that once attempted to counter misinformation spread, retracting their protective measures, are offloading the burden for misinformation protection onto individual users (Isaac & Schleifer, 2025). Within the current political climate that appeases technology companies rather than holding them accountable for their lack of user protection against misinformation, necessitates educational intervention that empowers citizens to evaluate, reshape, and navigate the online information landscapes.

This thesis demonstrates that Massive Open Online Courses (MOOCs) have potential to be the much needed tool for providing critical media literacy skills and countering misinformation within the current infodemic. The comparative analysis of the selected MOOCs revealed that effective instruction on misinformation-prone topics relies on embedding critical media literacy skills within activities, framed within the context that students are likely to encounter. Assessments should foster self-reflection, critical thinking, and open discussion to encourage the debunking of misinformation intertwined with identities and emotions. While approaches to addressing misinformation can range from peripheral integration of misinformation concepts to direct engagement with topic specific myths, the most effective learning occurs when learners are encouraged to apply newly acquired media literacy skills, critique diverse forms of sources, and collaboratively interrogate their personal biases. By situating media literacy training within an interactive and socially constructed learning environment, MOOCs are able to instil the practices of students contributing towards counter misinformation efforts in the digital spaces they occupy. The findings highlight the importance of adaptive, reflective, and community driven course design for misinformation-prone topics in an effort to cultivate informed and resilient civic participants in an information overload society.

The erosion of trust in designated institutions and experts that extrapolate truths from rigorous testing and collected data has resulted in a public relying greatly on their own

interpretations, which are often rife with biases and emotional reasoning making them vulnerable to the negative impacts of misinformation. Rather than seeking uncomfortable truths people are more likely to seek evidence that reaffirms their beliefs. With media messaging being weaponised to spread disinformation to the public, as was seen in the 2016 election (Abrams, 2019), we are gradually losing collective agreement on objective truths. AI generated content is exacerbating this by providing the tools to make misinformation more convincing than ever before which places citizens at great risk of being manipulated. In this current age people must be educated on media literacy skills that focus specifically on how media is used to misinform rather than its current general focus on understanding media messaging. Designing and providing misinformation aware training that includes practices of deprogramming that accounts for attendees coming with prior misinformation influenced knowledge, all while not eliciting the worldview backfire effect during the education process is crucial. This thesis demonstrates both the lack of such training available to students within schools and the potential benefits to society when done so through the online medium of MOOCs. Online course delivery options should be capitalised on to reach the mass audiences most vulnerable to targeted misinformation attacks.

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