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Counteracting Fake News (COFANE): Rethinking Digital Competences for the Future

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Mag.phil. Michael Reicho

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Betreut von | Supervisor:	ao. Univ.-Prof. Dr. Friedrich Hausjell Univ.-Prof. Dr.phil. Kathrin-Marie Otrel-Cass

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Foreword

In the midst of the refugee movements to Austria in 2015, the public debate underwent a sudden and significant shift. The initial welcoming culture was increasingly overshadowed by an atmosphere of rejection, influenced by a flood of fake news. It was in this turbulent context that the idea for this work first took shape. The question arose: What can be done about manipulation through fake news?

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Abstract

In the dynamic digital landscape, young people navigate complex online environments, which are often flooded with fake news. This underscores the urgent need to cultivate critical media literacy and analytical thinking skills from an early age in schools. This dissertation examines the development of digital competencies in secondary school pupils with the objective of counteracting disinformation. It considers the required competencies, the impact of pedagogical interventions, and innovative tools for the enhancement of multiliteracy in pupils. The qualitative methods used in this work include guideline-based interviews, focus groups, video ethnography, written field notes and co-creation.

The findings highlight three critical areas of digital competence: information management, opinion management, and identity management. To raise pupils' awareness of the potential for disinformation it is necessary to understand the nature of online interactions, the functioning of algorithms, and the construction of digital identities.

Two stages of teaching and learning are suggested with regard to multiliteracy to counter disinformation. Firstly, pupils in lower secondary schools (ages 10-14) can develop basic digital competences through phenomenon-based learning. Critical evaluation of sources, assessment of credibility, and analysis of information using new digital tools help pupils develop multiliteracy, technical skills, and self-management skills. In contrast, upper secondary pupils (ages 15-18) benefit from inoculation theory and civic online reasoning, which helps them deepen their understanding of disinformation. These approaches need to be holistic, cross-curricular and recurring, starting at age of 10 and embedded throughout the education system.

The results also highlight the importance of visuality and trust when using proximity and accessibility to evaluate digital sources. Proximity to familiar human actors, such as classmates or well-known companies, and the accessibility of visually appealing, professionally designed information can enhance the level of trust of pupils. A serious game that was developed as part of the work is also highlighted as an innovative tool that can enhance digital competencies. The game encourages critical thinking and reflection on cybersecurity issues.

The findings of this dissertation indicate that a multifaceted approach that combines theoretical frameworks, open pedagogy formats, practical applications and innovative tools can enhance the ability of secondary school pupils to navigate and critically assess digital information. This, in turn, may help equip pupils with the necessary skills to navigate online environments safely and critically.

Abstract (German)

In den dynamischen digitalen Landschaften bewegen sich junge Menschen durch komplexe Online-Umgebungen, die häufig von Fake News überflutet werden. Dies unterstreicht die dringende Notwendigkeit, kritische Medienkompetenz und analytisches Denken schon früh in der Schule zu fördern. Diese Dissertation untersucht die Entwicklung digitaler Kompetenzen bei Schüler:innen der Sekundarstufe, um Desinformationen entgegenzuwirken. Die Beiträge dieser Arbeit befassen sich mit den erforderlichen Kompetenzen, den Auswirkungen pädagogischer Interventionen und innovativen Instrumenten zur Förderung von kritischer Medienkompetenz bei Schüler:innen. Zu den in dieser Arbeit verwendeten qualitativen Methoden gehören Leitfadeninterviews, Fokusgruppen, Videoethnographie, schriftliche Beobachtungsprotokolle und Co-Creation.

Die Ergebnisse weisen auf die Bedeutung von drei kritischen Bereichen der digitalen Kompetenz hin: Informationsmanagement, Meinungsmanagement und Identitätsmanagement. Um das Bewusstsein gegen Desinformation zu schärfen, ist es notwendig, die Grundlagen von Online-Interaktionen, die Funktionsweise von Algorithmen und die Konstruktion digitaler Identitäten zu verstehen.

Diese Arbeit schlägt zwei Ebenen des Lehrens und Lernens von Medienkompetenz gegen Desinformation vor: Schüler:innen der Sekundarstufe I (10-14 Jahre) können grundlegende digitale Kompetenzen durch phänomenbasiertes Lernen entwickeln. Die Schulung der Schüler:innen in der kritischen Bewertung von Quellen, der Beurteilung der Glaubwürdigkeit und der Analyse von Informationen mithilfe neuer digitaler Werkzeuge scheint eine geeignete Methode zur Entwicklung von Mehrsprachigkeit, technischen Fähigkeiten und Selbstmanagement zu sein. Im Gegensatz dazu profitieren Schüler:innen der Sekundarstufe II (15-18 Jahre) von der Inokulationstheorie und dem Civic Online Reasoning, die ihnen helfen, ihr Verständnis von Desinformation zu vertiefen. Diese Ansätze müssen ganzheitlich, fächerübergreifend und wiederkehrend behandelt werden, beginnend im Alter von 10 Jahren und eingebettet in das gesamte Bildungssystem.

Die Ergebnisse unterstreichen auch die Rolle von Visualität und Vertrauen bei der Bewertung digitaler Quellen durch Nähe und Zugänglichkeit. Die Nähe zu vertrauten menschlichen Akteur:innen wie Klassenkolleg:innen oder bekannten Unternehmen sowie die Zugänglichkeit von visuell ansprechenden und professionell gestalteten Informationen können das Vertrauen der Schüler erhöhen. Darüber hinaus wird die Entwicklung eines Serious Games als innovatives Instrument zur Verbesserung der digitalen Kompetenzen hervorgehoben. Das Spiel regt zum kritischen Denken und zur Reflexion über Fragen der Cybersicherheit an.

Die Ergebnisse dieser Dissertation zeigen, dass ein vielseitiger Ansatz, der einen theoretischen Rahmen, offene pädagogische Formate, praktische Anwendungen und innovative Werkzeuge kombiniert, die Kompetenzen von Sekundarschüler:innen verbessern kann, sich mit digitalen Informationen zurechtzufinden und diese kritisch zu bewerten. Dies wiederum kann dazu beitragen, die Schüler:innen mit den notwendigen Kompetenzen auszustatten, um sich sicher und kritisch in Online-Umgebungen zu bewegen.

1. Introduction

Various forms of fake news and misleading information are increasingly affecting our social values, altering opinions on critical topics and redefining facts, truths and beliefs (Olan et al., 2022). As the digital technology has spread throughout the globe in the post-truth era, so has the amount of fake news in online environments. Examples such as the fake news spread about Brexit, Covid 19, Donald Trump and the Ukrainian war illustrate the extent of the impact of fake news on society and politics. Fake news reaches people very quickly, since it spreads six times faster online than factually correct information (Vosoughi, et al., 2018). In addition, the quality of fake news is so convincing that on average people believe around 75% of the disinformation they consume (Silverman & Singer-Vine, 2016). During the Covid-19 pandemic, false news had a 70% higher chance of being shared compared to true news (Kim et al., 2021).

Research into fake news has grown steadily in recent years across a number of disciplines, including psychology, information technology & computer science, communication, interdisciplinary research, politics, marketing, education, economics, sociology, and philosophy, just to name a few (George et al., 2021; Di Domenico et al., 2021).

What scholars agree on is that a multi-pronged approach is required to address fake news: (1) technological, e.g. detecting fake news automatically by means of algorithms (Kirchner & Reuter, 2020); (2) legal, e.g. updating laws dealing with online media; (3) economic, e.g. government intervention in markets; (4) political, e.g. by addressing companies' responsibilities (Verstraete et al., 2022); (5) social and/or communicative, e.g. through the debunking of fake news by users (Farte & Obada, 2018); or (6) pedagogical, e.g. teaching digital competences to encourage prebunking and to raise awareness (Lewandowsky & Van Der Linden, 2021). Since education on fake news is key to addressing the challenges that fake news presents, I will focus in this thesis on pedagogical and communication strategies. I analysed different theories relating to how communication and teaching strategies can tackle disinformation in Austrian secondary schools, prepared an intervention and evaluated the outcomes when teachers and their pupils applied this approach.

The fake news target group covers all ages, from young to old. Late adulthood poses certain social changes such as tending to be more trusting, having difficulty recognizing falsehoods, and placing less significance on accuracy in communication (Brashier & Schacter, 2020). But younger people, too, can be vulnerable when exposed to fake news in a variety of online environments (Pérez-Escoda et al., 2021). Fake news often deals in emotional details, inciting consumers of disinformation to spread misinformation on impulse, by means of the omnipresent mobile phone. Research indicates that younger generations are less likely to check content before forwarding items if they come from someone known to the forwarder (Herrero-Diz et al., 2020).

There is thus growing recognition of the importance of acquiring critical information literacy while at school, with policymakers exploring innovative approaches in public education initiatives (see chapter 2.4.2). Critical media literacy is now acknowledged to be crucial for every media user. An emerging approach across the globe is to engage young people as media literacy advocates, building on their affinity for technology and enthusiastic media consumption. (Lim & Tan, 2020).

Educational programmes on critical media literacy emphasise the need to involve all age groups, from young to old (Brashier & Schacter, 2020; Pérez-Escoda et al., 2021). However, this dissertation focuses on school pupils, as young people across the whole country can be targeted easily and effectively through compulsory schooling within the formal education system.

These considerations led to the following overarching research question for this thesis: *What pedagogical interventions for teaching and learning about disinformation have the potential to counteract fake news in secondary schools in Austria?* The sub-questions to draw out answers to the overall question have been addressed in a number of articles of this cumulative thesis. They include:

- RQ: *What kind of competences are necessary for secondary school pupils when they are confronted with fake news?* (Article 1)
- RQ: *How do experts from different disciplines envision the teaching of digital competences to counteract disinformation in secondary schools in Austria?* (Article 2)
- RQ: *What role do visuality and trust play when pupils work with different digital sources? How does the phenomenon-based learning approach help to build pupils' multiliteracy?* (Article 3)
- RQ: *What effect does phenomenon-based learning have on building multiliteracy to counteract fake news? (*Article 4)
- RQ: *How can a serious game aimed at increasing digital competences in secondary schools be developed with the relevant stakeholders?* (Article 5)

The following table describes the structure of this thesis in relation to these research questions, including the five articles and their perspectives, methods, approaches and publication.

	Perspective	**Methods**	**Approach**	**Title/Article**	**Journal/Book**	**Status**
1	Pupils, school, digital compe-tences	Focus group, content analysis	Post-humanist	Postdigital Truths: Educational Reflections on Fake News and Digital Identities	*Postdigital Humans: Transitions, Transformations and Transcendence*	Published, 2021
2	Teachers, experts in different disciplines	Expert interviews, content analysis	Trans-disciplinarity research	Beyond truth: Teaching digital competences in secondary school against disinformation	*Medienimpulse: Basic digital education as a compulsory subject - contexts and concretisations*	Published, 2022
3	Pupils & teachers, implementation, visuality and trust	Classroom observation, interviews, vignettes	Participatory research	In Pictures We Trust: Phenomenon-based learning about disinformation in secondary schools	*Video Journal of Education and Pedagogy (2024)*	Submitted, 28.02.24

4	Pupils & teachers, school implementation	Classroom observation, interviews	Participatory research	How Phenomenon-Based Learning May Contribute to Counteract Disinformation	*EDEN Conference Proceedings (2024)*	Accepted, 26.03.24
5	Serious gaming	Workshops, focus groups	Development, co-creation	"Digital? Sicher!" – An Educational Game to Build Digital Competences	*European Conference on Technology Enhanced Learning, Proceedings (2022)*	Published, 2022

Table 1: Order and structure of articles

The five articles (listed in table 1) cover the following ground: In the first article, I look at pupils' digital worlds, what digital media they consume, and how and what they learn about it. In the second article, I report an investigation into the opinions of expert from different disciplines on fake news and what they think it is important for young people to know. I also propose a pedagogical approach and discuss with them the adaptations required for the Austrian context. The third article looks at the role of trust and visuality in fake news and the role that phenomenon-based learning and multiliteracy can play in the classroom. The fourth article considers the implementation of Phenomenon-Based Learning in secondary school classes and collects experiences of it, focusing on the digital competences of lower and higher secondary school pupils (12-18-year-olds) to critically evaluate sources. The fifth article presents "Digital? Safe!", a serious digital literacy game designed for higher secondary schools (14-16-year-olds).

2. Chapter: Theoretical Framework

To establish the theoretical framework for this thesis, this chapter begins by presenting the shift in media consumption and the significance of trust in sources. It then examines the impact and repercussions of fake news, particularly on young and older individuals who are targeted by disinformation. Finally, it explores potential strategies for teaching digital skills, which can be categorised as prebunking (raising awareness, for instance through inoculation theory or serious games) and debunking (after disinformation has been encountered). An explanation of open teaching and learning formats is then provided, focusing on phenomenon-based learning.

2.1. Postdigital Media Consumption and Trust

The widespread availability of the internet has made it easier to go online, and this in turn has led to a ‘post-truth era’ in which the traditional roles of sender and receiver of news have become blurred, allowing individuals to share information freely and resulting in diverse viewpoints and multiple information channels (Marshall & Burnett, 2003). This shift reflects a change in public discourse, marked by the distortion of media reality. The rise of post-truth presents a challenge to media professionalism in the digital age. In the digital realm, subjective interpretations often hold more weight than truth, facts, and analysis. Post-truth is a product of postmodern processes, technological advancements, evolving social communications, and declining trust in institutions. Its consequences include the widespread dissemination of fake news and the deterioration of factual accuracy, which exacerbates societal divisions. There is therefore an urgent need for research to understand the specific characteristics of fake news and develop strategies to promote truthfulness in media discourse (Iufereva, A. (2023).

Knox (2019) emphasises the need for a nuanced and critical view of these relationships in the present era of digital technologies in education. Aligning myself with Knox, I propose the term 'postdigital' as a guiding concept to explore the changing dynamics between humans and technology. This concept moves beyond simplistic narratives that either embrace futuristic technological advancements or long for a return to a more 'natural' existence. The postdigital perspective challenges linear notions of technological progress by emphasising the interdependence of digital technologies with social practices, economic systems, and political structures. This approach aims to acknowledge the ways in which technology is already integrated into society, emphasising the need for a deeper comprehension of the intricacies of human-technology interactions (Knox, 2019).

Consideration of the impact of digitalisation on the public political sphere highlights the way democratic opinion and intent are formed. Habermas (2022) examines the role of the media and critical media consumption, noting that changes in the media landscape have led to citizens relying increasingly on social media, where the boundary between private and public spheres is becoming blurred. This phenomenon highlights the insufficient political regulation of new media. Habermas stresses the importance of critically evaluating the quality of online content and being aware of the interests behind different media offerings. This is essential to ensure that opinions and attitudes are formed an informed and democratic manner (Habermas, 2022).

Looking at facts with regard to changes in information and news media consumption, the Reuters Institute for the Study of Journalism's Digital News Report (2022) presents data from Europe, America, Asia and Africa showing that overall interest in news has fallen from 63% in 2017 to 51% in 2022. A significant amount of less educated and younger people say they avoid news because it is difficult to understand. The report illustrates the changing habits of younger age groups, particularly those under 30, which news organisations increasingly struggle to reach. But what are the changes in question?

Most young people consume the majority of their news and information online. 71% of Austrians consume news on their smartphones. 27% consume news on Facebook, 24% on WhatsApp, 22% on YouTube and 15% on Instagram (Newman et al., 2022). A recent study shows that WhatsApp remains the most popular internet platform among 11-17 year olds in Austria (overall usage: 76%, 77% daily), closely followed by Instagram (overall: 71%, 68% daily) and YouTube (overall: 70%, 51% daily). Especially among younger users, YouTube is becoming less relevant as all major networks have begun to integrate video content into their offerings. To differentiate themselves, teens are increasingly moving away from the big services to newer platforms where they feel there is less interference from adults. The study by saferinternet (2024) study shows that 71% of the young people surveyed have used generative chatbots (e.g. ChatGPT) at least once, with males being the most frequent users (78%). Notably, there were no differences between the 11-14 year olds (70%) and 15-17 year olds (71%) (saferinternet, 2024).

The problem with online consumption is that young people in particular have large gaps in their knowledge and problems with evaluating sources of information. The most trusted source among young people in Austria is Wikipedia, with 25% considering it very trustworthy. This is followed by traditional media sources such as radio (2023: 21%, 2017: 32%), television (2023: 20%, 2017: 29%), traditional media websites (2023: 19%, 2017: 23%) and newspapers and magazines (2023: 12%, 2027: 20%). It is worth noting that while traditional media are currently seen as more credible by young people, they are used much less. In contrast, influencers are increasingly viewed by young people as a daily source of news and information and are perceived as 'modern-day journalists'. 49% of young people aged 11-17 in Austria are often unsure whether information on the internet is true. However, even when it comes to school work, only 64% of young people check their information sources, and they only do so if the information seems untrustworthy (saferinternet, 2023).

The consumption of media through digital technology raises the question of which online sources young users can trust. Trust has become a key issue for a modern and functional society, especially in times of uncertainty. Communication research shows that trust plays a crucial role in the impact, perception, and evaluation of news media (Tsfati, 2003). According to Kohring and Matthes (2007), trust in news media is based on topic selection, facts, accuracy, and quality of journalism. They argue that trust is undermined when these characteristics are not present (Kohring & Matthes, 2007). Warner-Søderholm et al (2018) define the primary trust constructs as integrity, competence, concern, goodwill, and identification. The authors suggest this scale be used to predict trust predispositions with regard to social media use, broken down by categories such as age, gender, number of hours online, and choice of content provider (Warner-Søderholm et al, 2018).

The shift among young people towards the consumption of digital information, combined with the difficulty of deciding which sources are trustworthy, increases the risk of being seduced by fake news.

2.2. Impact of Fake News

As early as 2018, the European Commission warned of an increase in disinformation (Martens, et al., 2018). When it comes to the spread of fake news, we have to face some key impacts for society: Disinformation can have a major impact on people's perceptions of important issues such as climate change and vaccinations, making them seem less serious and undermining trust in science and social structures. Fake news can influence individual behaviour, such as voting patterns in elections. Fake news spreads six times more quickly than verifiable facts online, potentially leading to large numbers of people being misled. Differentiating between genuine and fake news can be a challenge for many people. Only 4% of participants demonstrated the ability to identify disinformation, revealing the importance of tackling the spread of fake news and helping individuals improve their ability to spot and counter disinformation (Skipper et al., 2023).

Fake news is false or misleading information that is presented as real news. It often has the aim of damaging the reputation of an entity or person, or making money through advertising revenue. However, the term lacks a fixed definition and has been used more broadly to refer to any type of false information, including unintentional and unconscious communications. Additionally, some individuals often apply it to any news that contradicts their viewpoint. The most cited definition describes fake news as information that is “intentionally and verifiably wrong and could mislead readers” (Allcott & Gentzkow, 2017, 213) or as “fabricated information that mimics news media content in form” (Lazer et al. 2018, 1094).

Wardle & Derakhshan (2017) distinguish between three types of fake news: disinformation, malinformation, and misinformation. Malinformation involves the dissemination of factually correct information with the specific intent to cause harm to a person, organisation or country, often by taking private information and making it public (e.g. data leaks). Misinformation refers to false information that is disseminated but is not intended to cause harm. It is important to note that misinformation is not created with the intention of causing harm. In contrast, disinformation is intentionally fabricated false information created to harm an individual, social group, organization, or country. The key distinction here is the deliberate intent to cause harm through the dissemination of false information. These distinctions are critical to understanding the motivations and potential impact of different types of false or harmful information: it is important to recognise that the motives for disseminating of false information may vary depending on the context and the individuals involved (Wardle & Derakhshan, 2017). Although these definitions emphasise intention to disseminate, it should be noted that in cases of deception through manipulated information, the distributor’s motivation is irrelevant. Users can be fooled intentionally or unintentionally.

In academic discourse, researchers tend to use the term 'disinformation' instead of 'fake news' due to the loaded nature of the latter, which is used to denote the rise of falsehood in today's digital landscape. However, 'fake news' has also become a buzzword for certain political players who seek to discredit opponents that challenge their viewpoint. The weaponisation of

'fake news' aims to erode public trust in established news sources, portraying them as intentionally spreading deception (Egelhofer & Lecheler, 2019).

Scholars distinguish between financial and ideological motivations for the intentional spreading of disinformation. Some individuals may be motivated by ideological reasons, seeking to advance a particular political agenda or influence public opinion, in the context of elections or in order to shape public discourse. On the other hand, financial incentives also play an important role in the spread of fake news. Some individuals and organisations may engage in the creation and dissemination of false information as a means of generating income through advertising on their websites or social media platforms. This may involve the exploitation of sensational or misleading content to attract traffic and the associated advertising revenue. Understanding the motivations and potential impacts of different types of fake news or harmful information is crucial for the development of effective strategies to combat it (Wardle & Derakhshan, 2017).

2.3. Consequences of Disinformation

The detection of disinformation poses two main challenges, relating to content and users respectively. Disinformation typically includes sensationalised content and heightened emotions, designed to provoke reader interaction and virality on social media platforms. The ease and low cost of creating sources of disinformation, coupled with the use of social media bots, further accelerate the spread of false information. From a user perspective, social media make people vulnerable to disinformation if they are not aware of the risks of disinformation (Shu et al., 2020).

Emotional factors, such as uncertainty, anxiety and confirmation bias, propel people to believe disinformation. During uncertain events such as natural disasters or elections, fake news may be spread as people try to make sense of unstable situations. In the absence of official sources of information, they often rely on unofficial social networks to fill information gaps and make predictions based on their own judgement. Anxiety, in particular, can contribute to the spread of fake news by making individuals more likely to share unverified claims and transmit information in a less accurate manner. In high-anxiety situations, fake news can serve as a coping mechanism to alleviate emotional tension, allowing individuals to express concerns and receive informal feedback, ultimately aiding meaning-making and problem-solving (Shu et al., 2020). Research findings indicate that individuals with increased levels of psychoticism, impulsivity and suspiciousness, coupled with diminished analytical reasoning skills, are predisposed to believe fake news. In addition, the study by Taurino et al. (2023) highlights the impact of fear induced by news content that prevents rational and factual analysis. These findings point up the interplay between the role of social media platforms and individual vulnerabilities in the spread of fake news (Taurino et al., 2023).

The COVID-19 pandemic has highlighted how the dissemination of false information (in the form of disinformation) can be used to cope with anxiety. Individuals select what information they expose themselves to, preferring that which is consistent with their existing beliefs and finding such information more persuasive than views that diverge from them (confirmation bias). Furthermore, people tend to accept information that pleases them, a phenomenon known as desirability bias that highlights the difficulty of correcting misleading claims:

individuals may become more convinced of their beliefs even after receiving corrections (Shu et al., 2020).

If users become silent observers of disinformation and remain inactive or passive, this can lead to a spiral of silence. This is a social theory developed by Noelle-Neumann (1974), which suggests that individuals are often afraid to express their views if they perceive themselves to be in the minority, for fear of isolation or reprisals from the majority. This can lead to a self-reinforcing cycle in which the minority view becomes increasingly marginalised, while the majority view is perceived as more dominant. In the context of misinformation and debunking, the spiral of silence can affect how individuals respond to corrections or misinformation on social media and other platforms, potentially continuing the spread of misinformation (Noelle-Neumann, 1974; Lewandowsky et al., 2020).

Conversely, when users try to correct fake news, they risk creating a backfire effect. The backfire effect occurs when efforts to correct disinformation or debunk false beliefs inadvertently reinforce those beliefs instead of dispelling them. In other words, when people are presented with corrective information that contradicts their existing beliefs, they may become all the more entrenched in those beliefs. However, recent research suggests that the backfire effect is not as common as was previously thought, and that in most situations it is less likely to occur than had been believed (Swire-Thompson, DeGutis & Lazer, 2020).

2.3.1. Deepfakes, AI, Bots and Trolls

Recent years have seen an increase in deepfakes and artificial intelligence (AI) that has significantly influenced the spread of fake news by enabling the creation of highly realistic and convincing fabricated content, including videos, images, and audio recordings. With the advancement of AI, particularly in the field of deep learning, it has become easier to generate content that is indistinguishable from genuine media. This has serious implications for the spread of disinformation. Utilising deepfakes, malicious parties can create false narratives, manipulate public opinion, and deceive individuals and communities. Such content can be distributed through a range of digital media platforms, including social media, where it can quickly reach a wide audience and potentially influence public discourse. Furthermore, the rapid and widespread dissemination of fake news facilitated by deepfakes and AI challenges traditional methods for verifying and authenticating information. This is leading to declining trust in media and information sources, as individuals struggle to distinguish between genuine and manipulated content. Overall, the combination of deepfakes and AI amplifies the challenges involved with combatting fake news, requiring a multi-faceted approach that combines technological solutions, media literacy, and regulatory measures to address this growing concern (Karnouskos, 2020).

But other new phenomena such as chatbots and trolls can increase the danger from – and spread of – disinformation. Chatbots can be programmed to mimic human behaviour and engage in conversations with users, spreading false or misleading information. They can also be used to target specific individuals or groups with personalised messages. Trolls, on the other hand, are human operators who use social media to spread disinformation and provoke emotional responses from other users. They use chatbots to amplify their messages and engage with a larger audience. Trolls sometimes also use social engineering techniques to build trust with their targets and manipulate them into spreading disinformation (Brief, 2021).

2.3.2. Young People and Older Adults

Various studies highlight the significant impact of fake news on young people under the age of 18 (Pérez-Escoda, 2021; Valencia-Arias et al., 2023). Social media and the internet have become the primary sources of information for young people, and the lack of training in identifying false content has contributed to the spread of fake news. Many young people rely on social networks to stay up to speed, and this can make them more vulnerable to misinformation (Pérez-Escoda, 2021).

Fake news can lead to a lack of trust in reliable sources of information, confusion or even fear. The sharing of fake news is often associated with young people's desire to raise awareness among those closest to them, especially when the messages shared are in line with their perceptions and beliefs, or when they do not have the time to check accuracy properly. It is concerning that young people perceive misleading information as being more commonly shared among older age groups, as this indicates a lack of awareness of their own responsibility for the information they share online (Valencia-Arias et al., 2023).

Fake news can cause significant harm, from triggering doubts about modern medicine to inciting distrust in social democracy. It is important to note that older adults (over the age of 65) are particularly vulnerable to disinformation. One study shows that older adults shared the most fake news during the 2016 US election (Brashier & Schacter, 2020).

Social changes in late adulthood may contribute to older adults' susceptibility to fake news for a number of reasons. Older adults may be more trusting and thus more susceptible to disinformation, as they may be more likely to believe content shared by their social network without questioning its accuracy. Furthermore, as people get older, their social networks may shrink, leading to fewer peripheral social partners (Brashier & Schacter, 2020). Decreases in social connections among older adults may lead them to misplace their trust, as they may depend more heavily on a limited number of contacts and assume that information shared by friends and family is genuine. It is worth remembering that older adults may face challenges in this regard: difficulties with detecting deception may make them more susceptible to fake news and misinformation. Such difficulty could also stem from changes in cognitive processes related to detecting dishonesty. It is important to understand the unique social dynamics of late adulthood when considering interventions to address older adults' awareness of fake news (Brashier & Schacter, 2020).

In the following chapters, I will focus on pedagogical and communication strategies with regard to the target group of pupils in formal education. Relevance to teachers and pupils is significant in this context. Livingstone (2004), for example, emphasises the importance of critical media literacy for young people in the context of new information and communication technologies. Critical media literacy programmes can be integrated into formal education to raise pupils' (and teachers') awareness. Teachers play a crucial role in critical media literacy teaching, so this thesis places special emphasis on these two target groups.

2.4. Pedagogical Approaches that Support Learning about Technology

The literature on media education indicates that learning occurs across a wide range of levels, including individuals, groups of individuals, communities (e.g. schools) and larger socio-cultural contexts (Sumara & Davis, 1997). This means that when it comes to media education,

we must not only look at individuals, but also consider the wider socio-cultural context of learning. Learning is defined here as the:

> "...relatively permanent acquisition of a new ability, skill or outlook, or the modification of an existing ability, skill or outlook. Improvements and changes in performance are not assumed to be the result of a natural process of maturation or growth, but rather the result of learners engaging with objects in their environment" (Kaiser & Kaiser, 2001, 102).

In this context, the focus is on learners' engagement with information and communication technology (ICT) within a socio-cultural context. Learning with ICT investigates the potential for education systems to be transformed by young learners' enthusiasm for ICT and their ability to quickly master its use through exploratory play. The focus is not on technology per se, but on strategies for redesigning traditional school routines to make learning more exciting and engaging (Somekh, 2007).

A specific pedagogical concept focussing on teaching and learning with information and communication technology (ICT) is the TPACK model (see Figure 1). The purpose of this framework is to integrate teachers' diverse professional expertise in technology, pedagogy and content that is essential for the effective use of technology in the classroom and for pupils to engage in learning through technological resources. TPACK (or TPCK) stands for Technological, Pedagogical, and Content Knowledge (Koehler & Mishra, 2009). The combination of these areas of theoretical and practical knowledge generates the adaptive knowledge required to effectively integrate the use of technology into teaching (Angeli & Valanides, 2014).

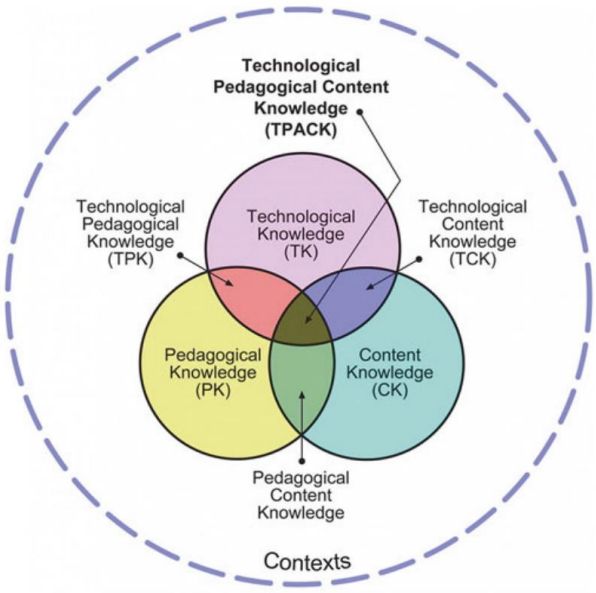

Figure 1: TPACK Model, reproduced by permission of the publisher, © 2012 by tpack.org

TPACK's three overlapping areas are technological knowledge (TK), pedagogical knowledge (PK) and content knowledge (CK). Technological knowledge (TK) refers to an individual's understanding and ability to use technology, particularly information technology. It goes beyond traditional computer literacy, encompassing a deeper understanding that enables individuals to use information technology effectively in different contexts, to recognise its impact on achieving goals, and to adapt to changes in technology. It includes the ability to use technology for information processing, communication, problem-solving and specific tasks. Pedagogical knowledge (PK) refers to a teacher's deep understanding of the processes, practices and methods of teaching and learning. It includes knowledge of how pupils learn, classroom management skills, lesson planning, pupil assessment and teaching techniques. Teachers with strong pedagogical knowledge understand how pupils construct knowledge,

acquire skills and develop positive attitudes towards learning; and how to apply cognitive, social and developmental theories of learning in the classroom. Content knowledge (CK) refers to a teacher's understanding of the subject matter being taught and learned. It includes knowledge of the concepts, theories, ideas, organisational frameworks, evidence, practices and approaches within a particular discipline. CK is essential in enabling teachers to communicate accurate information effectively, address misconceptions and facilitate meaningful learning experiences for pupils (Koehler & Mishra, 2009).

The intersection at the centre of the TPACK model is where technology, pedagogy and content knowledge are integrated to create meaningful and effective learning experiences for pupils. Where the circles intersect, the model identifies very specific competences, including understanding how to present content using technology in ways that are accessible, engaging and meaningful to pupils; knowing how to use technology in pedagogically sound ways to teach specific content and enhance pupil learning; recognising and addressing learning challenges by using technology to overcome difficulties; understanding pupils' prior knowledge and beliefs in order to integrate technology effectively in the classroom; being aware of different theories of knowledge and using technology to support the development of new ways of understanding; and recognising the contextual factors that influence the integration of technology, pedagogy and content and adapting teaching strategies accordingly (Koehler et al., 2013; Angeli & Valanides, 2014).

The model’s integration of these three areas of knowledge provides a framework for the planning of media-supported or technology focused teaching units (Koehler & Mishra, 2009; Harris & Hofer, 2011). According to TPACK, the use of technology goes beyond mere access and technical proficiency. Teachers need to understand the nature of technology and should consider the role of technology in lesson planning. This involves selecting, adapting and integrating appropriate content, teaching methods, and technology. Delivering these elements effectively prioritises student-centred learning (Angeli & Valanides, 2014). When teaching and learning with and about digital technology, this is an approach that is helpful in addressing learners' digital competences (Koehler et al., 2013).

To effectively implement TPACK in the classroom, it's crucial to raise teachers' awareness of their beliefs about pedagogy and technological self-efficacy. These beliefs are an integral part of self-regulated learning (Angeli & Valanides, 2014). Self-Regulated Learning (SRL) focuses on beliefs about pedagogy and self-efficacy. It focuses on the metacognitive and motivational factors that can help achieve personal goals, and covers three cyclical processes: planning (anticipating before action), monitoring (reflection during action), and reflection (evaluation post-action). Learners (pupils and teachers) practise self-awareness and engage in knowledge-building, asking themselves the key questions what, how, when and why. This then informs their approach to learning and teaching within the Technological Pedagogical Content Knowledge (TPACK) context (Angeli & Valanides, 2014) and deepens their understanding of their own beliefs (Zimmerman, 2000).

The stages of SRL are closely connected to the approach taken in writing this thesis. Where teachers are concerned, the TPACK-SRL approach aims to increase teachers' technological self-efficacy within the SRL framework, enhance their awareness of their beliefs and promote reflective decision. This concept actively engages teachers in a web-based hypermedia environment, providing new experiences for teachers, enabling them to deploy a constructivist

approach to learning and teaching. With regard to pupils, open pedagogy formats (see chapter 2.5) allow them to experience the three cyclical phases of SRL (Angeli & Valanides, 2014).

Another argument that focuses on digital learning (for both pupils and teachers) is self-efficacy. This belief plays a crucial role in motivating self-regulation. Bandura (1997) proposed that individuals' beliefs about their own self-efficacy influence their emotions, thoughts, motivation and actions. Drawing on this it can be hypothesised that high self-efficacy beliefs increase motivation and lead to greater success when tackling difficult tasks, such as learning about critical media literacy and becoming aware of disinformation.

As a side note, it seems important to reflect that the choice, justification and planning of a pedagogical approach is strongly influenced by the social habitus of the researcher and/or the educator (Bourdieu, 1992). Habitus refers to both potentialities and limitations in the action and perception of researchers and teachers. It includes attitudes such as style, taste, unconscious preferences, the influence of colleagues and mentors, and expectations of the rules of the game, all of which are part of the social habitus when it comes to model development. Models and theories are not exempt from preconceptions; they are influenced by the habitus of the planner and therefore require self-critical reflection (Kricke & Reich, 2015).

In summary, in this context, learning is understood as experience gained through interaction with one's environment. Rather than innate responses, the focus is on the acquisition of non-innate value orientation through interaction within a (digital) environment (Raithel et al., 2009). Learners have individual needs and these need to be addressed in different ways. Approaches to pedagogical ICT need to focus on realistic and authentic scenarios that address real life problems in order to connect with learners' digital habits. We need to understand the meaning of our interactions with ICT, but we can only do this in the context of our own personal experiences (Somekh, 2007). Critical media literacy cannot be learned from a textbook because digital technology is constantly changing. The next section will therefore try to develop an understanding of critical media literacy that is appropriate for the context of this thesis.

2.4.1. Digital and Critical: Information & Media Competences

Many researchers have highlighted the need for digital competences in education (Loveless & Williamson, 2013) to counteract fake news (McDougall et al., 2019; Larkin, 2017). But there is no consensus on the definitions and boundaries of digital competences, media literacy, information literacy, digital literacy or other concepts in that field. The media education landscape seems complex and heterogeneous, with multiple perspectives, and a range of angles and approaches. Studies argue that difficulties could arise with operationalising and assessing literacy, and that this can strongly influence the effectiveness of educational programs (Wuyckens et al., 2022). Below, I summarise the definitions of the most prominent concepts: information literacy, digital literacy, digital competences, critical media literacy, social media literacy, social media information literacy and multiliteracy.

Information literacy refers to the ability to identify accurate and complete information, make informed decisions, recognise the need for information, formulate questions, identify potential sources, develop search strategies, access both analogue and digital sources, evaluate

information, organise it, contribute new information to existing knowledge and use information in critical thinking and problem-solving (Doyle, 1992).

Digital literacy is the ability to operate effectively in a digital environment. The term 'digital' refers to information presented in numerical form and primarily used by computers. 'Literacy' refers to interpreting and reading media, reproducing data or images through digital manipulation, and applying and evaluating new knowledge from digital environments (Jones-Kavalier & Flannigan, 2006). The European Commission defines digital competences as the secure and critical utilisation of information society technologies for work, leisure, and communication (Punie & Cabrera, 2006).

Kellner and Share (2007) expand the definition of critical media literacy to include various forms of mass communication and popular culture. The concept emphasises the need to deepen literacy education to enable critical analysis of the relationships between media and audiences, as well as information and power. Critical media literacy is also presented as a crucial tool for participatory democracy in the 21st century. The authors contend that teaching critical media literacy is the only progressive option (Kellner & Share, 2007).

Social media literacy is the ability to understand and navigate the distinct nature of social media content, the technological affordances and architectures of social media platforms, and the multiplicity and changeability of realities on social media. This definition emphasises the centrality of the self and its relations with social media content consumptions, choices, engagement, and the social media network environment (Cho et al., 2022). Bühler et al. (2020) have broadened this understanding and developed the concept of social media information literacy (SMIL), outlining eight competences for individual social media users, including recognising the need for information, searching, obtaining, understanding, evaluating, creating, communicating, and re-evaluating information. They further adapt SMIL, adding three sub-items to address disinformation: distinguishing between headlines and news bodies, identifying satire and fake news, and recognising automated accounts or bots that are spreading information (Bühler et al., 2020).

Some researchers describe multiliteracy in the context of teaching and learning digital competences by placing it in a wider context, stating that this “umbrella term” is a comprehensive competence that encompasses cognitive, skill-based and affective elements (Kangas & Rasi, 2021, 344). It includes knowledge, attitudes, skills, ethics and values related to media literacy, visual literacy and advertising literacy, among other concepts. The term 'multi' highlights the diverse forms of texts, including verbal, visual, auditory, numeric, and kinesthetic symbols and their combinations (Kangas & Rasi, 2021). Other scholars present multiliteracy as an antidote to disinformation and propose a set of competences to tackle the issue. Multiliteracy highlights the importance of enabling pupils to identify false information, critically evaluate the role of technology in society, and engage in ethical civic discourse. These skills provide a basis for navigating the constantly evolving challenges of disinformation (Damasceno, 2021; Valverde-Berrocoso et al., 2022).

As mentioned at the beginning of this chapter, there is no consensus on the various different definitions. What seems important for this work and the awareness of disinformation is the critical evaluation of digital sources, discussion about the quality of information and the

creative design and application of digital technology. It is for this reason that I have chosen multiliteracy as the focus for this stage of my work.

The term used to describe the required skills has evolved over the progression of this work and through in-depth study of the literature, moving from ‘digital competences’ in the early articles to ‘multiliteracy’ in the subsequent stages of the research. This is primarily due to the fact ‘multiliteracy’ is a broader term and encompasses, for instance, the creative deployment of tools, and or digital wellbeing. This is why the term is not used consistently throughout the work presented here, as exemplified in the research questions.

2.4.2. Digital Media Frameworks for Educators

Having defined key terms relating to information and media literacy, this section describes some key theoretical concepts for practitioners and educators. The European Union Digital Competence Framework for Educators (DigCompEdu) is designed to promote digital competences for educators. It synthesises existing tools and provides a foundation for policy guidance and training initiatives. DigCompEdu was intended to be applied at all levels of education and to facilitate dialogue, good practice and the development of digital literacy models. It presents 22 fundamental digital competences, arranged into 6 categories. These categories cover a range of applications for digital competences, including professional interactions, resource utilisation, teaching and learning management, assessment, learner-centred strategies, and pedagogical facilitation. The framework also includes a six-stage progression model, running from Newcomer to Pioneer, to help educators evaluate and enhance their digital skills. Bringing together national and regional initiatives to capture digital competences specific to educators, it serves as a frame of reference for policymakers, educational organisations, and training providers across all educational levels (Redecker, 2017).

Another international framework is the UNESCO ICT Competency Framework for Teachers (ICT CFT), a comprehensive guide for educators who want to integrate information and communication technology (ICT) effectively into their teaching practices. It encompasses several key aspects of ICT competency for teachers. The framework comprises eight modules: (1) Technology Literacy, which covers basic and complex ICT tools and their application in education; (2) Knowledge Deepening, which focuses on the knowledge and skills required to develop innovative teaching practices using ICT; (3) Knowledge Creation, which aims to foster a knowledge society by integrating ICT in education; (4) Understanding ICT in Education, which enhances policy awareness, understanding, and innovation with regard to ICT in education; (5) Curriculum and Assessment, which aligns curriculum standards with appropriate software and ICT applications; (6) Pedagogy, which integrates technology into teaching practices, and promotes complex problem-solving skills and self-management; (7) Organization and Administration, which deals with transitioning from standard classrooms to collaborative learning environments and learning organisations; and finally, (8) Teacher Professional Learning, which focuses on the development of digital literacy, guiding and managing ICT use, and serving as a model learner for students. These modules equip educators with the competences to leverage ICT in the classroom, support educational reform, and enhance student learning outcomes. The framework emphasises the importance of continuous professional development and of adapting to evolving technological trends in education (UNESCO, 2011).

The Austrian digi.kompP competency model is aimed at educators and was developed by the Federal Ministry of Education and Women's Affairs. It is based on national and international frameworks and is an instrument for self-assessment, continuous professional development, and (higher) education. The model is divided into eight categories (A-H) and three development phases (0-2). The eight categories are (A) Digital competences and computer science education, (B) Digital life, (C) Digital materials design, (D) Digital teaching and learning, (E) Subject-specific digital teaching and learning, (F) Digital administration, (G) Digital school community, and (H) Digital professional development. Level 0 model indicates the competences that students should have at the beginning of their studies. The degree programme begins by transiting students from level 0 to level 1. Phase 1 encompasses the competences that need to be acquired during the teacher training programme. The transition from phase 1 to phase 2 occurs upon completion of the teacher training programme and entry into the teaching profession. Phase 2 encompasses the competences acquired through daily work, continuous professional development, and further training (Brandhofer et al., 2016).

All three frameworks acknowledge the importance of providing educators with digital competences that enable them to integrate technology into teaching and learning. They offer guidelines and frameworks for evaluating and enhancing educators' digital skills. Each framework highlights not only the technical aspects but also the pedagogical, social and emotional dimensions of digital competence. The frameworks include different specific competencies, reflecting diverse cultural, educational, and policy contexts. They vary in their level of detail and granularity, addressing different audiences and needs. The terminology and language used in each framework also vary depending on target audience and geographic region. In summary, they differ in scope, depth of coverage, cultural and regional context, and audience focus. I would argue that although these concepts are theoretically well-founded and suggest interventions by (educational) policy makers aimed at building literacy, they are of limited practical application for teachers in schools.

2.4.3. Prebunking, Debunking and Inoculation

The fields of pedagogy and communication studies offer a range of strategies to address disinformation, known variously as inoculation/prebunking, and debunking. Inoculation theory draws an analogy between biological vaccination and psychological resistance to persuasion, and in the context of fake news can be applied to help individuals resist the influence of disinformation (McGuire, 1961). The process involves the exposure of individuals to weakened versions of the deceptive techniques used in fake news, thereby enabling them to develop cognitive resistance to such tactics. First, individuals are exposed to simplified and weakened versions of the strategies commonly employed in fake news, such as logical fallacies, misleading headlines, or selective use of evidence. This pre-exposure triggers proactive cognitive responses, such as critical thinking, fact-checking, and scepticism, which help individuals recognise and resist deceptive techniques when encountering actual fake news. By engaging in counterargument and developing refutations to the weakened deceptive strategies, individuals strengthen their ability to identify and resist the influence of fake news when they encounter more sophisticated and deceptive misinformation (Compton, 2013).

Building on this approach, Lewandowsky et al. (2020) describe the process of prebunking, which exposes people to a weakened dose of misinformation techniques then pre-emptively refutes them in order to cultivate ‘cognitive antibodies’ against future attempts at persuasion.

Scheibenzuber et al. (2021) define four areas of cognitive activity in connection with disinformation: reception, information acceptance, cognitive integration and sharing of fake news. To address these four areas, these authors too suggest inoculation (Scheibenzuber et al. 2021). Inoculation is further proposed as a way of deepening 15-18-year-olds' understanding of misinformation by Fasching & Schubatzky (2022).

In contrast to inoculation theory's attempt to 'immunise' pupils against alternative beliefs before misinformation emerges (Bernsteiner, Schubatzky & Haagen-Schützenhöfer, 2023), debunking involves correcting misinformation after people have been exposed to it. While both approaches are therefore protective in intention, prebunking is proactive while debunking is reactive, aiming to correct misinformation after it has been spread (Lewandowsky et al., 2020).

Lewandowsky et al. (2020) list four practical steps to debunk online fake news, as follows. (1) State the truth first: Start by clearly stating what is true. This allows educators to frame the message and lead with their talking points, rather than allowing the misinformation to set the agenda. (2) Provide a detailed rebuttal of the misinformation, explaining why it is false. This may include explaining the logical or argumentative fallacies underlying the misinformation and providing a factual alternative. It is important here, state the authors, to ensure that the rebuttal is easily accessible to the target audience, and uses language and visual aids that are clear and easy to understand. (3) Use visual aids to help communicate the facts and debunk the myth. Well-designed graphs, photos, videos and other semantic aids can help to communicate corrections involving statistical or complex information concisely and clearly. (4) Explain the potential harm of believing the misinformation and the benefits of accepting the truth. At this stage, the authors highlight, it is important to emphasise the consequences of continuing to believe the misinformation and the benefits of accepting the correct information (Lewandowsky et al., 2020). By incorporating these components into the debunking process, the authors argue, communicators can increase their chances of effectively correcting misinformation and promoting accurate understanding (Lewandowsky et al., 2020).

Bernsteiner, Schubatzky and Haagen-Schützenhöfer (2023) suggest a mix of debunking (Lewandowsky et al., 2020) and inoculation (McGuire, 1961) strategies to equip teachers and pupils with required digital competences to counteract misinformation (Bernsteiner, Schubatzky & Haagen-Schützenhöfer, 2023).

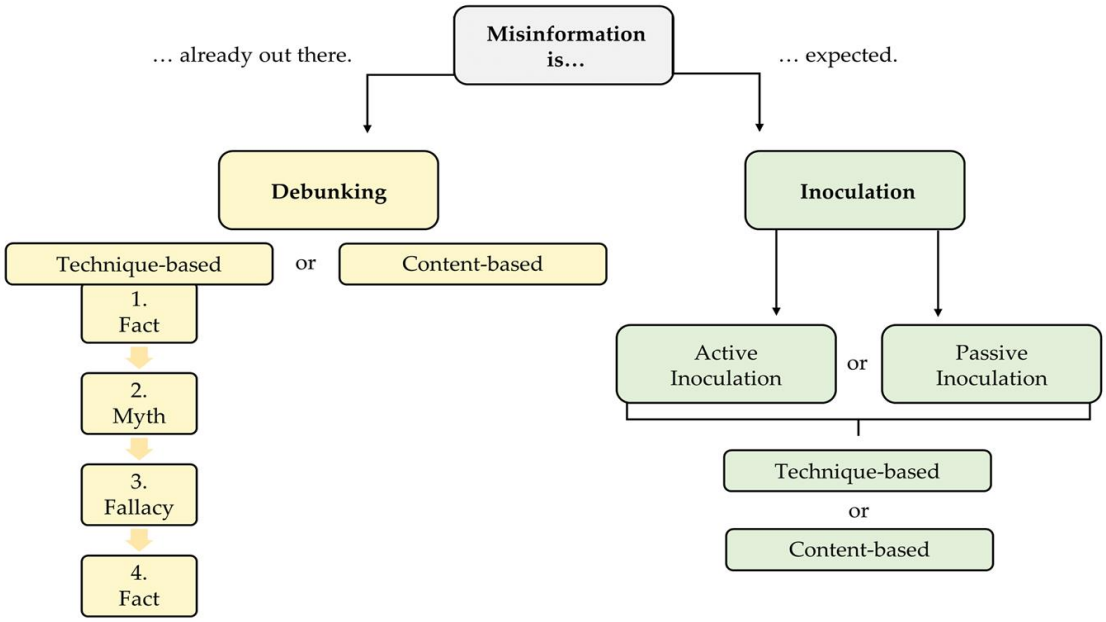

Figure 2: Debunking and inoculation strategies for dealing with misinformation (Bernsteiner, Schubatzky & Haagen-Schützenhöfer, 2023, 3), by permission of the publisher and authors

Figure 2 depicts potential debunking and inoculation strategies for dealing with existing or anticipated misinformation. The authors contend that active inoculation and debunking techniques "help future teachers to develop skills for dealing critically with (mis)information and to adopt an approach that can be used in teaching to help pupils deal critically with, or debunk, (mis)information" (Bernsteiner, Schubatzky & Haagen-Schützenhöfer, 2023, 19).

The FLICC (in German PLURV) framework is another helpful ingredient in inoculation or prebunking interventions. FLICC is based on five common science denial tactics: fake experts, logical fallacies and misrepresentations, impossible expectations, cherry picking and conspiracy theories (Hoofnagle & Hoofnagle, 2007), as illustrated in Figure 3. This taxonomy highlights the importance of understanding the techniques of misleading argumentation in order to reduce their influence on individuals. It explains the methods used to create doubt about scientific consensus and can thus help inoculate individuals against misinformation and promote critical thinking (Cook et al., 2017).

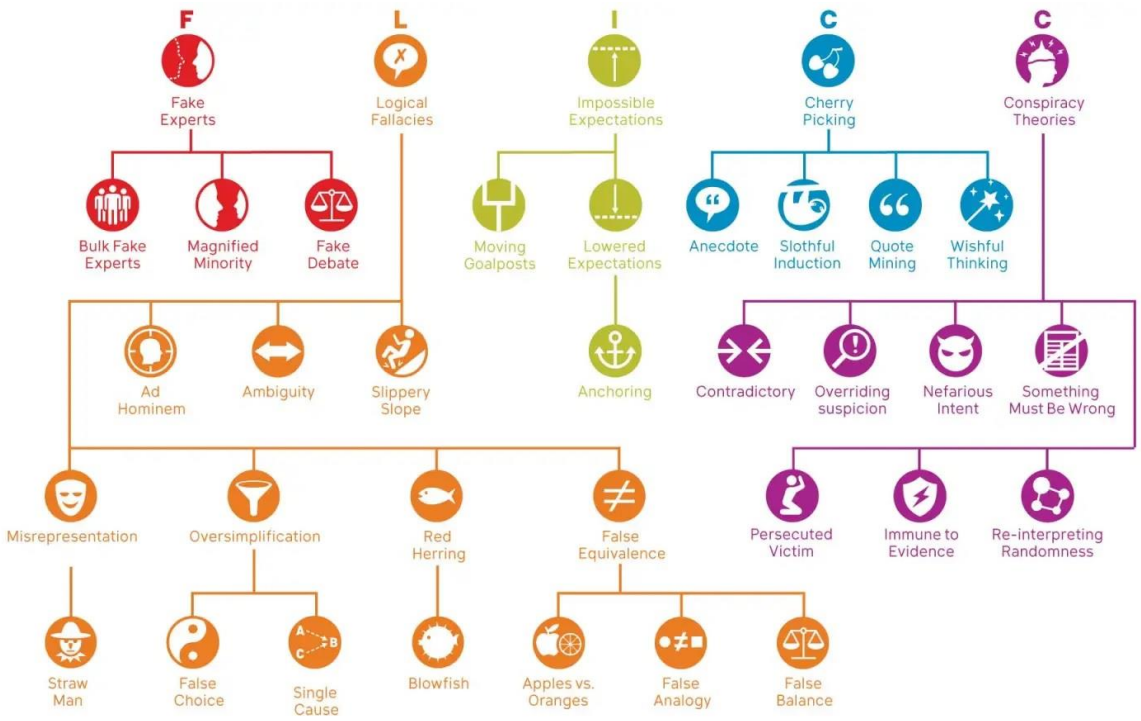

Figure 3: FLICC techniques of disinformation and science denial for inoculation (Cook, 2020, 69), by permission of the publisher and authors

The disinformation techniques highlighted by the FLICC model and listed in Figure 3 are explained below.

- Fake Experts present unqualified individuals or institutions as credible sources.
    - Bulk Fake Experts: large numbers of experts are cited in order to argue there is no scientific consensus on a topic.
    - Magnified Minority: the fact that a few scientists disagree with the majority on a scientific issue is emphasised.
    - Fake Debate: science and pseudoscience are presented in an adversarial format to suggest an ongoing scientific debate.
- Logical Fallacies draw conclusions that do not follow logically from premises.
    - Slippery Slope: suggests that a minor action will inevitably lead to major consequences.
    - Ambiguity: unclear language is used to lead to misleading conclusions.
    - Ad hominem: a person or group is attacked instead of their arguments being addressed.
    - Misrepresentation: a situation or an opponent's position is presented in a misleading way.
    - Oversimplification: understanding is distorted, leading to erroneous conclusions.
    - Red Herring: attention is diverted/distracted from the main issue.
    - False Equivalence: it is incorrectly claimed that two things are equivalent despite notable differences.
    - Straw Man: an opponent's position is misrepresented or exaggerated to make it easier to attack.

    - False Choice: two options are presented as the only possibilities, ignoring others.
    - Single Cause: it is assumed there is only one cause when there might be more.
    - Blowfish: an inconsequential aspect is focused on, blowing it out of proportion in order to distract from the main conclusions.
    - Apples and Oranges: it is falsely claimed that two things are the same.
    - False Analogy: it is assumed that two things are alike in all respects.
    - False Balance: two things are presented as equal, often giving undue weight to a minority view.
- Impossible Expectations demand unrealistic standards of certainty before scientific conclusions are accepted.
    - Moving the Goalposts: more/higher levels of evidence are demanded after requested evidence is provided.
    - Lowered Expectations: the standard by which performance or evidence is assessed is lowered.
    - Anchoring: there is too heavy a dependence on an initial piece of information when making subsequent judgments.
- Cherry picking selects data that appears to confirm one position while ignoring other data that contradicts it.
    - Anecdote: personal experiences or isolated examples are relied on instead of sound arguments or compelling evidence.
    - Slothful Induction: relevant evidence is ignored when a conclusion is drawn.
    - Quote Mining: words are taken out of context to misrepresent someone's position.
    - Wishful Thinking: something is believed because it is desired, not on the basis of evidence.
- Conspiracy theory proposes that there is a secret plan to implement a nefarious scheme.
    - Contradictory: a simultaneous belief in mutually exclusive ideas.
    - Overriding Suspicion: people doubt the official account, so they do not believe anything that challenges the conspiracy theory.
    - Nefarious Intent: it is assumed that intentions are bad.
    - Something Must Be Wrong: it is assumed the official statement is wrong even when parts of a conspiracy theory are wrong.
    - Persecuted Victim: someone is presented as victims of organised persecution.
    - Immune to Evidence: all evidence that does not fit with the conspiracy theory is deemed to be wrong.
    - Reinterpreting Randomness: random events are reinterpreted as having been caused by the conspiracy (Winkler & Cook, 2021).

Figure 3 depicts the FLICC categories and sub items that explain methods of disinformation and science denial. This model helps promote critical thinking and information literacy skills by encouraging users to assess information sources systematically and critically (Winkler & Cook, 2021; Cook, 2020).

Limitations of prebunking and inoculation might be that they are generally somewhat lengthy and rely on voluntary uptake; that it is not always possible to predict what misinformation people will be exposed to and inoculation requires a degree of specificity in order to be

effective; or that there is an evidence gap with regard to the effectiveness of inoculation on the ground, for example on social media (Roozenbeek, Culloty & Suiter, 2023). A practical downsize might be that inoculation needs to be given space and time during subject-specific lessons; but this might not always be (easily) available.

Roozenbeek et al. (2023) also identifies five limitations of debunking: (1) It appears to matter who is doing the debunking. The trustworthiness and expertise of the individual affect how likely it is the debunked correction will be accepted; (2) Debunks do not reach the same people as the original misinformation; (3) Correcting misinformation does not always undo specific (false) beliefs; (4) Arguments used in debunking might be subjective or ethical, but not reducible to objective facts; (5) The literature is unclear when it comes to the effectiveness of prebunking and debunking. Some authors, for example argue, that only prebunking is effective and debunking is not (Jolley & Douglas, 2017).

Although scientific findings may indicate a positive increase in early detection of disinformation with prebunking/debunking, it is important to note that these findings are subject-specific and require prior knowledge on the part of teachers, as well as classroom time. Therefore, in the present work, I decided to use phenomenon-based learning, because it allows for more general work with curriculum topics in (nearly) every school subject and does not require teachers to have any prior knowledge.

2.4.4. Serious Gaming

Another pedagogical approach to increasing digital competences to combat disinformation (connected to article 5 referred to in this dissertation) are serious games. Serious games have become a useful tool for enhancing pupils' interest in cybersecurity education. Serious games are defined as *"computer application, for which the original intention is to combine with consistency, both serious aspects such as non-exhaustive and non-exclusive, teaching, learning, communication, or the information, with playful springs from the video game"* (Alvarez & Djaouti, 2011, 11-12). In simple words, a serious game is "any piece of software that merges a non-entertaining purpose [...] with a video game structure" (Djaouti et al., 2011, 3). These games are also frequently associated with other terms, including edutainment, immersive learning simulator and digital game-based learning (Maekawa et al., 2020).

The content and visual design of these games can significantly impact learners' ability to acquire knowledge, develop skills and form habits. Studies have demonstrated that contemporary schools struggle to keep learners motivated, engaged and focused over long periods of time. As pupils in this generation are digital natives, some have argued that games are better suited to their learning preferences than other forms of input. Game-based learning facilitates error-making and learning within a risk-free milieu, in contrast to conventional modes of teaching. This affords pupils the opportunity to revisit a topic multiple times (Hill et al., 2020).

In recent years we have seen an increase in the development of serious games dealing with the topic of fake news; they seem to be a promising vehicle for inoculating the public against disinformation. There are also related products, such as board games and online quizzes, that aim to familiarise citizens with the problem of fake news and test their ability to identify the true or false nature of information (Hill et al., 2020). Below is a list of examples of serious games about disinformation with links to free games in English or German:

- Troll Bunker Escape Game – https://yle.fi
- Fake it to make it - Fake It To Make It
- Cranky Uncle - https://crankyuncle.com
- Get bad news - www.getbadnews.com/de
- Go viral (Covid19) - www.goviralgame.com/de
- LPB NRW – Fake News App - Fake News App (nrw.de)
- Paul Newsman Scherzartikel – www.paulnewsman.com

Gamification through serious games can significantly contribute to prebunking by motivating young people to learn about digital topics. However, this approach may require additional classroom time and teacher preparation.

2.5. Open Pedagogy Formats

Pedagogical strategies can offer a regulated approach to the creation of teaching and learning scenarios. Associated with this are questions such as: What is teaching and learning? Why is teaching done? Why do we learn? (Kergel & Heidkamp-Kergel, 2020). Potential answers include the TPACK model (see chapter 2.4.): having a firm idea about the pedagogical justification for a scenario, combined with the expert subject knowledge and an understanding of the purpose and application of technology. Education research has a long history of theories and definitions of terms with regard to teaching and learning. As a detailed explanation would exceed the scope of this work, I will provide a more detailed overview of the open pedagogy format in the following section.

Open Education Pedagogy is an approach to the design of learning experiences. It draws on established models of constructivist and networked pedagogy, while using the potential of open tools and content to generate innovative learning practices. Open pedagogy formats seek to use open approaches and technologies to facilitate active learning, enable real-time sharing of learners' work, facilitate formative feedback and peer review, and ultimately support community-engaged coursework. This approach encourages pupils to develop into public citizens, to increase their knowledge and skills about the copyright and control of online content, and to consider extending these rights to others. Encouraging learners to share their work more widely underscores the intrinsic value of their contributions beyond the confines of the course and provides an avenue for direct engagement with their community (Paskevicius & Irvine, 2019). Investing time in cultivating the skills to work with open pedagogical formats, and collaborating with colleagues to refine and share practices, is crucial to promoting greater openness in educational practice (Kimmons, 2016). The following section explores some open pedagogy formats.

Problem-Based Learning (PBL) is a pedagogical method involving learning that is situated, problem- and knowledge-based. Problem-based learning takes a (real) problem as a starting point, providing a stimulus to find out what information is needed to make the problem understandable and solvable. The process of learning is more important than the solution to the problem. The PBL approach therefore enables independent learning and a deeper understanding of the subject matter. The focus here is not on teaching, but on the learning of individuals (Weber, 2004).

Inquiry-Based Learning, also known as Research-Based Learning, takes learners' prior knowledge and curiosity as the central starting point for the acquisition of knowledge, and puts

the process from the question to the conclusion centre stage. Specifically in relation to teaching, this involves the formation of hypotheses, experiments to test hypotheses, data collection, conclusions and subsequent reflection by the learners. This approach can be used in a range of sessions to tap into learners' divergent levels of knowledge and can also vary the degree and nature of independent working. This approach is potentially promising for digital learning environments, as it allows learners to take a trial-and-error approach (Borchers et al., 2020).

Building on and extending these principles, Design-Based Learning (DBL) is a research-based form of learning that focuses on the integration of design experiences in science lessons. It is a form of project-based learning in which learners are involved in the design and organisation of the learning process. DBL emphasises the planning of learning processes, repetition and learning through mistakes and aims to foster creative self-confidence, empathy for others and self-reflective skills in learners. Learners try out, create and test their designs, and report back on solutions. In Design-Based Learning, the cognitive processes of planning, generating, evaluating and creating are essential to the implementation of ideas. Here, the design process is a medium for the construction of new scientific knowledge. The DBL approach is widely used in secondary education and in science subjects (Puente et al. 2013).

The bridge to technology-supported teaching and learning is provided by the Instructional Design (ID) approach, which goes back to Robert Gagné and has its roots in military training. Instructional design refers to the systematic development and provision of digital and physical learning environments. The starting point of this approach is the cognitive identification of learning needs, along with teaching and learning scenarios. The provision and planning of learning environments is based on a cognitivist understanding and has been associated with computer-based or digital teaching methods from the very beginning. In other words, instructional design is a planning science that develops a framework for learning needs within the teaching and learning infrastructure and analyses the resources required, in order to design and provide the appropriate teaching and learning environment (Kergel & Heidkamp-Kergel, 2020).

Phenomenon-based learning is a multidisciplinary learner-centred approach that focuses on investigating and solving problems. It supplements problem-based learning and design-based learning. Learners are not assigned to a specific subject but instead investigate and solve their own questions, having identified relevant topics (Lonka et al., 2018). Phenomenon-Based Learning has its roots in Finland and in contrast to the approaches described previously takes a global and interdisciplinary perspective, incorporating a range of viewpoints. Its goal is to equip learners with problem-solving skills that can be applied to real-life situations (Symeonidis & Schwarz, 2016). The Finnish core curriculum requires pupils to take at least one Phenomenon-Based Learning module per school year, even in primary school. This involves several teachers teaching simultaneously on an interdisciplinary and cross-curricular topic or phenomenon. The chosen focal points relate to perceptions and experiences from pupils' real lives, such as homelessness, the climate crisis, traffic noise or nutrition. The topic and mode of implementation are determined by each school individually. Phenomenon-Based Learning is linked to interdisciplinary, transdisciplinary, and multidisciplinary theories of learning. Its purpose is to strengthen interdisciplinary and professional collaboration between teachers, as well as facilitate extracurricular learning (Rasi et al., 2019).

On the basis of the above definitions, I have chosen Phenomenon-Based Learning (PhBL) as the framework for the present work since it encourages critical reflections about sources and learners' autonomy. The PhBL process may help to develop skills necessary for identifying disinformation at an early stage.

2.6. Phenomenon-Based Learning and Social Constructivism

The concept of phenomenon-based learning has been part of Finland's core education curriculum since 2014 and has attracted worldwide interest. In Finland, PhBL is associated with constructivism, educational psychology, inquiry-based learning (IBL) and problem-based learning (PBL). Despite its deep philosophical roots, the holistic approach of PhBL, which emphasises collaboration and shared responsibility, offers promising educational practices for addressing complex global challenges (Schaffar & Wolff, 2024).

In the Finnish education system, PhBL is designed to address pedagogical issues and take into account pupils' cognitive and development, allowing PhBL to be tailored to pupils' individual learning needs. Overall, the Finnish education system emphasises a student-centred approach to learning through the incorporation of educational psychology and constructivist principles into PhBL. Pupils are encouraged to explore phenomena in their own contexts, to collaborate with peers and to take responsibility for their own learning, thus fostering critical thinking, creativity and a deep understanding of complex phenomena (Lonka et al., 2018; Schaffar & Wolff, 2024).

Phenomenon-based learning is connected to the following theories of learning:

Phenomenon-Based learning is a strongly constructivist approach that emphasises the importance of the learner's previous experiences and active processing of environmental impressions, and contends that teaching media have only a minor influence on learning processes. According to Maturana and Varela (1987), individuals construct their own reality based on their subjective experience. Although constructivist approaches developed out of cognitivism, constructivism rejects cognitivist objectivism, because knowledge is seen not as a reflection of external reality, but rather as a function of cognitive processes (Raithel et al., 2009).

A variation of constructivism, known as radical constructivism, rejects the objective and ontological concept of reality and instead focuses on reality as subjective. Reality is thus not self-evident and cannot be scientifically investigated. Knowledge is constructed on the basis of personal experiences, as Glasersfeld (1997) proposed. Luhmann's systems theory also shows evidence of a connection to this theory (Luhmann, 1984). Social (and interactionist) constructivism distinguishes between observers, participants, and actors, establishing reciprocal attributions and roles through social activity. This approach avoids overgeneralization, subjective construction, or arbitrariness (Reich, 2009). Further developments of social constructivist approaches also consider social dynamics within the framework of constructivist cognitive structures. Learning is not an isolated, individual process. Instead, it is an intersubjective cognitive process in which learners work as a group to arrive jointly at an understanding of content (Kergel & Heidkamp-Kergel, 2020).

However, behaviourism, cognitivism, and constructivism emerged before the digital age and are complemented by connectivism. Siemens (2004) argues that traditional theories of

learning cannot adequately address the learning opportunities presented by digital technologies. Connectivism describes the interaction and learning contexts facilitated by digital technologies and the Internet. Siemens contends that learners participate in digital learning communities, such as wikis, chats, or MOOCs, based on their learning needs. They connect with these communities and exchange information within them. In this context, learning is a self-directed process based on the freedom of the learner. Learning is therefore a process of cultural exchange involving cognitive activity. The development of competences on the internet can be seen as bottom-up learning. This presupposes that learners pursue common learning goals, develop individual curricula, generate and exchange experiential knowledge and go through joint decision-making processes (Siemens, 2004). Learning occurs through the active creation of connections between content-related, social, and technical resources. It is based on creative social exchange on topics that learners can shape and influence themselves. Connectivism postulates structural equivalence between the media functions of the internet and participative and self-directed forms of learning (Grünewald et al., 2013). This description of socio-technical learning emphasises the internet's many-to-many structure and combines it with flexible learning strategies (Kergel & Heidkamp-Kergel, 2020).

2.7. Chapter 2 Summary

Social constructivism emphasises the idea that knowledge is co-constructed through social interaction, dialogue and negotiation between learners. This perspective fits well with PhBL's focus and the present work on interdisciplinary collaboration, where pupils with varying levels of prior knowledge work together to investigate and understand complex phenomena. In addition, social constructivism emphasises the role of the teachers as expert advisors who guide and support pupils on their learning journey, fostering a dynamic and interactive learning environment in which pupils actively construct meaning and knowledge. Teachers who hold constructivist beliefs typically structure activities that are learners-centred, fostering autonomous learning, group discussions, and activities where pupils construct meaning. Their emphasis is primarily on the learning process (Brooks, 2002). Overall, the social constructivist approach complements and enriches phenomenon-based learning by encouraging active engagement, collaboration and co-construction of knowledge among pupils.

But elements of connectivism also play a role in phenomenon-based learning. The latter emphasises the interconnectedness of different sources of knowledge, both human and technological. In this approach to learning, connectivist principles encourage the use of resources from a wide network of information and the understanding of complex connections between concepts. It also promotes learning through networking, helping learners to gain insights by interacting with peers, experts and resources.

Overall, both social constructivism and connectivism facilitate dynamic, collaborative learning environments in phenomenon-based learning, promoting knowledge acquisition through social interaction and the use of multiple resources with digital technologies.

3. Chapter: Methodological Considerations

This chapter presents the methodology and methods applied in this PhD. The methodology will detail the theoretical and analytical framework and to do so, it is necessary to position the research approaches clear. In the social sciences, various scientific paradigms and worldviews have been developed, each of which takes a specific approach to scientific questions. It is therefore crucial to position this work in the scientific discourse and provide related argumentation within the scientific community. The methodology of a research project can be seen metaphorically as a map for a long hike, guiding the researcher through potential rough terrain or poor visibility.

Research in education and communication sciences often follows the research traditions of the social sciences, analysing and explaining observable relationships in terms of possible causes and effects. Social phenomena are seen through the lens of subjective actions, by placing oneself in a situation or in the position of another person and considering their individual characteristics, expressions, or actions. Adopting a research stance that focuses on subjective conceptions of social reality means that the world is viewed as the construction of individuals with a variety of perspectives (Lieberman & Miller, 1978). Social science explores how individuals interact and interpret the world around them, so this approach focuses on describing relationships between individuals and their impact on actions (Cohen et al., 2017).

Broadly speaking, social science studies may adopt a positivist or an interpretative research tradition. The logical positivist approach suggests that all “knowledge is based on sense experience and can only be advanced by means of observation and experiment” (Cohen et al., 2017, 8). Positivism describes human behaviour as rule-governed that should be investigated by the methods of natural science. This approach is based on the overall acceptance of natural science as the paradigm of human knowledge (Kivunja & Kuyini, 2017). Positivism involves the specific view of a social scientist as an analyst of his or her subject matter (Cohen et al., 2017). A shortcoming of this tradition is that it fails to capture the complexities and nuances of human interactions that are often the focus of educational research.

The present project, however, requires approaches that are sensitive to the diverse and context-dependent nature of learning, incorporate subjective experiences and interpretations, consider socio-cultural factors, address ethical considerations, and recognize the dynamic and participatory nature of the learning process. The qualitative or interpretative paradigm is better suited to those research needs. This approach is characterised by a focus on individuals and takes an anti-positivist viewpoint. Interpretative research investigates the subjective human experience of the world, with the main effort being to understand individuals from within and by trying to see the world through their eyes (Kivunja & Kuyini, 2017). It does not investigate generalisable truths or causal relationships between variables, instead viewing an individual’s actions as a response to the external environment. Here, action is viewed as behaviour-with-meaning, intentional and future-oriented behaviour, or shared experiences (Cohen et al., 2017). Researchers adopting an interpretive paradigm typically conduct research *with* individuals, seeking to “understand their interpretations of the world around them” and derive theory from specific situations (Cohen et al., 2017, 23). The goal of interpretive research is to understand how the creation of an individual's reality happens in one time and place, in order to compare observations of what happens in other times and places. Theories are a

combination of meanings that lead to insights and understanding of human behaviour (Cohen et al., 2017). Following these arguments, the present work is positioned as anti-positivist and interpretative research with a focus on the reality of individuals.

The acquisition of knowledge is based on the development of a theory generated through data that has been collected using various methods (Cohen et al., 2017). In other words, the epistemological approach selected by the researcher will influence the types of knowledge they rely on and the methods they use to uncover knowledge within the social context being investigated (Kivunja & Kuyini, 2017). The methodology systematises methods and approaches to establish valid and binding techniques. Methodological considerations are necessary for the development, modification, and use of individual methods to research specific phenomena. As there is no universally accepted methodology for generating theories in a given discipline, they must be derived through argumentation. This approach significantly impacts the entire research process, from theory and methods to the interpretation and explanation of social reality (Mackenzie & Knipe, 2006). In communication research and educational research, the term methodology is used in various ways. It can be used synonymously with philosophy of science as an “analysis of scientific procedures and methods” (Kron, 1999, 70), as a “doctrine of the principles, rules, and methods of scientific work” (ibid., 71), as a metatheory, i.e. as a theory about theories and as the logic of research (ibid., 71), and as a fundamental study of scientific methods and the framework for scientific work (ibid., 71). Methodology is also understood to denote the scientific thinking that reflects and informs the connection between a system and a method. It is a discipline of logic or the logic of research itself (Thaler, 2013). Somekh and Lewin (2005) define methodology as both "the collection of methods or rules by which a particular piece of research is undertaken" and the "principles, theories and values that underpin a particular approach to research" (346). Walter (2006) defines methodology as a frame for research which is shaped by the "paradigm in which our theoretical perspective is placed or developed" (35). Most commonly, methodology is understood to be the broader research approach associated with a particular paradigm or theoretical framework. In contrast, method pertains to the systematic techniques, procedures, or tools utilised for gathering and analysing data (Mackenzie & Knipe, 2006).

Based on the specific theory being used, a process of inductive and deductive reasoning allows researchers to move back and forth during their investigations. The researcher first operates inductively from observations towards hypothesis generation and then moves deductively from these hypotheses to the consequential implications in order to determine their validity (Cohen et al., 2017). During interventions, the present work aims to evaluate and adjust hypotheses during the ongoing process of transcription and data analysis. This makes it possible to generate hypotheses that can be tested in subsequent interventions. This adaptive process needs meet not only the research goals, but also the learning objectives, i.e. training pupils’ awareness of disinformation (Roth, 2005).

As the present work is interested in learning environments and pupils’ knowledge creation processes, an ethnomethodological approach has been chosen. Learning environments need to recognise the potential of digital technologies as tools within (physical) educational settings. This requires the determination of appropriate pedagogical approaches, the definition of learning goals and outcomes, the integration of digital resources into learning environments, the acknowledgment of digital media as a social activity, the incorporation of digital media into child-directed experiences, and the utilisation of digital resources to facilitate open-ended

learning opportunities (Arthur et al., 2001). Ethnomethodology is concerned with how people make sense of their everyday world, focusing on how participants achieve and sustain interactions in social encounters, including their assumptions, conventions and practices (Garfinkel, 1967). Ethnomethodology is well-suited to exploration of the inner order or local organisation of specific social activities. It can be used in empirical studies focusing on situated human action, as an alternative to mainstream sociological theory (Button, 1991). It also offers theoretical reformulations of classical themes in the human sciences. As in Garfinkel's (1967) organisational study of ordinary affairs focusing on the experience of everyday life, the term 'ethno' refers to a member's body or to people's knowledge. Ethnomethodology thus focuses on the behavioural aspects of human experience, encompassing questions about 'inner states' with observation as its primary method of inquiry (Moore, 2013).

Ethnomethodology distinguishes between the notions of indexicality and reflexivity. Indexicality refers to the potential social actions within a social context and the shared meanings of the participants, which are not necessarily explicit. Reflexivity refers to all accounts of socially and mutually interdependent settings, such as analyses, criticism, and descriptions (Garfinkel, 1967; Cohen et al., 2017). Linguistic ethnomethodology focuses on language and conversation, while situational ethnomethodology considers a wider range of social activities to investigate how individuals negotiate the social context (Cohen et al., 2017). The present work adopts a reflexive and situational ethnomethodology approach.

Video ethnography has become a popular approach for generating empathetic encounters and individual depth with participants. Unlike other social research methodologies, video ethnography acknowledges the importance of technological, digital, and data-infused elements of contemporary environments. Video ethnography can be advantageous in educational contexts because it can capture participants' perspectives as they move through their (digital) environments. Pink et al. (2017) highlight that one methodological challenge of these kinds of investigations is understanding what it means to be part of these "configurations of things" (372). In the digital sphere, our objective is to both establish and contextualise a reflective approach to empathy. The authors provide three reasons for this: firstly, they argue that focusing on the technological and digital elements as integral parts of the overall experience shifts the focus away from the object of inquiry. Secondly, they explore how video can be utilised to capture and comprehend participants' experiences within the everyday flow of life, encouraging them to document and explain these experiences collaboratively with the researcher. Finally, the role of video ethnography in facilitating a processual approach is examined, which allows researchers to empathise with the subjective experience of digital materiality, while acknowledging the ongoing nature of these experiences (Pink et al., 2017).

In the context of practical research, video recordings allow scientists to identify social processes and interactions during the analysis phase that may not be immediately apparent during observation. Digital visual tools have the advantage of providing a cultural/historical perspective when studying pupils' development, enabling researchers to analyse their intentions and engagement in various settings. Video footage and basic computer video editing tools provide an opportunity to visualise pupils' development from multiple perspectives (Fleer, 2014).

3.1. Methodological Approaches in the Articles

The empirical work presented in five articles takes a multi-theory and multi-method approach. I will now detail each article, starting with the details of the theory and the methodology. In the first article (chapter 4.1.) I worked with the concepts of posthumanism, postdigitalism and socio-material methodology and applied the analytical lenses of the actor-network theory (Latour, 1996) and cultural-historical activity theory (Kaptelinin & Nardi, 2006).

Post-human constructs are useful approaches within recent theoretical trends in media literacy studies, as they do not silence humans or exclude them from accounts of the various phenomena surrounding material (and immaterial) technological actors. This theoretical lens attempts to explore new ways of representing the networks that encompass people and things in the context of learning. The post-humanistic perspective challenges traditional human-centric views and explores broader relationships between humans, technology, and the environment. (Williamson et al., 2019).

In contrast, the postdigital perspective emphasises the pervasive influence of digital technology on society and culture (Lyngdorf et al., 2023). Knox (2019) argues that post-digital concepts offer an alternative perspective on the relationship between humans and technology. They present technology as both a solution and a challenge for education going forwards. This view goes beyond the conventional understanding of technology and its role in education. Critical examination can help avoid simplistic stances, such as optimistic technological determinism (the belief that tablets for all will make learning more efficient), pessimistic determinism (the belief that AI will lead to dehumanisation), and pedagogical determinism (the belief that only people can drive change) (Lyngdorf et al., 2023).

Sørensen (2009) describes the socio-material perspective and the influence both of social interactions and of the physical environment. This implies that the objects we use and our physical actions are crucial for learning. Learning is also influenced by the people we interact with and the culture we are part of: although we have some control over it, it is also shaped by the opportunities provided by our surroundings. It is crucial to consider the impact of various environments on learning is crucial. Sørensen's concepts of socio-material learning demonstrate that learning is a multifaceted combination of actions, tools, and social interactions (Sørensen, 2009). Floridi (2015) highlights the fusion of the digital and physical worlds and how it affects the way we live and think. He points out that studying online activities requires that attention be given to ethical dimensions including privacy, identity, and hierarchies. This approach views the digital world as a vast system where information flows and shapes society, requiring responsible and thoughtful online behaviour and good digital citizens. The author explores the influence of technology on our interactions and identities. The socio-material perspective serves as a reminder that the digital world is closely intertwined with the physical world (Floridi, 2015).

In summary, postdigital, post-human and sociomaterial perspectives underscore the importance of understanding the complex interplay between humans, technology, and learning environments, emphasising the need for ethical engagement and critical awareness in navigating the digital age.

To analyse and interpret the data in article one, I used the actor-network theory (ANT) and the cultural-historical activity theory (CHAT). Actor-network theory (ANT) is a framework for

understanding how actors, whether individuals or collectives, are connected within networks of relationships and influences (Latour, 1996). ANT suggests that entities, whether human or non-human, are interactive parts of complex networks. ANT argues that entities are not solid or discrete, but sets of relations within networks, and that these networks are co-extensive with the entities themselves. ANT highlights that both human and non-human actors have agency to shape the network through actions and relationships (Callon & Law, 1997). ANT analysis has enabled me to identify the different actors involved in a situation, including people, organisations, technologies and objects, and analyse their relationships and interactions, emphasising how they influence each other within the network.

Field research in school settings must reflect (on) the sociocultural and cultural-historical context, including the institutional, parent, or teacher community (Roth, 2005). The cultural-historical activity theory (CHAT) is helpful for the exploration of connections between digital materials and social factors. CHAT is an analytical lens that can be used to examine material or technical objects and their role in an individual's goal-directed activities (Kaptelinin & Nardi, 2006). This approach is based on activity theory, which draws on the work of Russian psychologists Vygotsky, Rubinstein, and Leontiev. The approach initially focused on individuals and culture, but later shifted towards collective activity, mediational means, and division of labour as basic historical processes (Kaptelinin et al., 1995). Engeström and Cole's development of the activity theory places additional emphasis on dialogue, multiple perspectives, and cultural diversity (Cole & Engeström, 2007). This approach considers an activity as a crucial source of development within the context of the subject and object, which cannot be understood in isolation. According to this theory, the subject can be an individual or a group directed towards an object that may serve as the motive or outcome. The primary unit of analysis in this idea is the activity system, which is shaped by history and transformed over time (Kaptelinin & Nardi, 2006; Engeström, 2000).

In the context of this work this means that the process of learning cannot be investigated without looking at subjects (pupils, teachers, principals,...) and objects (critical information literacy, information literacy,...) as well as the cultural and historical setting of the learning environment (school, rules, community, tools, division of labour). This framework facilitates the analysis and interpretation of a historically evolving system of activities in a multifaceted network of relations and motives. The added value is the consideration of multiple points of views, traditions and interests within the analysed activity (learning) system.

Article two (chapter 4.2.) starts from the concept of transdisciplinary research. Its transdisciplinary character derives from two perspectives: first, the involvement of 19 experts from various disciplines; and second, collaborative work with a researcher from the Didactics Centre for Natural Sciences and Mathematics, combining this area with my perspective (media pedagogy). Transdisciplinary research combines different methods and ways of knowing from various fields. The changing landscape of knowledge generation in modern societies has led to an increasing interest in transdisciplinarity. According to Wickson et al. (2006), the primary features that distinguish this approach from other interdisciplinary methods are problem orientation, methodological development, and collaborative efforts. The authors discuss pluralistic methodology, which involves using multiple methods or considering different ideas and perspectives to develop a shared approach. This idea is connected to collaborative deconstruction, where different research methods analyse and break down each other to improve a methodology (Wickson et al., 2006). With regard to Article 2, it seemed necessary

to address the phenomenon of disinformation not only from an educational and/or communication perspective, but also from the transdisciplinary perspectives of the news media, media law, social and youth work, NGO, policy-making, criminal justice and anti-racism work.

Articles three (chapter 4.3.) and four (chapter 4.4.) are related to the concepts of multimodal and participatory research, video ethnography and a 'train-the-trainer' approach. In social science, multimodal research uses multiple modes of communication and representation, such as text, image, sound, and gesture, to investigate social, educational or communicational phenomena. This approach recognises that different modes of communication and representation can convey meaning in unique ways and seeks to leverage these diverse modes to gain a more comprehensive understanding of educational processes and outcomes. Multimodal research in social science aims to capture the complexity of social experiences by considering verbal, written, visual, auditory, and embodied forms of expression and interaction. This approach enables researchers to represent findings through different modes, create an inclusive research process, engage with diverse target groups and audiences, collaborate on different forms of authorship, and tap the potential of comprehensive and inclusive inquiry. Multimodal research offers methods that reflect the multifaceted nature of learning and teaching (Literat, 2018).

Participant-led research, also known as participatory research, is an approach in which the individuals or communities being studied actively participate in the research process as partners or co-researchers, rather than being passive subjects. The participants may be involved in different research steps, such as defining the research questions, designing the research methods, collecting or analysing data, and interpreting findings. This approach promotes a more balanced and objective perspective, as it acknowledges the expertise and knowledge of the participants and ensures that their voices are heard throughout the research process. Participant-led research aims to empower individuals or communities being studied, enabling them to shape the research agenda and ensuring that the research is relevant to their experiences and needs. By involving participants as active collaborators in the research process, participant-led research seeks to produce more meaningful and impactful findings, promote social change, and address issues of power and representation in research (Hansen, 2001).

A train-the-trainer approach was adopted, as the pedagogical concept was designed (in collaboration with teachers) to enable teachers to deliver the lessons independently. For this reason, I myself only took part in the field phases as a passive observer and did not actively participate in the lessons. Train-the-trainer programmes have been used in a wide range of settings (Yarber et al., 2015). These programmes offer potential benefits, in particular the ability to reach larger audiences through follow-up training led by those initially trained. Provided that trainees are local to the communities they will serve, they may have greater access to and understanding of contextual issues, thereby improving the relevance of training. In addition, local capacity- building has the potential to promote collaboration, networking and sustainability of training efforts (Yarber et al., 2015).

In article five (chapter 4.5.) I describe the development of a serious game using a co creation approach. In participatory design-based methodologies, it is crucial to prioritise the comprehension of situated practices and change (Ehret & Hollett, 2016). To achieve this, the

project team collaborated with a wide range of stakeholders (e.g., pupils, teachers, experts) from the beginning until the end of the project to shape the technology and participate in collaborative activities alongside designers and developers (Leinonen & Durall-Gazulla, 2014). A co-creation approach was applied to ensure that the resulting technology and associated practices were in line with broader ecosystems and to create a meaningful game for the intended audience (Zwass, 2010).

3.1.1. Summary and Critical Reflections

The sections above detail my research position within the framework of qualitative social research utilising the interpretive research paradigm. This included the development of theories as part of the research process, the adequacy of the research principle and the originality of the research objective in the context of the response heuristic. The qualitative research approach is characterised by the conscious inclusion of subjective factors such as the person of the researcher and their communication with the research participants. Data is seen as the result of the interaction processes between the researcher and the research participants (Thaler, 2013).

This thesis presents work that has been interrogated through a variety of lenses, including postdigital and posthumanist perspectives, as well as socio-material approaches in combination with transdisciplinary, multimodal, and participant-led research methodologies from an ethnomethodological perspective. Each of these frameworks offers a different view of digital education. In the context of this thesis, these methodologies offer a framework and provide an understanding of learning processes. They emphasise contextual sensitivity, accommodate the dynamic nature of educational landscapes, promote participatory engagement, empower stakeholders, foster critical reflection, and address ethical considerations. This may contribute to the development of more relevant, inclusive, and socially responsible research practices.

This framework also has several limitations with regard to complexity, methodological challenges, resource intensiveness, interpretive flexibility, generalisability, subjectivity, time-consumption, and integration. It is important for researchers to carefully consider these limitations when designing and implementing multidimensional research methodologies.

3.2. Study Design

This study design chapter highlights the mix of qualitative methods deployed to explore the phenomena of disinformation and critical media literacy. The following summarises the process of data collection, data analysis and data sampling. Chapter 4.5. provides details of authors' individual contributions.

Article one draws on observational data from two projects: "Digital? Safe!" and "One day in my onlife", conducted in Denmark and Austria. The two data sets included secondary school pupils, aged 17-24 in Denmark and 14-19 in Austria. Video recordings of interactions are transcribed, and three video vignettes are identified for analysis using actor-network theory and cultural-historical activity theory (Otrel-Cass & Fasching, 2021).

Article two reports on 19 expert interviews lasting between 45-80 minutes. The study involved six teachers and thirteen practitioners (n=19) with varying perspectives on disinformation. The

interviews were based on a semi-structured guideline consisting of 24 questions, which led to the emergence of eight inductive categories. Reliability checks with both researchers were conducted, and content analysis was performed, resulting in 35 subcategories (Fasching & Schubatzky, 2022).

Articles three and four present interviews with pupils (n=36, 20 female and 16 male), aged between 12-18 years, and their teachers (n=8, 6 female and 2 male), aged 26-45 years. In addition, this study collected video observations and recorded field notes from six classes (including 8 teachers and 107 pupils) across three secondary schools in Austria (Styria), resulting in 17 observed teaching lessons. The video recordings and field notes were subjected to a content analysis with 11 inductive categories. For Article 3, six selected video vignettes from the observations were also analysed to provide deeper insights into classroom dynamics focusing on trust and visuality (Reicho & Otrel-Cass, 2024, submitted).

Article five focuses on co-creation, with 18 industry representatives, 157 pupils aged 13-18, and 11 teachers developing a serious game. The process involved three design cycles focusing on story, interface, and school integration. The analysis of qualitative data from focus groups and interviews during the workshops, along with quantitative analysis of learning data from the game, provided insights into participants' perspectives and the educational impact of the game (Otrel-Cass et al., 2022).

By combining these approaches, the design of this research aims to provide a comprehensive understanding of digital literacy practices and challenges with disinformation in secondary school contexts.

3.3. Methods & Data Sources

This chapter discusses the scientific methods used to gather data in the articles comprising this thesis. They include interviews, focus group interviews, videoethnography, co-creation, content analysis and written observations. This section is crucial to the thesis as it outlines the research journey taken to achieve the study's objectives. It establishes the foundation for a thorough analysis and interpretation of the findings, ensuring the credibility and validity of the research outcomes.

3.3.1. Interviews

Interviews are considered a crucial means of data generation for the social sciences. They are widely used in social science research to gather valuable insights and information. From a theoretical perspective, interviews are complex interactions involving multiple layers of communication and meaning-making between interviewer and interviewee. It is important to understand the dynamics of the interview setting, including the role of the interviewer, question construction, and response interpretation. It is crucial for researchers to reflect on their own assumptions, subjectivities, and biases, all of which may affect the interview process and data interpretation. Interviews in social sciences are analysed through a theoretical lens that takes into account the complexities of human interaction, knowledge construction, and meaning negotiation within the research process. This theoretical perspective emphasises the significance of training, practice, and ongoing reflection to improve the quality and rigour of interview-based research in social sciences (Roulston et al., 2003). The conduct of research in education (or in this case media studies teaching) requires a wide range of perspectives,

including pupils, teachers, principals and specialist subject teachers. But the purpose of interviews is not to test hypotheses, get answers or assess interviewees/teachers; rather, the aim is to gain an understanding of lived experiences and the meaning interviewees make of these experiences (Seidman, 2006).

For this work I used qualitative semi-structured interviews and expert interviews. Guideline-based interviews are conducted on the basis of a prepared questionnaire, while expert interviews are defined by the selection and status of the specific interviewees (Helfferich, 2022).

It should be noted that the process of interviewing may be subject to a number of limitations. These include the potential for bias on the part of the interviewer, and errors in recall and social desirability bias among participants. Furthermore, non-verbal cues and nuances that present in face-to-face interactions may also be missed, which could impact the depth of understanding gained from the interview process (Helfferich, 2022).

3.3.2. Focus Group Interviews

The qualitative focus group interview method has been widely used in academic research over the last two decades. Its flexibility and validity have made it one of the most common techniques for gathering qualitative data. In this method, a moderator guides a group of individuals with specific characteristics to discuss a research topic in a comfortable environment. An important aspect of focus group interviews is the ability of participants to engage in comfortable conversations with others (Krueger, 2014). Focus group interviews have become popular in education research over the last 10 years; examples of usage include developing learning tools that appeal to learners' needs, assessing learners' attitudes to curriculum issues, developing new strategies for educational programmes, and improvement of survey results in educational research (Williams & Katz, 2001).

In this work, the choice of focus groups is based on two key assumptions. Firstly, they assume that individuals can offer valuable insights into their digital habits and experience with regard to disinformation. Secondly, it is assumed that interaction within the group setting will produce unique material that differs from other research methods (Glitz, 1999), because participants feel more confident in a group setting and group dynamics will enhance their flow - especially when working with young people. In the fieldwork phase of my research, I conducted interviews with pupils as well as teachers and experts. This revealed that small focus groups (2-4 participants) are particularly suitable for young (and possibly shy) pupils, while individual interviews with adults allow for greater depth.

The limitations of focus group interviews in research include the potential for dominant participants to influence group dynamics and steer the discussion, which may result in limited input from quieter participants. Additionally, social desirability bias may affect participants' responses, as they may conform to perceived group norms or withhold sensitive information (Krueger, 2014).

3.3.3. Video Ethnography

The use of video technology to capture, analyse and interpret social interactions, teaching practices and learning processes in educational settings is known as video ethnography, or

video-based observations. This method enables researchers to record classroom activities, teacher-pupil interactions, and pupils' behaviours for in-depth analysis and reflection. Video ethnography is a valuable source of data, offering insights into classroom dynamics, instructional strategies, and pupils engagement (Xu et al., 2018). Using video as a method to research social interactions in educational settings has both advantages and disadvantages. Video technology enables the comprehensive capture of complex social interactions over extended periods, providing a detailed and nuanced understanding of classroom dynamics. Digital video analysis software allows researchers to analyse interactions from various theoretical and participant perspectives, leading to a more comprehensive understanding of social dynamics. Additionally, it can be used as a medium to communicate, share, and disseminate educational practices, facilitating the exchange of innovative teaching strategies and approaches (Pink et al., 2017).

Interpreting video data requires careful consideration of context, potential biases, and the subjective nature of analysis, which can introduce interpretive challenges. Video analysis and processing demand specialised skills and software, which may pose technical challenges for researchers and educators. Additionally, video recordings may not capture the complete context of social interactions, potentially leading to incomplete interpretations of classroom dynamics (Xu et al., 2018).

The limitations of video ethnography include potential privacy concerns, as participants may feel uncomfortable being recorded, which could result in altered behaviour or refusal to participate. Additionally, video recordings may not capture all relevant contextual information or non-verbal cues, which could limit the depth of analysis. Technical issues such as poor audio or video quality, and the logistical challenges of analysing large volumes of video data, can also pose challenges for the conduct of video-based research. Finally, it is imperative to address the ethical considerations pertaining to informed consent, data storage, and data security when utilising video ethnography in research (Pink et al., 2017; Xu et al., 2018).

The ethnomethodological approaches of this work are strongly influenced by the impact on digital environments and habits of the Covid-19 pandemic that started in March 2020. Video ethnography, for instance, was enriched by increased acceptance of video and virtual meetings and the introduction of screen recordings for research analysis.

3.3.4. Co Creation

In research, co-creation involves the active involvement of various stakeholders, such as consumers, producers, and communities, in the generation of knowledge, ideas, and solutions. This collaborative approach aims to leverage the collective intelligence and diverse perspectives of participants to drive innovation, create value, and address complex challenges in a more inclusive and effective manner (Zwass, 2010).

The limitations of co-creation include the potential for hierarchical imbalances among participants, where certain voices or perspectives may dominate the process, leading to marginalised viewpoints being overlooked. Additionally, achieving consensus among diverse participants with varying interests and priorities can be challenging. Furthermore, co-creation processes may require extensive time, resources, and facilitation expertise, making them impractical or inaccessible in certain contexts (Zwass, 2010).

3.3.5. Content Analysis

In terms of data analysis and interpretation, this thesis makes extensive use of content analysis. Qualitative content analysis is an evaluation technique used in social science research to analyse contents after data collection. These contents can include transcripts of open-ended interviews or focus groups, responses to open-ended surveys, observation notes from field studies, documents, files, newspaper articles and online materials. According to Mayring (2014), qualitative content analysis builds on the strengths of quantitative content analysis while developing systematic techniques for analysing data with a qualitative focus. A notable advantage of content analysis methods over other approaches to textual analysis is their strong grounding in the communication sciences. The material is always considered in the context of communication, requiring interpreters to specify to which part of the communication process their conclusions from material analysis relate (Mayring, 2014).

First, categories are either generated from the material or posited theoretically and assigned to individual text passages. Although this process follows the precise rules of content analysis, it retains its qualitative, interpretive nature. Subsequently, analysis is undertaken to determine whether certain categories can be assigned to text passages more frequently. Finally, these categories are examined in relation to the research questions (Mayring, 2014).

The limitations of content analysis in social research include the potential for subjectivity in coding and interpretation, as researchers may bring their own biases and preconceptions to the analysis process. Content analysis may also overlook the context in which communication occurs, leading to interpretations that are disconnected from the broader social and cultural dynamics. Furthermore, the reliability of content analysis can be influenced by factors such as coder training, inter-coder agreement, and coding scheme consistency, which may vary across studies. Finally, it should be noted that content analysis may be limited in its ability to capture nuanced or complex meanings, particularly in qualitative data where context and interpretation are essential (Stemler, 2000).

3.3.6. Written Observations

Written observation involves the use of sensitive concepts to gain insight into the empirical world. This methodology emphasises the importance of researchers consciously questioning their own biases and striving to accurately understand the perspectives and experiences of those being observed. It suggests that researchers need to adopt a kind of 'outsider position' in order to capture the reality of the observed world as accurately as possible. This method aims to lift the veils that obscure perceived reality and requires an intense engagement with the observed domain in the interests of gaining profound insights. This methodology promotes in-depth analysis and interpretation of observed phenomena, leading to well-founded insights into observed reality (Clough, 1998). In the present work, written observations were mainly used in schools where it was not possible or permitted to record video or images.

The limitations of written observations in social research include the potential for observer bias, whereby researchers' interpretations and perceptions may influence the observations recorded. Additionally, written observations may lack the richness and depth of detail that can be captured through other methods. There is also the risk of selective attention, with observers focusing only on certain situations while overlooking others. Furthermore, written observations

may be subject to interpretation errors or misinterpretation of the observed behaviour (Clough, 1998).

3.4. Ethical Considerations

The use of video recordings and work with minors in educational research raises ethical concerns relating to privacy, consent, and the responsible use of recorded interactions. In one school, the head teacher did not allow any picture or video recordings. In this school, therefore, only audio recordings or written field notes were used.

Written consent was obtained from all participants in this study, who were informed about data protection regulations. In the case of minors, the consent of their parents (or legal guardians) was obtained. Individuals in videos and images had their faces pixelated, and pseudonyms were used in reports instead of real names. The University of Graz ethics committee approved the study as complying with ethical standards (reference GZ. 39/79/63 ex 2019/20).

3.5. Summary Chapter 3

In conclusion, the present work is situated within the interpretative paradigm, employing a reflexive and situational ethnomethodological approach. The various articles report on work deploying postdigital, posthumanist, and socio-material approaches in conjunction with transdisciplinary, multimodal, and participant-led research methodologies, with a particular focus on video ethnography. The data gathering methods include interviews, focus group interviews, video ethnography, co-creation, content analysis, and written observations. The ethical standards have been approved by the ethics committee of the University of Graz.

Having described the methodology and methods in chapter 3, the next part will present the articles that comprise this thesis.

4. Chapter: Overview of Manuscripts

In chapters 4.1 to 4.5 below, the five articles comprising this thesis are presented in full. Citations are listed in table 2.

Article 1	Otrel-Cass, K., & Fasching, M. (2021). Postdigital truths: Educational reflections on fake news and digital identities. In *Postdigital Humans: Transitions, Transformations and Transcendence* (pp. 89-108). Cham: Springer International Publishing. DOI https://doi.org/10.1007/978-3-030-65592-1_6
Article 2	Fasching, M., & Schubatzky, T. (2022). Beyond truth: Teaching digital competences in secondary school against disinformation: Experts' views on practical teaching frameworks for basic digital education in Austria. *Medienimpulse*, *60*(3), 65-Seiten. DOI https://doi.org/10.21243/mi-03-22-19
Article 3	Reicho, M., & Otrel-Cass, K. (2024, submitted): In Pictures We Trust: Phenomenon-based learning about disinformation in secondary schools. Video Journal of Education and Pedagogy. Brill (submitted 28.02.2024).
Article 4	Reicho, M (2024, accepted): How Phenomenon-Based Learning May Contribute to Counteract Disinformation: A case presentation from Austrian Secondary Schools. In: EDEN Conference Proceedings. 2024 (accepted 26.03.2024)
Article 5	Otrel-Cass, K. M., Thalmann, S., Pammer-Schindler, V., Fasching, M., Cicchinelli, A., Griesbacher, E., ... & Doppelreiter, T. (2022, September). “Digital? Sicher!”–An Educational Game to Build Digital Competences. In *European Conference on Technology Enhanced Learning* (pp. 485-491). Cham: Springer International Publishing. DOI https://doi.org/10.1007/978-3-031-16290-9_40

Table 3: Overview of articles comprising the present thesis

4.1. Article 1: Postdigital truths: Educational reflections on fake news and digital identities.

Otrel-Cass, K., & Fasching, M. (2021). Postdigital truths: Educational reflections on fake news and digital identities. In *Postdigital Humans: Transitions, Transformations and Transcendence* (pp. 89-108). Cham: Springer International Publishing.

Postdigital Truths: Educational Reflections on Fake News and Digital Identities

Kathrin Otrel-Cass and Michael Fasching

1 Introduction

Mona, an 18-year-old secondary school student from Denmark, is talking to us about how she evaluates the information she collects from the Internet, and especially how she assesses her own competences in dealing with fake news. She says that she has experienced a lot of fake news when surfing the Internet. At school they learned about how to identify fake news, but it was *'out of touch because as a younger generation we know that fake news exists and we know to be critical of the things we read'*. This short example should depict the problem we would like to address in this chapter, namely: what kind of digital competences young people should acquire at school, in particular when they are or will be faced with fake news.

Fake news is not a new phenomenon, but it has become increasingly difficult to distinguish between correct, erroneous, and deliberately falsified information (Auberry 2018), and the debates about the magnitude of this problem amongst media industry, politics, and academia have increased (Lazer et al. 2018). Around two-thirds of students, rate news reports in social media as credible, and an increasing amount of fake news is interpreted as fact (Himmelrath and Egbers 2018). It seems therefore necessary to better understand young people's postdigital practices. For this reason, we asked students to *show* us their online performances (Goffman 1959). This approach should help us gain a better understanding of young people's online practices and sharpen our suggestion of what kind of competences are needed to obtain critical digital literacies (Davies 2018).

K. Otrel-Cass (✉) · M. Fasching
University of Graz, Graz, Austria
e-mail: kathrin.otrel-cass@uni-graz.at; michael.fasching@uni-graz.at

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2 Education for Digital Competences

Although the debate of what entails digital literacy has been ongoing, we find at least one fundamental question that needs to be answered: How important is the reliability of information when we are getting used to consume, produce, and reproduce digitised information? When Information Communication Technologies (ICTs) have become agents that are more than just tools, but a force majeure that is shaping who we are, how we socialise, and how we experience reality and our own agency (Floridi 2015) we need to develop new reflective approaches.

In postdigital ages, ICTs have transformed lives so that globally, education systems and governance bodies are focusing on ways to boost the development of digital competence for teachers and students [see, for example the European framework for the digital competence of educators: DigCompEdu (Redecker 2017)]. Alkali and Amichai-Hamburger point out that when it comes to 'digital competences' the terminology can be a bit diffuse, but that in general it describes 'a large variety of complex skills—cognitive, motoric, sociological, and emotional—users need to have in order to use digital environments effectively'(2004: 421). Since the main focus in this chapter is on the kind of competences that are necessary to be handling fake news, we will now focus on that particular knowledge and skill set.

3 Managing Compromised Online Spaces

Lazer et al. (2018: 1094) define fake news as 'fabricated information that mimics news media content in form but not in organizational process or intent'. This means that dealing with *fake news* requires a person to identify and manage manipulated online content and differentiate it from real news. This critical competency, reserved to the management of digital media, is also referred to as *information literacy* (Jones-Jang et al. 2019; Livingstone et al. 2008). Management of digital information under these new conditions requires meta skills to avoid an operationalised and simplistic approach to information literacy as Barnett (1994) points out. Dealing with fake news is not only about the tampered content of a message but also has to do with how information is received in the first place, since users of online spaces (that includes young people) are navigating in compromised online spaces (Allcott and Gentzkow 2017). For example social media and also search engines are operated by algorithms that select content and posts based on a person's viewing history and create so-called *filter bubbles* (Pariser 2011). While this, in its simplest form, is convenient for instance when cookies remember settings or information, filtered search results can create the illusion of personalised online spaces, and this can produce a self-affirmation of one's interests. The illusion is hidden in the fact that the person using this function may not realise the magnitude of profiling that has taken place in the background in order to create a given context menu.

Zuboff (2019) has described the financially and politically motivated drivers that lead to what is also described as surveillance capitalism. Zuboff argues that 'highly profitable machine intelligence operations convert raw material into the firm's highly profitable algorithmic products designed to predict the behaviour of users' (2019: 65). When a person utilises these functionalities deliberately (for example in social media) to follow selected content providers, the online space that is created is also described as an *echo chamber* (Pörksen 2018). When people are faced with information that is contrary to the information they have expected to receive through their echo chambers, they may experience a dissonance effect and be forced to make a decision between this information and their pre-existing position (Liao and Fu 2013).

The growing empirical literature on fake news can be divided into three categories: research on how fake news occurs in public discourse, studies that focus on their impacts, and those that examine how to counteract the spread of fake news (Egelhofer and Lecheler 2019). Tandoc et al. (2018) analysed in a study a collection of six different types of fake news: news satire, news parody, news production, photo manipulation, propaganda, and advertising together with public relations. Tandoc et al. (2018) as well as Egelhofer and Lecheler (2019) distinguish further between high and low levels of factuality. What the literature agrees on is that fake news are not tied to a specific media type, they are always verifiable wrong, are not necessarily produced with an intention to deceive, and do not automatically imply a misdirection of the recipient (Zimmermann and Kohring 2018). While there is focus on the producers of fake news, the role the recipients play seems to be overlooked so far (Hermida 2011). Some questions whether fake news can be called fake news, if recipients do not classify the material they read as real news in the first place. This puts the need for information literacy of the recipients into the foreground (Jang and Kim 2018). In order to understand the ways young people encounter or manage online content, it helps to unpack what shapes their digital presence.

4 Being Digitally Present and Having a Digital Identity

The persistency of our digital footprints ensures that we create our digital identity whether we want it or not (Williams et al. 2010). From a postdigital perspective, digital identities are the 'collections of digital information that belong to an individual or an organisation' (Hansen and Meints 2006: 543) and configure a person's digital relationships (Buckingham 2007). Since digital identities seem to be enmeshed with our everyday offline lives (Otrel-Cass 2019), it affects millions of people everywhere (Floridi 2011). This is an issue of growing importance. Taking the postdigital approach allows us to hone in on the 'normalisation of the digital in almost all aspects of activity' (Cormier et al. 2019: 482).

Burden and Savin-Baden explain that 'identity creation and exploration is not only evident through representations on social networking sites but also the ways in which people accessorise themselves technologically' (2019: 198). This means it is

important to take note of how people furnish their own online appearances and the online spaces they create for themselves. Depending on media or online contexts, identities change and shift, so there is no such thing as a fixed identity. Identities move with contexts, temporalities, and the virtual world in which we live (Burden and Savin-Baden 2019). The construction of digital identities influences how young people understand themselves as well as their peer groups, societies, and cultures to which belong. They contribute to shaping their self-esteem, lifestyles, moral behaviours, values, and ethical expectations (Floridi 2011). Another important role in the formation of digital identities is online communities, which are 'understood as dynamic, interactive and distributed networks, in which the individual is never a stand-alone entity but always a participant' (Floridi 2011: 478). What becomes evident is that digital identities change and are being changed constantly. This active shaping of one's digital identity in response to changing social and cultural contexts is also referred to as 'tinkering' (Hitzler and Honer 1994). *Tinker identities* are not reserved for specific feelings of belongings (e.g. nationality) but describe social contextual relationships with multiple cultures as well as hybrid identities (Scherke 2011; Lindau 2010).

This ability to tinker with and reassemble representations about oneself also shows that the production process of digital assemblages creates information or knowledge in a seemingly liquid way (Sørensen 2009). Sometimes, however, these liquid assemblages can become more stabilised. However, Sørensen qualifies that '[l]iquid knowledge of the virtual environment is not a knowledge that maps the practice of the environment 'on the scale of a mile to a mile'. Liquid knowledge is not a map. It is not regional' (128); it is communal and temporary, and this makes it liquid according to the author.

Caught in Echo Chambers and Filter Bubbles

When social media or the Internet is accessed, pre-filtered information is received. This means that personalised filtering systems consisting of complex algorithms gate keep or gate *manage* what kind of information is being presented. This filter function only shows selected information that algorithms have identified to be of interest to users and creates an illusion of personalised online spaces for the recipient, a self-affirmation of one's interests—a so-called echo chamber or filter bubble (Pörksen 2018). Pariser describes filter bubbles in this way:

> The new generation of Internet filters looks at the things you seem to like - the actual things you've done, or the things people like you like - and tries to extrapolate. They are prediction engines, constantly creating and refining a theory of who you are and what you'll do and want next. Together, these engines create a unique universe of information for each of us - what I've come to call a filter bubble. (Pariser 2011: 7)

The difference between filter bubbles and echo chambers is that the former is the result of different information search processes, selection, perception, and the

algorithm-tailored information that fits the pre-existing attitudes of the individuals (Boutyline and Willer 2017). The latter describes communities in which content that confirms certain ideologies is echoed and multiplied. Echo chamber communities are prone to foster processes of polarisation and possibly group radicalisation (O'Hara and Stevens 2015).

Filter bubbles are not a new phenomenon, since people have always consumed media and topics that appealed to their specific interests (Pariser 2011). However, filter bubbles can influence the way choices are made. Pariser writes that people are alone in their bubbles and have no specific reference audience to share the experience with. The agenda behind the filter bubble is invisible to most, since search engines for instance do not reveal the full details of why they are displaying certain search results. Typically, people do not choose to enter the filter bubble, but rather they are often presented to them due to profits made by the (mostly unpaid) digital services that are being used. For that reason, it will become harder and harder to avoid filter bubbles (Pariser 2011).

The hidden nature of manipulated content is exacerbated in the production of so-called *deepfakes,* which are techniques based on artificial intelligence (AI) to synthesise new visual products, such as the production of a video with replaced faces (Floridi 2018). Some of the better-known examples of deepfakes are of well-known personalities like Barack Obama, Donald Trump, Mark Zuckerberg, or Boris Johnson. Automated video and audio editing tools make it almost impossible for recipients to distinguish between real and fake content. With specific video software, the production of deepfake videos is becoming increasingly easier even for individuals with lower technological skills (Chesney and Citron 2019).

In addition, *chatbot*s, AI-based conversational software agents that get activated by language inputs in the form of voice, text, or both (Radziwill and Benton 2017), as multipliers of echo chambers, increasingly aggravate the problem of spreading rumours. In social media, such as Twitter, fake user profiles have been set up to artificially increase the number of followers to spread fake news, to dynamically adapt to user behaviour and to influence particular political positions of users (Ferrara et al. 2016).

Information Literacy for Education

The importance of equipping young people with the competences to understand the scope of dealing with fake news is just becoming evident to educators and educational governance bodies. In a report, McDougall et al. (2018) focus on primary and secondary school students' media literacies and present their analysis of the European education landscape. They argue that being media literate was a matter of developing students' citizenship competences, since young people need to have the ability to participate in democratic societal processes, and to not have those skills would compromise this important aim.

There are still too few educational studies that examine fake news in all its complexity, and what this means especially for primary and secondary school students (Sciannamea 2020). It may be a tempting solution to advise students to simply not trust, to avoid non-traditional news sites, and to access information only from traditional quality media. But this approach would be far too simplistic, and the creation of dichotomous 'good' or 'bad' distinctions is not helpful, since there is always the possibility that mainstream media may spread false information too and that less credible sources uncover legitimate stories (Journell 2019). Farmer (2019) suggests that fake news is a 'wake-up call' for education and that young people urgently need support to develop their critical analytical skills, but that this is only possible if teachers too gain those competences. Farmer urges that curricular changes are needed, and he too stresses that being information literate is about becoming an informed citizen. Williamson et al. (2019) describe the challenge of education in dealing with fake news as a 'live issue', which falls 'between traditional subject silos and often they have no formal place in the curriculum at all' (2019: 89).

The next section presents the methodology of the research we present here. Our aim was to find an overarching strategy and rationale to consider the networks of people and things in the context of their online practices.

5 A Socio-material Methodology

Estrid Sørensen (2009) describes in her book the '*Materiality of Learning*' and points out that it is important to ask 'how specific technologies contribute to practice' (2009: 7). Sørensen is critical of the tradition to approach learning from the humanist perspective which only grants humans, a priori, exceptional positions in practice. To analyse people's practices with technology, we should describe particular learning practices as patterns of relations of human and non-human components. This in turn characterises the performance of humans. However, since this is an investigation shaped by postdigital intentionality, we are interested in understanding socio-material relations (Knox 2019), and their consequences for thinking about the purpose of information literacy in education. With this intention, we do want to draw attention to material perspectives but only to return to human practices. For this reason, we have analysed the online materials our participated students use with the help of actor–network theory (ANT) (Latour 1987, 1992; Callon and Law 1997). Actor–network theory helps us to sensitise ourselves to the presence of material actors, while identifying how they are assembled and how they occupy a defined landscape. The theory allows for the unravelling of what is also described as 'assemblage or gathering of materials brought together and linked through processes of translation' (Fenwick and Edwards 2011: 5). The authors point out that ANT offers new insights into educational objects. We wondered how ANT might help us gain insights into objects students should be learning about.

To return the focus of our analysis on human practices, we utilised cultural-historical activity theory (CHAT) in a second step to explore the relationship of

digital materials and social factors, since materials and people have shared histories that allow them to connect their practices (Cole 1996; Law 1987). CHAT is an analytical lens that allows us to examine material objects in their ideal and material form to ask in what ways those artefacts become part of people's goal-directed activities. In other words, by tracing a person's online activity and paying attention to the materials they utilise to achieve the goal of an activity, we can also examine how they are embedded in context, are more than information processing, operate at different levels, and relate to other objects in the world (Kaptelinin and Nardi 2006).

We used these theoretical frameworks to examine observational data from two studies conducted in Denmark and Austria. The analysis of this chapter was conducted on selected episodes that are presented as vignettes. The project 'One day in my Onlife' is a digital ethnography tracing the entanglements of human–machine consciousness that has been conducted in Denmark involving young people aged 17–24. The Austrian project 'Digital? Safe!' is a study on cybersecurity and digital competences amongst Austrian pupils between the ages of 14 and 19. The students, whose stories are presented here, were secondary school students at the time of the interviews. The students were commenting on their practices with social media and were doing so while sharing and exploring content on their laptops and/or mobile devices. We recorded their screens while they were showing us content while reflecting.

Our analysis process began by transcribing the video recordings. After identifying episodes of interest that were relevant to responding to our research question, we followed up with a familiarisation of the non-human actors within the given episode. This meant that we started by identifying seemingly heterogeneous components and determining how these parts become part of a network, since we did not want to assume that any technology operates as 'automatons that work by themselves' (Sørensen 2009: 53). We continued analysing relevant levels of proximity or distance and expressed this in a graphical representation (Callon 1984; Latour 1999). We decided to show proximity in two ways: by shading and by distance vectors. The darker shades are the actors we identified as central in a given episode and have concentrated on in our analysis. The grey shades indicate other contributing actors that are more distanced to those in the first layer. Patterned fills should indicate non-human actors that may not be visible to human actors. Lines should indicate the relative nearness of the actors to each other. In a second step of our analysis, we applied CHAT to return to the human actor and their motives in a given activity. We took note how material objects mediated the pursuit of goals in the activities of our participants (Kaptelinin and Nardi 2006).

6 A Socio-material Analysis in Three Vignettes

Three vignettes are presented: information management, opinion management, and identity management followed by a discussion with our participants on the kind of competences they believe they and their peers need to have.

Vignette: Critical Information Management

Analysis of human and non-human actors: Mona (pseudonym), an 18-year-old young woman from Denmark, is scrolling on a laptop through her Facebook timeline. The Facebook page was set up in the traditional layout. Left were shortcuts or links to other places including messenger, but also a Covid-19 information centre (see Fig. 1).

To the right are the list of contacts and the centre of the page is occupied by the main feed of information. It is also noteworthy that the Facebook page was opened on an incognito tab, and the background colour of the screen was set in black. The episode starts at a point where Mona stops at a bright map of Denmark showing Chinchilla farms and a picture of a caged Chinchilla in the right corner. Above the map is a logo and name of the vegan party, and below it says that it is a sponsored ad by the vegan party. It says: '*Vi har over 40.000 afdissepelsdyr bag fremmer.* (We have over 40,000 of these fur animals caged up). *Vil du også have det til at stoppe?* (Do you too want this to stop?)'.

The map was headlined brightly '*Chinchillafabrikker I Danmark* (Chinchilla farms in Denmark)'. Below it says in small writing '*Hjælpchinchillaen med envælgererklæring, 2 klik* (Help the chinchillas with this petition, two clicks)', followed by a button saying 'Learn more'.

In this first episode, we identified the following non-human components: a laptop, the Internet, Facebook, the Vegan party post, images, text, algorithms. The algorithms are shaded since they stayed hidden, yet their presence could be experienced everywhere on the social media page. These components are juxtaposed to the human actor, Mona, a young woman living in Denmark, still going to school. In

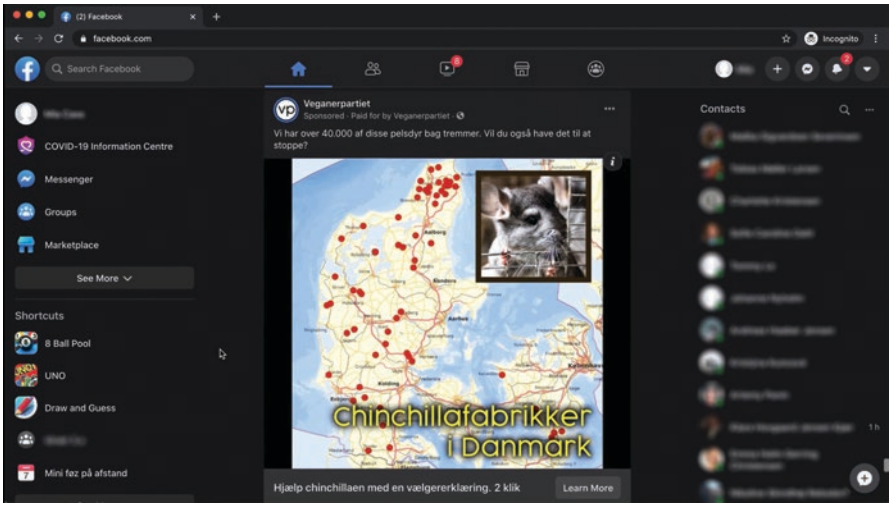

Fig. 1 Screenshot Vegan party, Chinchilla factory map Denmark

the figure, we have indicated the relative significance and proximate distance (Fig. 2).

In a next step, we followed Mona's activity as it unfolded in this episode and considered the social-historical configurations. Mona scrolls through her Facebook timeline when she stops at an advertisement of the Danish Vegan Party—'*ok, this is interesting*' she says. Her motivation in this activity was to show us her Facebook page and how she manages the material and content she receives. The post (see Fig. 1) shows a Danish map with red dots pointing to chinchilla rodent factories with a link to an animal welfare petition. Mona recognises that this is a sponsored post and clicks on 'more information' in the post and to find out why she received this advertisement.

She finds out she received the post because she is '*…older than 18, living in Denmark, Danish speaking*'. Mona is surprised and comments, '*I am not a vegan […] it's funny, that it's reaching me*'. Mona wonders '*I don't believe that*' and starts to fact check the post with a Google search. Her first search result leads her to 'Kopenhagen Fur' but she dismisses this result: '*because that's just gonna be advertising*'. However, she cannot find the desired information while browsing the first Google page. This confirms to her to be critical about this post. Facebook pages typically include a note saying 'There may be other reasons not listed here', such as location data, movement profiles, interactions with similar companies, information from Facebook or Instagram profiles, or offline activities are also considered in the ad-tracking. Maybe Mona knows of this. However, she did not refer to this when we spoke to her.

The analysis of this episode illustrated that sustaining investment of Mona's attention into the party's aims via the Facebook technology required an orchestration of visual imagery plus text information to lead Mona into a cyber-rabbit hole to find out more.

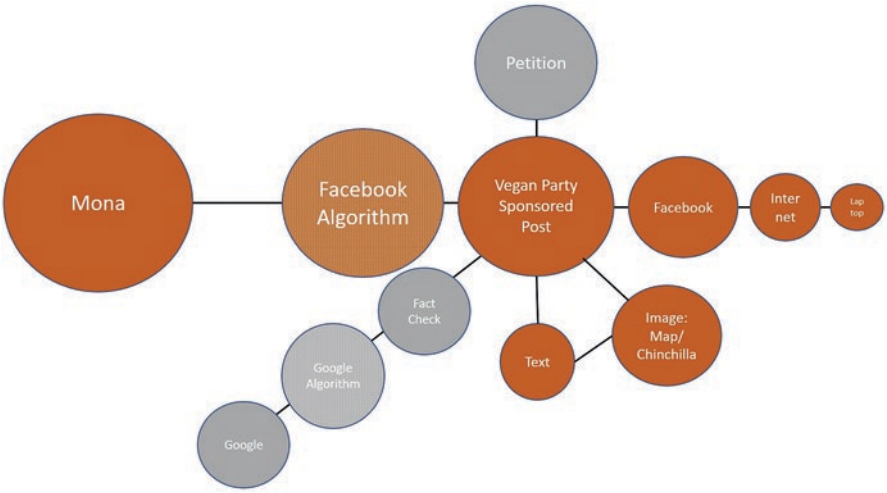

Fig. 2 Analysis of Mona and her fact check

Vignette: Opinion Management

Analysis of human and non-human actors: Mona stops scrolling at the private Facebook group 'Vax vs. Anti-Vax' on her laptop and describes things she notices. She explains that she had joined this private group out of interest.

On the left are still the groups in which Mona is actively registered. In the middle of the page is a picture of US President Donald Trump with the quote 'I don't take any responsibility at all'. Above the picture are 3% figures about Covid-19: '% of the world population who are American: 4.2%. % of world Covid-19 cases who are American: 33.1%. % of world Covid-19 deaths who are American: 28.2%.' The three numbers are in the colours of the US flag, in red, white, and blue. Below the numbers is the following text 'Data accurate as of 6 May 2020'. A logo with the letters 'RtAVM' is on the right side (see Fig. 3).

In this episode, Mona notices a logo on the right side of the image and we have identified the following non-human actors: a laptop, the Internet, Facebook algorithm, Facebook group Vax vs. Anti-Vax (image/text), logo, Google algorithm, and a Twitter post (see Fig. 4). Different from the previous episode, the Facebook algorithm was defined by Mona herself, since she had subscribed as a member of the Vax vs. Anti-Vax group.

Applying an activity theory analysis, we identify in this episode that the goal of the activity was to show the researcher an example of a group Mona was following. Mona's motive to be part of this group was because she was intrigued by the topic. Her goal was to observe the discussion, because she '*finds it funny*' to scroll through private groups that show heated debates, false comments and discussions. She explained she had joined the group solely to watch as a bystander since she would

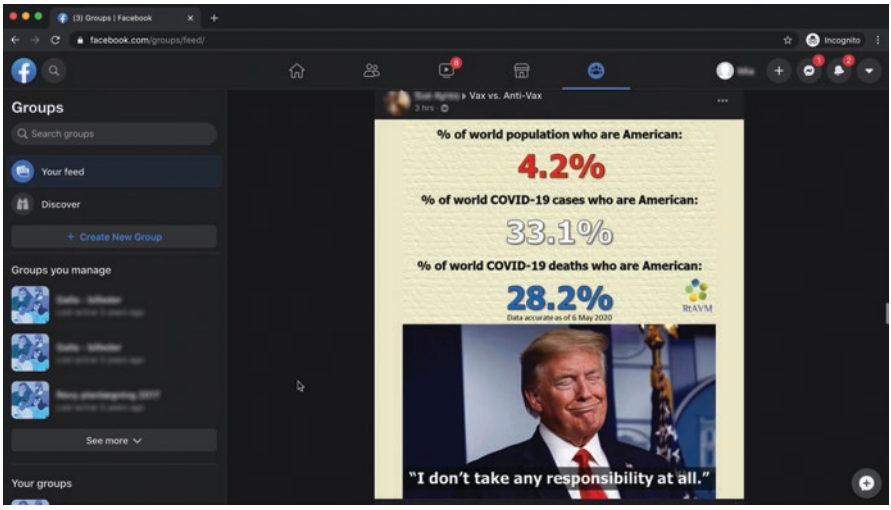

Fig. 3 Screenshot, Covid-19 and Donald Trump in the group 'Vax vs. Anti-Vax'

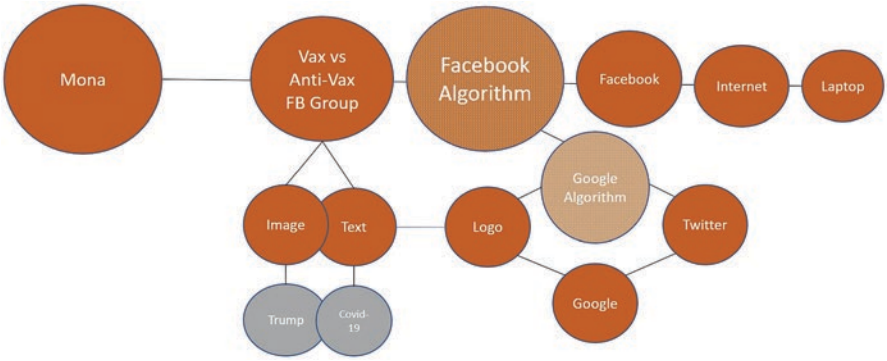

Fig. 4 Analysis of Mona and her echo chamber with Actor–network theory

encounter '*unbelievable posts*' such as the picture showing Donald Trump (see Fig. 3). Mona identifies this post as a hate-post against Trump and says that she rather believes in the content of the post because it reinforces her opinion. '*Automatically I am more inclined to believe it, because it is sort of aligning with my beliefs*', she says. She notices a logo and starts a Google search that leads her to the Twitter account 'Refutation of anti-vaccination memes', which she classifies as an untrustworthy source, *'this is not a source at all, this is just a watermark'*. Mona thinks the logo is *'misleading'* because it suggests seriousness. Although the image is linked to the date of the displayed percentages, there are no further references, *'they do not cite any sources'*. This suggests as if it is '*from the World Health Organization*'. The activity shows that there are particular rules, norms, and procedures that regulate Mona's interactions and her coordination related to the use of the target technology. Mona had defined some of those rules herself. She created an echo chamber where she received information she believed in and other information that confirmed her position about often politically polarised topics.

Vignette: Identity Management

The third vignette is from the Austrian project 'Digital? Sicher! (Digital? Safe!)', a study on cybersecurity and digital literacy amongst Austrian students aged 13–19 years. Analysis of human and non-human actors: Flora and Maria (pseudonyms), two 13-year-old school girls from Austria, talk about their preferred social media and the content they particularly like to engage with. One of the two girls shows the researcher TikTok, a social media app on her phone, with a number of videos posted by another girl under the banner 'black lives matter' (see Fig. 5). The app shows the girl's profile, pictures, videos with reach, likes, and comments.

In this episode, we identify the following non-human actors: a smartphone, the Internet, TikTok, the TikTok algorithm, TikTok profile of Charlie D'Amelio, her

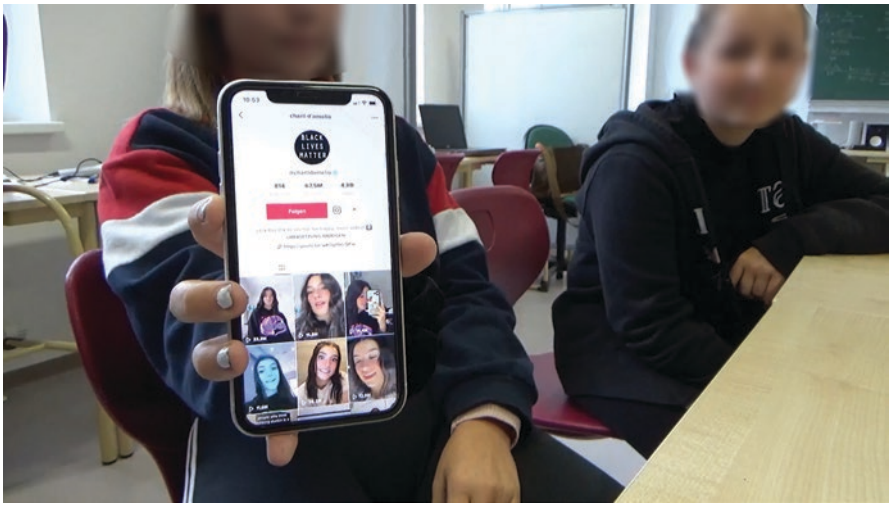

Fig. 5 Screenshot, Flora and Maria talking about #blacklivesmatters on TikTok

images, videos, a Black Lives Matters profile picture, following numbers, follower numbers, and like numbers, red follow button (see Fig. 6). Each of the video thumbnails includes a count of the reach.

Using an activity theory analysis lens, we identify that Flora and Maria are following the 16-year-old TikTok star Charlie D'Amelio from the USA, who is one of the most successful TikTokers worldwide with 81.1 million fans (as of August 2020). To follow this girl, they utilise their smartphones and the TikTok apps that creates a personalised connection to the young influencer, since it shows not only how many followers Charlie D'Amelio has but also how many people Maria or Flora are following. They state that the motivation for using TikTok is because of its funny content or because they are bored, or to get tips and suggestions from tutorials. Flora and Maria like watching tutorials on cooking, make-up, dieting, or what movies to view, and they watch product test videos. They show the researcher a video of Maja, a German TikTok influencer who tests sweets. *'I think it's good to watch, and sometimes you buy some things,'* says Maria. For entertainment, the two also like to watch dances and choreographies on TikTok to current music hits. TikTok mediates these goals by using a very particular spatial layout and temporal organisation that shapes also the rules and the motivations for being online. Number counts of likes or followers indicate degrees of popularity of oneself and others.

Maria and Flora tell us also about making their own TikTok videos. They say that they would check the videos *'100 times'* before uploading anything. *'I don't like having a double chin in the video',* says Flora. The videos form part of their identity which is fluid and moving between the on and offline. They adapt and negotiate their online identity. The video recorded and highly orchestrated material snapshots of their identity almost appear unstable; however, what has been put online is a

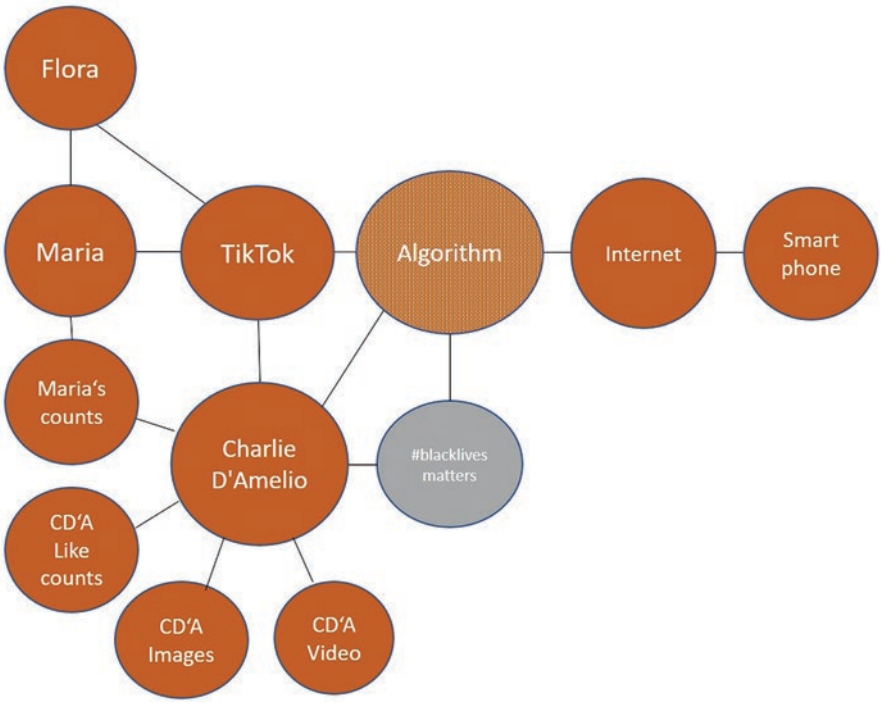

Fig. 6 Analysis of the fragility of Flora's and Maria's digital identity with actor–network theory

semi-permanent material piece in time and is as such not as fleeting as offline performances are.

7 Returning to the Human Actors: Conversations About Digital Competence

We discussed with our participants what kind of competences young people need specifically when it comes to fake news. Mona explains that the problem of fake news was real and that she experienced a lot of fake news when surfing the Internet. She told us that she had a workshop at school to learn how to analyse fake news, but it was *'out of touch because as a younger generation we know that fake news exists and we know to be critical of the things we read'*. Mona describes it as a problem of the older generation.

Thinking about the term fake news, Mona wonders about the role of advertisements. She talks about Instagram that only shows *'the best parts'* of an ideal life. Is it fake news, when users are sharing *'crazy and photoshopped body standards?',* Mona asks. In her opinion, advertisements are also fake news: *'If you define fake*

news as advertising this perfect life, then everybody produces fake news on Instagram'. She talks about advertisements of health teas or hair vitamins that tell you that it will make you look fantastic. *'I know a lot of girls that follow these influences'*, says Mona.

Mona talks also about deepfake videos, she seems terrified, because *'that's gonna be the end of everything. I mean imagine [...] somebody who doesn't like you taking your face and putting it on a very inappropriate video and then sharing it with your entire family. I mean that would just [...] really harm you. People are not prepared for that'*, Mona says. But she is sceptical when it comes to the place of education for digital competences, because *'there is a limit of what education can do'*.

Flora and Maria reflect on fake news: '*on Facebook, there are some things that are not true*'. They tell us that they too had a workshop at school and that they had learned about the possibility of reporting fake news, but that they have never done this before, just scrolling on. Different from Mona, Maria and Flora believe that they should have workshops of this kind more often, to deal not only with disinformation but also with unwanted information. Flora and Maria tell us also that they have received '*strange pictures*' sent to them by people they did not know, naked photos of men (so-called 'dickpics') and that '*almost everyone in our class got one of these before*'. They explain to us that the reason they got these pictures was because they used the chat page omegle.com, where a random generator connects them with an anonymous person. After a short conversation, they exchanged Snapchat names and received the pictures on Snapchat. They explain that even when they immediately block or delete those contacts, they do not dare to talk about it with their parents. They fear that parents might want to see this content on their mobile phone and ban or restrict their activities on social media platforms. They only talk with close friends about it because it is a '*very unpleasant*' topic for them.

8 Discussion

In their report on European media literacy in education, McDougall et al. (2018) ask how students can be prepared for a future where they have to deal with fake news. They point out that this is a key competence and a matter of citizen engagement. While young people find it easy to access many different platforms and information sources, they need guidance on how to navigate and make sense of the materials they are faced with. We found that all participants reported having received some kind of formal introduction or training to build their information literacy competencies. However, all of them lacked some degree of knowledge to detect when they should be careful with the information that has been presented to them, or the mechanisms that are operating in the background. Maria and Flora were using an online application that connected them with strangers and the consequences were disturbing and embarrassing for the girls. Mona, who was clearly capable in assessing the ways in which information is presented, did not fully realise the extent to

which the Facebook algorithm analysed and shared her profile. Also, she may not be aware how politically motivated many of the posts are that she receives. Given some of the more serious experiences the young people in our studies had, it demonstrates how difficult it is to assess the trustworthiness of some online information, and it would seem that you cannot start early enough to prepare young people for this complexity.

The findings illustrate three themes of critical information literacy: information management, opinion management, and identity management.

Information management requires an understanding of the asymmetrical arrangements in online environments. Young people need to understand the complexity of different agents including those that are not visible, such as the algorithms that seem to be pulling strings behind the curtains. Information management skills also require competences to orchestrate these agents. Jones-Jang et al. (2019) observed that accurate identification of fake news was significantly connected with heightened information literacy. Transferred to the educational context, this illustrates the need to foster the understanding, finding, evaluating, and use of information. The authors stress that to successfully deal with fake news, students and teachers need the ability to navigate and locate information in digital environments (Jones-Jang et al. 2019).

Opinion management describes the competence to identify how algorithms reflect and amplify opinions, how filter bubbles work, how echo chambers operate, and what benefits but also dangers can be associated with them. The students whose stories we presented here told us that they are part of digital communities and that these groups present materials to them they like to read and view. The European Commission (2018) warns about 'powerful echo chambers' that shape 'information campaigns'. Mona beliefs that she understands the nature of topics in the group's debate and that spending time with this group would reinforce her opinion. Perhaps she is not fully aware of the potential to polarise and radicalise.

Identity management is about the ability to construct and maintain a personal identity in online environments. Floridi (2011) refers to Personal Identity Online (PIO) that is created and changed in an ever-perpetuating spiral. It requires an ability to evaluate how one's online presence should be received by others and how it is expressed and how it shapes identity formation, for example through quantifications (likes). The permanency of online spaces has an additional profound impact on the production of digital identities.

The entanglements mean also that the distinction between facts, opinions, or commercial advertising seems to become very blurred. Maria points out that she occasionally buys products advertised by influencers. Mona appears more critical of the distorted reality on Instagram and wonders whether this presentation of a 'perfect life' could not also be classified as fake news. However, she knows enough others who are influenced by the kind of stories that are being spun in social media. Although Flora and Maria are reflective of their activities, they are clearly affected by the ability to quantify likes, comments, followers, and reach. These materialised quantifications become significant actors that shape how (young) human beings feel about themselves or others.

Students need to be equipped with more knowledge on how to deal with their and other people's digital identity. They also need to have network competences during their information journey, in order to manage and control the information from their online networks, while they themselves become a hub in these networks when they are sharing relevant information, news, or digital content (Pegrum 2010).

9 Educational Consequences

A number of studies have examined how to prepare young people for a digitalised future. We found that the online activities of our participants are deeply infused with political intentionality. While political interest and participation increase with age 'the only exceptions are signing a petition, participating in a demonstration or arguing for one's opinion' (Holt et al. 2013: 29).

Since positions or ideologies are hard to discern in digital texts, this can be especially problematic for younger audiences. It is well documented that by the age of 10, most young people are active users of social media and this means they need to be equipped with the skills needed not only to find and collect information but also to filter, process, and shape this information, before becoming the creators of new information they may wish to share with others (Gibson and Smith 2018).

Yet it is not clear at what age young people are confronted with decisions where they have to draw on their information literacy competence. Rather than adopting age-related user profiles, it may be more conducive to focus on individual needs of students (Jauregui et al. 2020). Students operate within different online environments in and outside of school times. However, if education systems want to ensure they contribute to building information literacy competence, they need to invest equally into building teachers' competences.

Building information literacy competencies should be a societal matter. This means that the responsibility to prepare young people should be shouldered not only by teachers but also by parents and caregivers who have a vested interest in preparing young people to become active citizens. As a society, it will be increasingly important that we all understand the material components that have been put in place in digital environments that not only allow for the distribution of information but also for the distortion and manipulation of content and its consequences.

10 Conclusion

In this chapter, the analysis of the entanglements between their on- and offline worlds, and in particular the worlds of young people, showed us that we need to prepare ourselves, especially young people, for possible manipulations of online content. The information we had collected from our studies was disassembled to identify human–non-human associations and by doing so we were hoping to 'under-

stand connections and relationships' (Otrel-Cass 2019: 148). Being postdigital means to understand socio-material relations (Knox 2019), and this will allow us to get a better grasp on the consequences of the entanglements we have created for ourselves. Based on the findings of our studies, we suggest that we need to pay attention to three dimensions of digital literacy: information management, opinion management, and identity management.

Information management suggests that young people should develop critical analytical skills in order to identify deception through untrue digital information, advertisement, or politically driven intentionality and be prepared for a future where they have to deal with fake news. Opinion management entails that students should get a deeper understanding of how algorithms, filter bubbles, and echo chambers work. They need to acquire an understanding on how people's online experiences are shaped, at times polarised, or radicalised when selected digital information is presented. Identity management requires learning about how to reflect on our online and offline identities and how they change over time and in different environments. This includes the changes we experience as we grow up, participate in different social groups, and tinker with our own representations.

Jan Masschelein (2010) points out that we know the world through its representations and that representations have redefined what 'real' means. We have created different digital products that mirror the world and concurrently we mirror versions of ourselves to the world and share (willingly and unwillingly) our views and ideas. Masschelein tells us the only way to find out about reality is to expose ourselves to the reality that is presented to us. It is about being 'conscious about what is "really" happening in the world and becoming aware of the way our gaze is itself bound to a perspective and particular position' (Masschelein 2010: 43). In an era of fake news, educators and also parents and caregivers will need to 'walk' with young people to learn together how different digital materials are produced and shaped and experienced.

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Beyond truth: Teaching digital competences in secondary schools to counteract disinformation. Experts' views on practical teaching frameworks for basic digital education in Austria

Michael Fasching

Thomas Schubatzky

Increasing disinformation makes it necessary for schools to sensitise students from an early age. Various recent developments around the globe underline the need to teach and learn about disinformation in classrooms. Moreover, digital literacy in

Austria will be revised in 2022. This paper therefore discusses the circumstances and requirements for teaching and learning against disinformation. The paper draws on the concepts of phenomenon-based learning, multiliteralism, immunisation theory and civic online thinking to propose practical teaching interventions for Austrian secondary schools focusing on two target groups: Lower Secondary students aged 10–14 years and Upper Secondary students aged 15–18 years. Based on qualitative semi-structured interviews with teachers and practitioners (n=19), the above theoretical approaches are applied to Austrian secondary schools. Experts suggest that phenomenon-based learning trains younger students (10–14 years) in basic multiliteracy, while vaccination theory and online civic thinking deepen resistance to disinformation in older students (15–18 years). Our findings indicate that digital literacy training needs to be made a compulsory part of digital literacy education, with a holistic, cross-curricular approach, so that skills can be addressed in all school subjects from the age of 10 in regular lessons.

Die zunehmende Desinformation macht es notwendig, dass die Schulen die Schüler:innen von klein auf sensibilisieren. Verschiedene aktuelle Entwicklungen rund um den Globus unterstreichen die Notwendigkeit, in den Klassenzimmern über Desinformation zu lehren und zu lernen. Außerdem wird die digitale Grundbildung in Österreich im Jahr 2022 überarbeitet. Dieses Papier diskutiert daher die Umstände und Anforderungen an das Lehren und Lernen gegen Desinformation. Der Beitrag stützt sich auf die Konzepte des phänomenbasierten Lernens, der Multiliteralität, der Impftheorie und des bürgerlichen Onlinedenkens, um praktische Unterrichtsinterventionen für österreichische Sekundarschulen vorzuschlagen, die sich auf zwei Zielgruppen konzentrieren: SchülerInnen der Sekundarstufe I im Alter von 10–14 Jahren und Schüler:innen der Sekundarstufe II im Al-

ter von 15–18 Jahren. Auf der Grundlage qualitativer halbstrukturierter Expert:inneninterviews mit Lehrer:innen und Praktiker:innen (n=19) werden die oben genannten theoretischen Ansätze auf österreichische Sekundarschulen angewendet. Expert:innen schlagen vor, dass phänomenbasiertes Lernen jüngere Schüler:innen (10–14 Jahre) in grundlegender Multiliterarität schult, während Impftheorie und zivilgesellschaftliches Onlinedenken die Resistenz gegen Desinformation bei älteren Schüler:innen (15–18 Jahre) vertieft. Unsere Ergebnisse zeigen, dass die Schulung digitaler Kompetenzen zu einem obligatorischen Bestandteil der digitalen Grundbildung gemacht werden muss, wobei ein ganzheitlicher, fächerübergreifender Ansatz verfolgt werden sollte, damit die Kompetenzen in allen Schulfächern ab dem Alter von 10 Jahren im regulären Unterricht behandelt werden können.

1. Introduction

Increasing levels of disinformation through digitalised media means pupils' awareness needs to be raised at a young age in school classrooms (Loveless/Williamson 2013). Recent developments around the globe (e. g. the Covid-19 pandemic, the climate crisis) clearly show how harmful the impact of fake news on society can be (Lewandowsky et al. 2017). This highlights the need to teach and learn about disinformation in classrooms (Burnett/Merchant 2011). The importance of age group-specific teaching in school is thus the subject of vibrant discussion (Wardle 2017). In Austria, basic digital education ("Digitale Grundbildung") is currently being revised and made a compulsory component of edu-

cation – so this is a good time to rethink the subject and discuss how this could be done.

Having a deeper understanding of the possible (in)visible factors that may be involved with disinformation can prevent the dissemination or creation of disinformation (Starbird 2021) and help pupils to develop healthy digital identities and safe online practices. In this paper, we investigate teachers' and practitioners' ideas on how to develop pupils' digital competencies. Based on their feedback and on selected approaches, we discuss practical approaches to teaching and how to address the topic in educational settings.

We will identify the educational consequences of teaching and learning to counteract disinformation, and the associated pedagogical approaches and requirements. We analyse the perspectives of selected experts from Austria (n=19), including 6 interviews with teachers from different types of schools and 13 interviews with practitioners covering multiple viewpoints including social work, the Ministry of Education, law, journalism, fact checking, conspiracy myths, teacher education, extremism prevention, the Chancellor's Office and the probation service. Based on these findings, we draw on the concepts of phenomenon-based learning (Kangas/Rasi 2021), inoculation theory (Compton 2013) and civic online reasoning (McGrew 2020) to formulate guidelines for a teaching framework for lower secondary (10–14 year-olds) and upper secondary school pupils (15–18 years) in Austria.

A growing body of literature suggests that preventive measures are needed to counteract disinformation at a general level; these typically include ways to identify fake news through inoculation measures such as media literacy, artificial intelligence technology, fact-checking and correction (Ha/Perez/Ray 2021). In addition to stronger regulation, the strengthening of technological mechanisms and the expansion of qualitative news media, Wardle (2017) describes educational initiatives to counteract disinformation, calling for a greater number of news literacy programs. The curriculum, she contends, should include strategies to (1) build traditional news literacy skills; (2) fact checking skills with regard to social media; (3) improve understanding of algorithms and how they shape what is presented to us; (4) promote learning about the ethical implications of artificial intelligence; (5) develop scepticism so that pupils are less vulnerable to provocative content and emotional reactions; and (6) promote a basic understanding of statistics. Recent programs focusing on critical thinking, source evaluation and emotional manipulation have been successful (Wardle 2017). Experts largely agree that censorship and/or blocking of content is not recommended (Ha/Perez/Ray 2021). This paper therefore focuses on how experts envision the development of digital competencies in secondary schools, including source criticism, fact-checking and media literacy.

2. Spotting fake news: Competences and digital teaching

Ha, Perez and Ray (2021) present an analysis of 142 journal articles published in the last 10 years on misinformation and fake news and found that communication (n= 30) and psychology (n= 35) were the two major disciplines addressing these issues, while education (n= 2) was underrepresented (Ha/Perez/Ray 2021). This underlines the need for more research on education and fake news.

2.1 Facts about fakes

The interest in fake news has grown since the rise of social media in 2008; and fake news became the word of the year in 2017 (BBC 2017). Fake news is currently defined as information "that is intentionally and verifiably false, and could mislead readers" (Allcott/Gentzkow 2017: 213) or as "fabricated information that mimics news media content in form but not in organisational process or intent" (Lazer et al. 2018: 1094). Scholars distinguish between two motives for providing fake news: Financial motivation drives content that spreads virally with high click-rates, thus generating income for advertisers; and ideological motivation spreads content to promote certain "themes or ideas" (Allcott/Gentzkow 2017: 213).

The development of artificial intelligence and social media bots has aggravated this problem (Ferrara et al. 2016). The polarisation of ideologies provides fertile ground for fake news. People on both sides of the political spectrum are more likely to believe fake

news when they are surrounded by negative emotions. This effect is intensified when news reinforces recipients' opinions. The use of information provided by algorithms also increases the impact of fake news (Brisola/Doyle 2019, Tandoc et al. 2018). Since people have phones with them most of the time from a young age, it is easy for them to receive and share content in an instant, making it equally easy for disinformation to be disseminated (Ha/Perez/Ray 2021). However, as Monsees (2021) argues, 'sharing' does not necessarily mean 'believing'. People also share fakes in the knowledge that they are fakes, with a view to debunking it or to making fun of it. Fake news works because it is addictive and grabs our attention. Venturini thus calls it "junk news" or "viral news" (Venturini 2019: 126). Pariser (2011) addresses the phenomenon of filter bubbles and echo chambers, in which users only see personalised information that reinforces their own opinions, giving them a distorted view of reality. There is no transparency for recipients about what they are seeing and what is being filtered out (Pariser 2011).

Some researchers are already cautioning against using the term *fake news*, as this buzzword is often misused in other contexts, or used to denounce political opponents or criticise media reporting. The term has been applied to a large variety of phenomena since 2016. It has been investigated in the context of disinformation, media criticism and increasing insecurity about societal truth (Egelhofer et al. 2020). We therefore distinguish between *fake news, misinformation, malinformation* and *disinformation*. Fake

news is defined as intentionally and verifiably false articles created to manipulate (Allcott/Gentzkow 2017). Misinformation is the sharing of false information with no intent to harm (Wardle/Derakhshan 2017), whereas disinformation is a wider mixture of techniques aiming to manipulate public opinion, shared knowingly and with political intent in order to cause harm (Brisola/Doyle 2019; Wardle/Derakhshan 2017). Malinformation is the dissemination of real information in order to cause harm, for instance by leaking information to the public sphere that was intended to be kept private (Wardle/Derakhshan 2017). In this paper we focus on the concept of *disinformation***,** because it involves more than the question of whether it is true or false: "Disinformation goes through an 'informing machine' that also uses the truth and parts of the truth to disinform" (Brisola/Doyle 2019: 277). Since 2020, the Covid-19 pandemic and the associated spread of disinformation have led to the coining of the term *infodemic* (Eberl/Lebernegg 2022).

Wardle and Derakhshan (2017) distinguish between *agent, message and interpreter*. The agent, as the creator of a fabricated message, might be different from its producer or distributor. We therefore need to understand agents and their motivations. Different types of messages can appear depending on the agents that distribute them. Recent debate has focused overwhelmingly on fabricated texts, whereas fabricated visual content is just as widespread and harder to identify and debunk. Interpreters of disinformation also influence how it is processed: messages can

be shared in line with their original intention, re-shared with controversial information attached or distributed offline in personal conversations (Wardle/Derakhshan 2017).

Huber et al. (2021) highlight the distinction between *victims and perpetrators*. Perpetrators are private individuals, people belonging to political or religious groups, or working for companies or states, regardless of whether they are aware that they are participating in disinformation. Victims can be classified as parties through whom disinformation is spread or who are deceived by disinformation (Huber et al. 2021). Interestingly, targets of disinformation are often to be found in the centre and to the right of the political spectrum (Arendt et al 2019). Therefore, people with more right-wing political tendencies are thought to be more likely to be the recipients of disinformation, fake news and conspiracy theories (Huber et al. 2021).

2.2 From digital competences to multiliteracy

Digitisation and emerging technologies have made it increasingly difficult to identify reliable information (Auberry 2018). Therefore, the teaching of *digital competences* in schools needs to bring together different types of knowledge, abilities and skills. A number of studies have explored different approaches to the development of digital competences, focusing amongst other things on *information literacy, digital literacy, computer literacy and media literacy*.

Although literacy in general is often a primary goal of education, the increasingly complex nature of digital landscapes requires new skills and competences, which can be summarised with the overarching term "digital literacy". Gilster describes *digital literacy* as "the ability to both understand and use digitized information" (Gilster 1997: 2). *Digital literacy* is the "confident, critical and creative use of ICT to achieve goals related to work, employability, learning, leisure, inclusion and/or participation in society" (Ala-Mutka 2011: 1), while *computer literacy* is typically, a functional definition, specifying "the basic skills that are required to undertake particular operations" (Buckingham 2015: 23). "*Media literacy* sees media as a lens through which to view the world and express oneself while *information literacy* sees information as a tool with which to act upon the world" (Livingstone et al. 2008: 106). The concept of *media literacy* is closely linked to digital literacy, but media literacy refers to the skills to manage media, reduce their influence, filter information, orientate oneself with regard to content and assess the truthfulness of content. Media literacy competences are therefore also interest-oriented and shape one's identity within a society (Fukuyama 2006). Hobbs and Jensen (2009) have a wider understanding of *media literacy* involving the "important life skills" of analysing

> news and advertising, examining the social functions of music, distinguishing between propaganda, opinion and information, examining the representation of gender, race and class in entertainment and information media, understanding media economics

> and ownership, and exploring the ways in which violence and sexuality are depicted in media messages. (Hobbs/Jensen 2009: 8)

Brisola and Doyle (2019) conclude that *critical information literacy* is a key component of resistance to fake news as it enables recipients to deal with the flood of information and to actively build "a more ethical society [with regard to] the use of information" (Brisola/Doyle 2019: 274). Other studies have investigated whether people with media, information, news and digital literacy skills are better at recognising disinformation, and which of these skills are most important. The results indicate that information literacy – but no other skills – is most likely to increase individuals' ability to detect fake news (Jones-Jang et al. 2021).

Although all these approaches address important aspects, *multiliteracy* represents a broader perspective and has had a strong impact on work in this field. *Multiliteracy* is defined as

> the competence to interpret, produce, and make a value judgement across a range of different texts, helping pupils to understand different modes of cultural communication and to build their personal identity. (Rasi et al. 2019: 98)

This understanding includes the strengthening of basic literacy through links to other types of literacy, e. g. media literacy and visual literacy (Rasi et al. 2019). Multiliteracy sets digital competences in a wider context and includes the ability to combine, obtain, understand, modify, present, produce and evaluate different information in different contexts, modes and situations using a range of different tools. Kangas and Rasi (2021) argue that multi-

literacy is one of the central civic skills education should focus on in order to enable pupils to interpret, produce and judge the value of a variety of texts in visual, auditory, verbal, kinaesthetic and numeric systems and in combinations of such systems. The prefix multi underlines the variety of different texts in multiple contexts (Kangas/Rasi 2021).

Because of its breadth of scope, multiliteracy can be fuzzy or problematic: some researchers understand it as referring to abilities or competences, whereas others see it as a pedagogical approach (Palsa/Ruokamo 2015). In this paper we use multiliteracy as an umbrella term for a variety of concepts relating to digital competence, including digital literacy (Ala-Mutka 2011), information literacy (Jones-Jang et al. 2019), visual literacy (Felten 2008), media literacy (Hobbs/Jensen 2009), computer literacy (Buckingham 2015) and advertising literacy (Rozendaal et al. 2011).

2.3 Teaching digital competences

Digital pedagogy refers to the use of electronic elements to improve or modify the experience of education (Croxal 2012), and the skill to deploy digital technology to enhance teaching, learning, assessment and curricula (Kivunja 2013). The concept is seen as constructivist and pupil-centred compared with more traditional teacher-centred approaches (Väätäjä/Ruokamo 2021). Traditional approaches to digital skills development in teacher education have focused on fostering the digital literacy of pupils (Borthwick/Hansen 2017). However, these have increasingly been questioned as new digital formats and new uses for technology

have emerged. Teaching digital competences now means prioritising technical skills and using the most appropriate digital tools for the learning goals in question (Admiraal et al. 2016).

The frequently cited European Union DigComp 2.0 and DigCompEdu frameworks set out key digital competences within policy instruments for educational institutions (Vuorikari et al. 2016; Redecker 2017). Their Austrian counterparts, digi.komp and digi.kompP, include a competence matrix listing the required digital competences for pupils and teachers (BMBWF 2016). However, these frameworks confine themselves to listing competences and skills; they do not include specific, practical suggestions for teaching in classrooms. The aim of this article is to address this shortcoming.

Recent studies have called for teacher education programmes to be re-conceptualised, suggesting that the current focus on digital competences be broadened into models that recognise the diverse knowledge, skills and dispositions of future teachers (Falloon 2020). This new understanding sees digital competences both as specific knowledge and as familiarity with other issues concerning technology, for example legal and ethical aspects, privacy and security, and an understanding of the role of ICT in society. While this acknowledges the relevance and importance of technical knowledge and skills, it also takes a broader socio-cultural view, underlining the need to understand and consider the broader implications of digital technologies for individuals and society (Janssen et al. 2013). Further, it focuses on attitudinal issues,

including the development of a "positive mindset" to improve teachers' understanding and critical evaluation of technological innovations and the role and influence of technology in the formation of new practices (Janssen et al. 2013: 474). The absence of a positive mindset might be the answer to the question raised by Väätäjä and Ruokamo (2021), namely why some teachers do not integrate digital technologies into their teaching despite having all necessary competences to do so.

Thus, teacher education institutions should not only prepare pre-service teachers to use digital resources in their teaching, but also to understand, conduct research into, and develop further reflections on, the use of technology and its impact. Their understanding will need to be constantly revised and developed in order to keep up with the speed of technological change (Janssen et al. 2013). This requires educational institutions to constantly reflect on current needs in order to respond to technological innovation and the new opportunities it presents for educational environments (Falloon 2020).

2.4 Basic digital education in Austria: Digitale Grundbildung

Basic digital education (Digitale Grundbildung) was initially introduced in 2018 as a compulsory addition to the existing curriculum for lower secondary schools in Austria (BMBWF 2018). In late 2021, the Austrian National Council decided that the subject should be given the status of a compulsory subject, which it is planned to introduce in schools with effect from autumn 2022: at lower secondary level (age groups 10–14) with at least 4 weekly

lessons per year. In order to meet the demand for teachers, 150 new jobs are being created (Parlamentsdirektion 2021). Alongside this measure, around 150.000 pupils in the first two years of lower secondary school were given low-cost laptops and tablets in autumn 2021 (BMBWF 2020). To prepare and qualify teachers to teach the new compulsory subject, the Ministry of Education is planning a three-stage training initiative: in the short term, a Massive Open Online Course (MOOC) for teachers; in the medium term, university courses at teacher training colleges for in-service teachers; and in the long term, a new teacher training curriculum (BMBWF 2022).

The goal of the Austrian basic digital education agenda is to build media, application and information technology competences in order to enable learners to orient themselves in the context of digital technology and take a responsible approach to it. The new curriculum is based on the *Frankfurt Triangle*, which considers three perspectives: (1) how digital technologies work, (2) the socio-cultural interactions that arise from their use and (3) the options for pupils to interact and take action. The focus is on five areas of competence: orientation, information, communication, production and action (Brinda et al. 2020).

The Ministry of Education has not specified in further detail how basic digital education should be delivered. Sections 3 and 4 below describe educators' existing approaches to disinformation.

3. Phenomenon-based Learning: Multiliteracy for 10- to 14-year-olds

In the context of multiliteracy teaching, phenomenon-based learning provides fertile ground, since it focuses on real-life topics and pupils' areas of special interest (Rasi et al. 2019). Despite the existence of research on multiliteracy (e. g. FNBE 2016) and phenomenon-based learning (e. g. Lonka et al. 2018), there have been no studies of the practical aspects of phenomenon-based learning and multiliteracy in secondary schools in Austria.

3.1 Phenomenon-based learning and project teaching

Phenomenon-based teaching and learning invites educators to reposition the boundaries of traditional subject teaching to include interdisciplinary explorations of phenomena (Lonka et al. 2018). It links school knowledge to real-life topics, enabling pupils can create new solutions, individually or collaboratively. Pupils acquire knowledge through the exploration of their experiences and lifeworlds and of societal issues (Lonka et al. 2018). According to Silander (2015a) a phenomenon is an authentic object of observation, a systematic model for the things to be learned, a metaphorical model for the things to be learned or a motivating fundament for attaching the things to be learned (Silander 2015a). Teaching requires a problem-solving environment, where teachers raise a topic and pupils "build answers together to questions or problems posed concerning a phenomenon that interests them" (Silander 2015a: 17). Learning goals are negotiated and evaluation is used as a tool for self-analysis. Teaching processes

are learner-centred and the content to be learned by pupils is connected to practical situations. Team teaching and cross-curricular lessons are crucial aspects of the process. Teachers are seen as facilitators of learning, encouraging and guiding pupils as they deal with the question they themselves have identified (Silander 2015b). Phenomenon-based learning has a lot in common with problem-based learning, design-based learning and inquiry-based learning (Puente et al. 2013) but has a stronger focus on team teaching, multidisciplinary, authentic, cross-curricular and contextualised projects (Lonka et al. 2018).

When it comes to the practical implementation of phenomenon-based learning with regard to multiliteracy, Kangas and Rasi (2021) suggest the following eight steps, as shown in Figure 1.

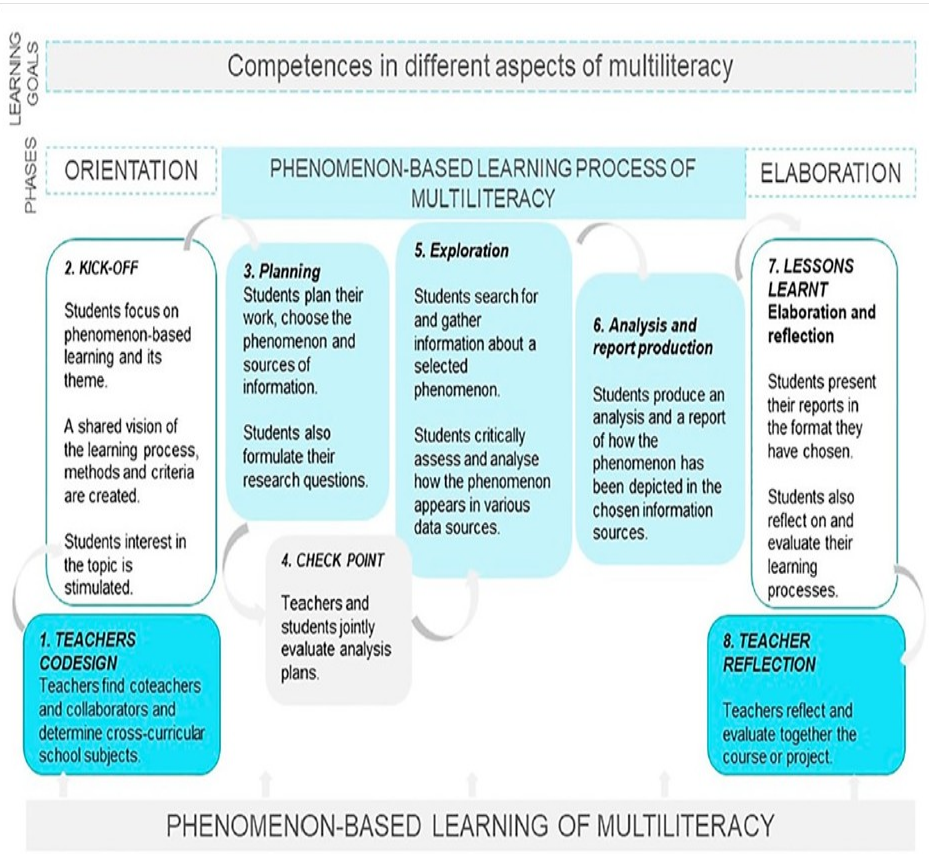

Figure 1: Phenomenon-based teaching and learning for multiliteracy in secondary school (Kangas/Rasi 2021: 13)

A specific practical example of delivery based on this approach (Kangas/Rasi 2021) in a secondary school might be as follows: (1) Teachers Co-Design: Two teachers (of English and Biology respectively) get together and define learning goals, teaching/learning methodologies and evaluation criteria as well as setting a duration of (e. g.) two weeks. The chosen topic (in this instance climate change) is linked to the curriculum and to pupils' lives by allowing them to choose a problem that is connected to their lives.

(2) Kick-Off: In the first lesson(s), the teachers share the vision and the goals of the project and arouse interest through subject-specific stimuli, for example a film about Greta Thunberg. The teachers encourage pupils to ask questions. (3) Planning: Pupils choose their own research question based on their specific interests. They form groups or work individually on questions such as: What effects of the climate crisis do I notice in my hometown? What can I myself do to combat the climate crisis? How can we make everyday life in school sustainable? What can my family do? The aim is to find the most relevant sources for their projects. (4) Teachers and pupils jointly analyse and evaluate work plans and project ideas. (5) Exploration: The pupils undertake research, looking at news articles, YouTube videos, blogs, Twitter, TikTok, advertisements, etc. They consider how their phenomenon is presented in different sources. (6) Analysis and report production: Pupils try to answer the questions using the available sources and discuss them in the group or in a plenary session. Depending on pupils' ages and the prior knowledge, an additional checkpoint with teachers and pupils could be included here, to evaluate the findings. Pupils produce reports and presentations and are encouraged to make creative use of various digital tools and formats as appropriate to their research question, creating comics, short videos or podcasts in German and English language, for example. (7) Lessons learnt: The results are presented in class and published in a shared folder on the school's learning platform. The multimedia reports are also displayed in the school building for other pupils and parents to see. Finally, the pupils discuss the

learning process and the results with their teachers in English and Biology. Teachers assess the reports and pupils evaluate themselves and/or their classmates (8) Teacher reflection: At the end of the project, the two teachers discuss the learning process and compare the results with the desired outcomes, taking pupil feedback into account.

3.2. Criticism of phenomenon-based learning and constructivism

Phenomenon-based teaching and learning have their roots in constructivism and aspects of socio-cultural learning (e. g. Vygotsky 1987), progressive inquiry learning (e.g. Hakkarainen 2003) and problem-based learning (e. g. Hmelo-Silver 2004). Some researchers criticise the central constructivist premise of phenomenon-based learning, raising concerns that it avoids pupils' responsibility for any failure to learn (Symeonidis/Schwarz 2016). Critics highlight the need to exercise care with regard to "educational reform and policy making that tends to shift the responsibility for learning outcomes onto the pupils and reduces the teaching job to facilitating, mediating and organizing multidisciplinary learning modules" (Symeonidis/Schwarz 2016: 41). This critique argues that a constructivist approach disconnects teachers from their responsibilities through the creation of phenomena in pupils' minds. The idea of pupils as self-regulated learners might become an unintended consequence, releasing teachers from the responsibility if educational goals fail (Symeonidis/Schwarz 2016).

In this paper, we take a look at phenomenon-based learning in the form of time-limited interventions rather than as a wholesale

replacement for traditional teaching methods. The above mentioned criticism of phenomenon-based learning is less applicable in the context of periodic, short-term projects.

This chapter has shown that phenomenon-based learning provides pupils aged 10-14 years with training in basic digital skills. The following chapter describes teaching and learning methods for addressing disinformation issues with older students.

4. Ways to deepen understanding of disinformation – for 15 to 18 year-olds

As outlined in the previous sections, digital competences in the context of disinformation need to be developed from an early age and extended at upper secondary level. While basic digital education in Austria is intended to foster basic digital competences, the core aspects at upper secondary level are techniques for spotting, addressing and countering disinformation. We therefore outline two established approaches for 15–18-year-olds: Inoculation theory (Compton 2013) and evaluation of online information sources (McGrew et al. 2018).

4.1 Inoculating pupils against disinformation

The technique known as prebunking has generally seemed to be a fruitful way of neutralising the effects of false experts and/or disinformation (Cook et al. 2017). Prebunking is based on inoculation theory, which was first introduced by McGuire in the 1960s

(McGuire 1964; McGuire/Papageorgis 1962). The main idea is that individuals can be inoculated against misinformation attacks that can impact on their attitudes, in the same way as individuals can be immunised against a virus (Banas/Rains 2010; Compton 2013). Attitudinal inoculation consists of several steps: First, a "threat" is introduced by forewarning people that they may encounter (mis-)information that could challenge their pre-existing beliefs. Then one or more (weakened) examples of such (mis-)information are presented and directly refuted in a process called "refutational pre-emption" or "prebunking" (Van der Linden et al. 2017), which uses established debunking techniques. It is worth noting, however, that the deepening of debunking skills could also be seen as a meaningful approach in its own (Ha/Perez/Ray 2021).

Studies found that inoculating people with facts against misinformation was effective in the context of 9/11 conspiracy theories (Banas/Miller 2013), but also in the context of global warming (Cook et al. 2017; van der Linden et al. 2017). Recent studies even found that actively inoculating adults during online gaming phases significantly reduced the perceived reliability of tweets in which common online misinformation strategies were embedded (Roozenbeek/van der Linden 2019).

To our knowledge, there has been no investigation of whether inoculation theory can also be used in educational settings with pupils aged between 15 and 18. But we see clear merit in this approach and there are some initial hints of its effectiveness in educational settings. Schubatzky and Haagen-Schützenhöfer (2022)

investigated the effect of inoculation of Austrian adolescents (15–18 years) with regard to the perceived scientific consensus on climate change; this was shown to have a significant impact on beliefs about whether climate change was happening and whether it was caused by humans (Cook et al. 2016) and the researchers concluded that the approach was useful for pupils in this age group.

4.2 Evaluating Online Resources

The internet may be an empowering and enriching platform for knowledge sharing if citizens can use it effectively (Kahne et al. 2012). However, it is critical for pupils to understand how the internet changes the information they get (e. g. Lynch 2016; Mason/Metzger 2012; Pariser 2011) and to know how to identify trustworthy information (Kahne et al. 2016; Metzger 2007; Metzger et al. 2010). Young individuals are easy misled if they consume information without first determining who is behind it and what the source's objective is.

Students' assessment internet material has been extensively researched. Pupils used the order of search results as a signal of a website's trustworthiness when conducting open searches. They frequently clicked on the first or second result, believing that the higher a site's listing in the search results, the more trustworthy it was (Gwizdka/Bilal 2017; Hargittai et al. 2010; Pan et al. 2007). When looking for information about online news sources, college students had misconceptions about the curating of Google's Knowledge Panels, and frequently concluded that sources were

trustworthy if they had a strong social media presence in the search engine results page. Pupils' evaluation of the webpages they accessed was similarly inappropriate, and they rarely made decisions based on content (Lurie/Mustafaraj 2018).

When conducting searches on relatively straightforward questions, pupils ignored sources and evaluated websites based on superficial features (Hargittai et al. 2010). They fared worse when content was more contentious (Brand-Gruwel et al. 2005). Analyses of thousands of responses to tasks assessing pupils' ability to evaluate social and political information online showed that pupils did not distinguish between traditional news and sponsored content and rarely based their evaluation on the reliability of a source (McGrew et al. 2018). Instead, they were swayed by what appeared to be strong evidence and evaluated websites on the basis of their design or how authoritative their logo or references made them appear (McGrew et al. 2018; Wineburg et al. 2016). Studies have also shown, however, that it is possible to foster evaluation skills through interventions involving civic online reasoning (McGrew 2020).

We believe that inoculation theory and civic online reasoning might represent useful approaches for teaching digital competence, including in the context of Digitale Grundbildung. To evaluate our hypothesis, we shared these ideas with experts on teaching, education, law, social work, media and journalism and sought their views.

5. Methods and methodology

We followed up on two research questions:

RQ1: How do experts from different disciplines envision the teaching of digital competences to counteract disinformation in (lower and upper) secondary schools in Austria?

RQ2: How do experts rate the proposed educational approaches of phenomenon-based learning, inoculation theory and civic online reasoning for practical use in (lower and upper) secondary schools in Austria?

In addressing these questions, we follow Guba and Lincoln's methodological principles (1994) for qualitative social research.

5.1 Methods

Since we were interested in how experts envision teaching and learning of digital competencies, we used semi-structured interviews with experts in disinformation in professional environments to find out their views on what teaching and learning to counteract disinformation should entail. Expert interviews are undertaken with individuals who are ascribed expert status (Helfferich 2014). Our goal with the interviews was to reconstruct the expert knowledge embedded in a specific social context. Teachers and practitioners are identified as experts in this context as a result of their experience with disinformation and/or teaching. However, it is vital to note that being an expert in one field does not make an individual expert in another or associated field or fields. Hence, we are not seeking to claim that individuals' expertise in

disinformation in particular areas also makes them experts in the teaching of digital competencies to counteract disinformation. However, when taken in combination, expert views can deliver new insights that may help with the development of teaching frameworks. To ensure the results from the expert interviews were comparable, we used interview guidelines consisting of 24 questions, which is set out in the appendix (Gläser/Laudel 2009).

5.2 Research Design

In general, it is assumed that expert knowledge can be detached from individuals in a generalisable manner. However, both the historical interchangeability of expert knowledge and the differences in opinions within the group of the experts mean that such generalisability cannot be equated with objective opinion. Subjective interpretation is hence also required when conducting expert interviews (Helfferich 2014). In the interdisciplinary context of teaching and learning about disinformation, we tried to give a voice to experts who are otherwise not heard. The interviewees were experts in their own subjective reality and approached the topic through their individual professional lenses (Gläser/Laudel 2009). In our analysis, we drew on the expertise that could be attributed to the respective experience of the experts in question and tried to put it into perspective from a pedagogical point of view. To provide comparability, all practitioners were asked the same set of questions. The teachers were not asked precisely the same questions, but all the key aspects for answering the research questions above were addressed.

5.3 Analysis

Based on the 24 questions in the interview guidelines (see appendix), we inductively created 8 categories with a reliability check (general circumstances, understanding of digital competences, basic digital education in Austria, the concept of digital competences teaching, age of pupils, lesson content, phenomenon-based learning, inoculation & civic online reasoning theory) and 35 subcategories for content analysis (Kuckartz 2012). Three categories were excluded.

5.4 Sample and data collection

To address the myriad and complex approaches in the field of disinformation, we chose publications that combined a range of perspectives from pedagogy (e. g. Loveless/Williamson, 2013), communication (e. g. Ha/Perez/Ray 2021), economics (Allcott/Gentzkow 2017), sociology (Buckingham 2015), media (e. g. Kangas/Rasi 2021) and science education (e. g. Falloon 2020), technology-enhanced teaching and learning (e. g. Admiraal et al. 2016) and technology (e. g. Starbird 2021). Where possible, these perspectives have been incorporated into our analysis. All other disciplines – outside of scientific publications – were taken into account via interviews with experts. These included the perspective of teachers, head teachers, high school teacher educators, social workers, journalists, fact checkers, conspiracy theory and extremism prevention workers, media lawyers, civil servants from the Federal Chancellery and the Ministry of Education, employees of

criminal justice programmes working against hate speech and socio-psychological counselling consultants for victims.

The empirical data is based on 19 semi-structured expert interviews (6 teachers and 13 practitioners) lasting between 45 and 80 minutes. Table 1 and Table 2 provide an overview of the individuals interviewed and their field of expertise. The interviews were conducted and recorded online. All ethical and data protection regulations, including anonymity, were considered. The interviews with 6 teachers were conducted as part of the Digital? Safe! project at the University of Graz (Otrel-Cass et al. 2022).

Participant	*Subject(s)*	*School type*
Teacher 1	Computer science	secondary school (BRG)
Teacher 2	German, History	vocational secondary school (HTL, HAK, NMS)
Teacher 3	Accounting, Business Informatics	vocational secondary school (HAK)
Teacher 4	Maths, Arts	secondary school (NMS)
Teacher 5	English, Italian	vocational secondary school (HLW)
Teacher 6	English, Sports	secondary school (NMS)

Table 1: Informations about the 6 teachers who participated in the study.

Participant	*Occupation / Employer*	*Field of expertise*
Practitioner 1	NGO youth worker	social work, fake news
Practitioner 2	head teacher	secondary school
Practitioner 3	journalist, fact checker	media company
Practitioner 4	content and social media manager	fact checking
Practitioner 5	CEO	conspiracy theory education
Practitioner 6	chief editor	media company
Practitioner 7	university of education	didactic and digital teaching & learning
Practitioner 8	lawyer/law firm	media law
Practitioner 9	NGO youth worker	social work, extremism prevention
Practitioner 10	Chancellor's office	youth competence
Practitioner 11	Ministry of Education	media education
Practitioner 12	social institution	criminal justice, probation assistance
Practitioner 13	NGO counselling service	civil courage and anti-racism work

Table 2: Informations about the 13 practitioners who participated in the study.

6. Results and findings

This section describes the main findings resulting from the qualitative expert interviews (n=19). It begins by outlining the experts' views on the main ideas underlying teaching against disinformation. We organised the results into two major categories, further dividing them into eight subcategories. Section 6.1 sets out the factors that shape education on disinformation and form the

framework in accordance with which the experts believed education against disinformation should be structured. Section 6.2 describes the experts' proposals for educational interventions and their evaluation of the practical teaching frameworks described in section 3 and 4 above. The experts' various views are then consolidated and used to outline what teaching of digital competences could look like in the age of disinformation.

6.1 Current circumstances and requirements for education against disinformation

Contextual factors stemming from the school system, pupil prerequisites and the understanding of digital competences all shaped the experts' vision for the teaching of digital competences against disinformation. The headings of the next sections represent the categories we analysed. The content of the sections is drawn from our analysis of the expert interviews. The next section concludes with clarification of these statements (Figure 2).

6.1.1 General circumstances

The experts stressed that most disinformation arises in non-public online environments (e. g. Telegram) in closed groups and spreads further via other social media. Adults are more likely to be misled in the course of this process. Hence, the experts stressed that teachers should see their pupils as experts on this issue. As one expert from our sample puts it (translated from the German):

> The question is which target group education is aimed at. I think teachers and pupils should be taught equally, maybe even together. So that teachers realise that they have major problems when it comes to dealing with digital media, just as we all do. […] We are all sitting in highly engineered machines in an editorial society and have only just learned to drive carts. (Practitioner 6)

According to the experts, young people are more likely to have the courage to experiment with new tools on the internet, even if they make mistakes. Experts observe that older teachers are often more afraid of digital teaching tools than younger teachers because they have a less positive mindset (Janssen et al. 2013) towards digital trends. Teachers should therefore be open to digital innovations and introduce them and critically reflect on them in the classroom.

On the social and political side, the experts pled for more funding and investment in resources, more precisely the production and dissemination of quality information to increase participation in democratic political processes. On the one hand, they argued, state institutions should provide tailor-made information for target groups, and on the other hand, they should promote quality journalism. A greater range of high-quality formats should be created to appeal to younger people, for example on social media.

6.1.2 Experts' understanding of digital competences

The following overview brings together the experts' understanding of the digital competences pupils require, and is based on the three lenses structure of the Frankfurt Triangle (Brinda et al.

2020) to highlight the connections with basic digital education (Digitale Grundbildung) in Austria (BMBWF 2020): (1) *Technological and media structures and functions*: understanding of traditional media and media consumption, understanding of journalism, communication flows, basic knowledge of social media, media law (and criminal law), checking and classification of information (sources, website legal details, opinions, satire, fact-checks), ability to put content into context, political education, source criticism; (2) *Social and cultural interactions*: societal, social and political competence, understanding of offline/online effects on oneself and others, background knowledge of overall context, critical faculties, formulation of discussion, recognising emotionality in content, potential dangers, awareness of plausibility, potential of digital tools and opportunities they present, environmental issues and consequences; (3) *Interaction: use, action, subjectification*: operating programmes, devices and search engines, 10-finger system, awareness, consciousness, critical thinking, capacity for reflection and self-reflection, direct, indirect, long-term and short-term effects (data traces, legal claim, privacy), interpretation of facts, tracing sources of pictures and videos, capacity for self-learning. One expert summarised the issue as follows (translated from the German):

> There are simply rules for dealing with the Internet: I call them the digital traffic regulations […] We have to teach primary school kids the rules – just as we do with cycling proficiency, we could introduce media 'driving licences' for kids. (Practitioner 5)

This understanding of digital competences reflects the ideas that are integral to the 'Frankfurt Triangle'. Although we did not show the experts the triangle, they highlighted the relevance of the same aspects for inclusion in teaching of digital competences. The digital competences to address disinformation can thus be divided into three categories, or perspectives: "socio-cultural", "interaction" and "technology and media". Some of the experts highlighted that up to now, the process of fostering digital competences has focused heavily on the technology and media perspective; in the future, therefore, the other two perspectives should be given particular attention.

6.1.3 Basic digital education in Austria

The Ministry of Education's targets for the introduction of basic digital education represent a major challenge for teachers and headteachers: they have indicated that this is an ambitious goal and will take several years to achieve. The quality of implementation is heavily reliant on teachers: whether they are young or older, teachers need extensive digital education and regular in-service training and in some cases persuasion in order to implement the curricula. The experts saw the greatest weaknesses of the current regulations as being the strongly informatics- and ICT-oriented curricula and the danger of shifting the responsibility for digital teaching onto the shoulders of basic digital education teachers, despite the identification of digital competences teaching as a cross-curricular subject/activity.

6.1.4 The concept of digital competences teaching

The experts agreed that digital competences must be taught on a cross-curricular basis. Computer science lessons are strongly application-oriented and are not sufficient. On the one hand, it was suggested that ideally digital competence training should be delivered via mandatory project days or weeks; on the other, all the experts emphasised the importance of regularity, as otherwise the content can quickly be forgotten. It was also pointed out that lessons needed to be interactive and entertaining. Most experts placed particular emphasis on deconstructing real-world examples of disinformation in classrooms; this corresponds with the idea of active inoculation as outlined in section 4.1. It was felt that pupils should even be given the chance to construct their own fake news to help them understand how disinformation techniques work. Here, competence took precedence over subject matter. As one expert puts it (translated from the German):

> Don't just take any fake news and investigate it – maybe write some fake news yourself in a protected environment. Let the kids select photos of political events or whatever, for example, and then generate news that is simply not true. Doing something yourself provides a huge amount of insight. Then the class could rate the fake news items, for example. Ideally the items should be in the right kind of layout to make the activity as serious as possible. (Practitioner 5)

This should be the responsibility of trained teachers, but also of external practitioners.

6.1.5 Age of pupils

Experts in digital education mentioned different pupil ages as the appropriate time to begin training digital competences. While many thought this should start at lower secondary level (10–14), others thought primary school (6–9), or even kindergarten (3–5) was the right time. It was emphasised that digital literacy training should start at the latest when children first encounter digital devices. In upper secondary school (15–18), it was felt, content should be further deepened and reflected upon. Interestingly, legal regulations in Austria allow young people to create their own social media accounts from the age of 14. Nevertheless, many digital stakeholders (influencers, advertising, opinion formers, …) deliberately target younger children. It is important to stress here that the experts we interviewed did not all declare themselves experts in digital education. Nevertheless, there seemed to be consensus among them that the training of digital competencies should start at the latest with young people's first encounters with digital devices.

6.1.6 Lesson content

When it came to content, the experts highlighted the importance of focusing on the required competences. All the experts agreed that the best way to deliver content was through engagement with case studies.

Firstly, young people should create and reflect on fake news themselves in a safe environment, use digital tools, identify ma-

nipulation of images and videos or manipulate material themselves and try out tools for research and fact-checking.

Secondly, young people should practise classifying information, comparing (political) viewpoints in the media, recognising text forms (satire, news, agency reports, …) and deconstructing radical or propagandistic narratives and conspiracy theories. Such deconstruction could focus on agenda-setting or mass-media framing as an analytical lens. The classification of information should include an overview of social media platforms, their economic goals and functions (algorithms, filter bubbles, social bots).

Thirdly, pupils should study what constitutes a healthy digital identity. Topics such as resilience, addiction, personal coping strategies, digital ethics, diarising personal experiences, exclusion and intersectionality, bullying and building a personal shield against hate and trolls all play a crucial role.

The Codiv-19 pandemic in particular has shown that science education, and in particular basic scientific methods and the interpretation of statistics, are essential here. But a basic understanding of media law, especially as regards the publication of content, but also in connection with dangers such as blackmail, nude photos, contact with strangers, radical or extremist content, is vital too. In this context, it is important not to place any blame on pupils, but rather to provide practical examples.

6.2 Practical teaching frameworks for Austria

Having analysed the current circumstances and requirements as regards digital teaching in Austria, we will discuss how the experts viewed phenomenon-based learning, civic online reasoning and inoculation theory (described in section 3 and 4) as means for addressing disinformation through education.

6.2.1 Phenomenon-based learning

The experts' suggestions with regard to introducing phenomenon-based learning in the Austrian context ranged from clarification of the overall concept to the curriculum, the role of teachers, teaching techniques, defined responsibilities, legal issues, the choice of topics and the conclusion of the project (see Figure 2). The next section sets out the main arguments made in the interviews.

Clarifying the concept in advance: The experts interviewed took the view that the first step was for school management to provide support for any new teaching and learning environments being introduced. This was based on their own experiences, e. g. when conducting workshops or teaching in schools. The second step identified was for teachers to be given the appropriate competencies to ensure phenomenon-based learning. The third step was to discuss planning, implementation and learning goals with pupils and the fourth was to inform parents about the new learning framework. The experts suggested it was advisable not to think in terms of individual, 50-minute lessons, but rather in terms of project days or project weeks. It would be beneficial to avoid the

phases of the school year that typically involve a large number of tests and to take time to deepen pupils' understanding of the topic. Teachers estimated that delivery would realistically require between 8 and 15 teaching hours once or twice per year. Teachers said they would also need to consider school infrastructure (computer rooms, WiFi, library, …) and where necessary switch projects to alternative locations (e. g. city library, university, …). They also felt different learning areas might be useful for different project phases (e. g. quiet work, creative work, discussion).

Curriculum: Practitioners recommended that phenomenon-based learning approaches be a mandatory aspect of the school curriculum. Conversely, they also emphasised that no teacher should be forced to teach in a particular way, because this could lead teachers to become defensive. The teachers interviewed contended that each educator should determine their own pedagogical style. Further criticisms included the risks of increased overtime, the need to adapt to the specific school type (morning and afternoon teaching), and organisational and workload challenges as well as less obvious factors such as the need for teachers to rethink their approach to education.

Role of teachers: The experts frequently mentioned the concern that teachers' ages and years of service could have an impact on their ability/willingness to use phenomenon-based learning to deliver qualitative teaching. Teachers themselves highlighted that older and more experienced teachers were often less eager to try out new formats. On the other hand, it was emphasised that

young teachers and older teachers could learn from each other when working together. While not arguing that team teaching should be mandatory, practitioners felt it was highly recommended.

Teaching and pedagogy: One of the most important aspects highlighted was the need for teachers to have a positive mindset towards digital technologies and not to fear stepping out of their comfort zone when teaching. The experts interviewed felt it that some rethinking of teacher training was necessary in order to address new pedagogical approaches such as phenomenon-based learning. Practitioners highlighted the pedagogical importance of teachers in the orientation phase, stressing that teachers should be responsible for initiating the learning process in such a way as to capture pupils' interest. Almost all experts said that a greater number of checkpoints with pupils should be available to enable their learning processes to be assessed – depending on age, year group and prior knowledge. Teachers themselves underlined that they knew their pupils and, depending on the setting, they were able to assess how much guidance or freedom different groups needed. In contrast to traditional teaching methods, teachers needed to step back more often and allow pupils to learn through trial and error. Sufficient time needed to be planned in for discussion and reflection.

Defined responsibilities: The teachers interviewed emphasised that everyone involved in the teaching process needed to be clear about their responsibilities in order to successfully implement the

framework. Year group heads can offer help with coordination and organisation; teachers must agree who will take responsibility for which parts of the project, and take advantage of synergies; pupils should discuss the distribution of group tasks and distribute work fairly. During the implementation of the project, teachers should be kept aware of progress (e. g. through notes made in a shared document).

Legal aspects: When publishing the project report, pupils and teachers should be aware of copyright issues with regard to videos, images and music. Raising awareness of legal issues should be an integral part of the project. Digital tools, class presentations and publication in a contained/limited environment (e. g. through learning management software such as Moodle) address copyright concerns and are legally designated as free to use for the purpose of teaching. Publically published reports (e. g. on social media) must take copyright regulations into account. Here, legal experts recommended large, commercially active, reputable platforms with licence-free content.

Choice of topics: When teachers suggest topics, it is important they ensure in advance that reliable data is available. Neutral topics attracting less polarised ideological views (e. g. nuclear dumping, homelessness, nutrition, plastic pollution in the sea) are particularly suitable here. Less suitable topics include Covid-19, chemtrails or other issues that are the subject of conspiracy theories. Caution is needed with regard to topics where pupils might have had negative previous experiences (e. g. racism, bullying).

Teachers should use checkpoints to ensure that no negative group dynamics or re-traumatisation occurs during project phases. Teachers from our sample suggested considering in more detail topics that had already been covered in class. Dealing with topics that were on the curriculum would, they argued, reduce the risk of not covering certain areas due to lack of time.

Project conclusion: Pupils should be encouraged to also present their search methods in the final report, including search words, tools and sources. The experts recommended pupils undertake self-reflection including a psychosocial checkpoint (e. g. How did it make me feel? What did it trigger in me?). The phenomenon-based learning model recommends that project reports be presented and shared within the class. The experts recommended that views should also be exchanged with teachers from one's own school and from other schools. Examples of best practice should also be disseminated through various digital channels – taking account of copyright issues – to inspire other teachers to trial the framework.

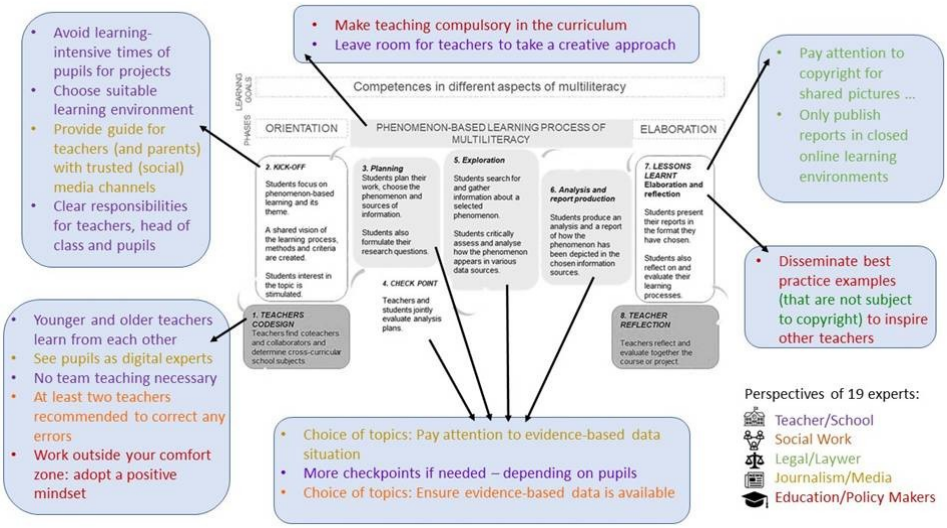

Figure 2: Revision of the "phenomenon-based learning for multiliteracy in secondary schools" model (Kangas/Rasi 2021: 13) to reflect the Austrian context.

6.2.2 Teaching of explicit strategies to counter disinformation

Three major approaches for dealing with disinformation emerged from our interviews: (1) teach pupils how to identify accurate and relevant information in the current media landscape, (2) address how to identify sources' intentions and select accordingly, and lastly, (3) teach pupils how to identify disinformation by "immunising" them. Drawing on these topics, we propose a practical teaching framework that includes all three aspects. First and foremost, all the experts highlighted that using real-life examples to deepen pupils' understanding of disinformation was a particularly fruitful approach.

Learn how to filter relevant information: The experts stressed that a basic understanding of the media landscape is important to un-

derpin understanding of disinformation. Pupils should thus develop the appropriate skills during secondary education. The experts' vision was very much in line with ideas of scientific media literacy as proposed by Höttecke and Allchin (2020), who argue that pupils need to recognise the epistemic challenges of public science communication and the role played by mediators. Our experts also highlighted that this includes the initial realisation that there is a lot of disinformation and irrelevant information out there.

Learn how to identify relevant sources and critique sources: The experts agreed that it was important for pupils to learn how to identify relevant sources, but also to identify how information is framed and the intentions of information providers on social media and mass media in general. This is basically the idea of lateral reading, namely the act of searching for information about a source while you are reading it in order to understand where the information is coming from. Our experts saw this technique – which mimics a strategy commonly used by fact checkers – as an important part of deciding whether information is trustworthy. In practical teaching settings, therefore, pupils should learn how to contrast vertical reading with lateral reading using real world examples. Such examples should ideally use disinformation that has circulated in the past or examples of disinformation pupils have encountered in their own lives. Stanford University, for example, has developed extensive teaching materials addressing civic online reasoning.

Learn disinformation techniques in order to provide immunity against known disinformation mechanisms: As one expert put it (translated from the German):

> Yes, it's important to debunk or refute disinformation, but prebunking is much more important – to immunise pupils against disinformation. (Practitioner 8)

With regard to the third explicit strategy to counter disinformation, the experts talked about learning how "disinformation works". Six experts suggested that pupils should create their own disinformation products – for example social media posts, fake images, in order to understand how disinformation techniques work. This correlates closely with the idea of active inoculation (see section 4.1; Roozenbeek et al. 2019). Creating their own disinformation products will on the one hand acquaint pupils with the technological tools commonly used to produce disinformation (for example how to fake images or videos) and on the other hand give them experience of using tools to identify such fakes. In this context, the experts recommended pupils be familiarised with fact checking tools like:

- Reverse Image Search, online at: https://tineye.com/ (last access: 15 September 2022).
- Mimikama Austria, online at: https://www.mimikama.at/ (last access: 15 September 2022).
- Waybackmachine, online at: https://archive.org/web/
- (last access: 15 September 2022).
- Twitter Bot Indicator, online at: https://www.truthnest.com/ (last access: 15 September 2022).

- Weather/Data/Area Check online at: https://www.wolframalpha.com/examples/science-and-technology/weather-and-meteorology/ (last access: 15 September 2022).
- Verifying sunlight, online at: http://suncalc.net/#/51.508,-0.125,2/2022.09.17/10:12 (last access: 15 September 2022).
- Verifying Pictures/Videos) online at: https://www.invid-project.eu/tools-and-services/invid-verification-plugin/ (last access: 15 September 2022).

Once again, they stressed that it is also crucial for teachers to be competent in this field: Schubatzky and Haagen-Schützenhöfer (2022) provide a practical example of how to approach this.

7. Discussion and Conclusion

Before we discuss the main results of our study in the light of existing literature, we want to address several limitations associated with it.

7.1 Limitations

Although expert interviews are a suitable data collection method for gathering a range of information and ideas from experts with a multiplicity of backgrounds, there are some limitations associated with the expert interviews in this article. First and foremost, the validity of the information collected is highly dependent on the quality of the experts. Although we believe we approached highly respected experts in their fields, we cannot rule out the possibility that we omitted experts whose answers might have shifted the outcome of our analysis. Interviews with different experts might thus lead to different outcomes. However, we see the

coherence between our interviews as a strong argument for the reliability of our findings. Although a link between the reliability and validity of data cannot simply be assumed, it seems plausible that coherent views from experts are also more likely to represent valid information. Furthermore, our sampling was purposeful and we took individual experts' different backgrounds into account, anticipating that some experts would be more informed on certain issues than others.

Besides the selection of the experts, another aspect that needs to be considered is the fact that we did not incorporate the recipients of digital competencies teaching, namely school pupils. We acknowledge that the experts we interviewed may be experts in disinformation, but they may not be experts in pupils' actual needs when it comes to counteracting disinformation (see section 5.2). A similar argument could be made with regard to the evaluation of the educational approaches proposed in this article. A significant proportion of the experts interviewed were not experts in pedagogy, hence their evaluation needs to be interpreted with care. During our analysis, therefore, we took a critical stance with respect to statements from the experts on pedagogical issues, as already outlined in section 5.

Additionally, we want to stress that we only interviewed experts working in (or related to) Austria. We can therefore not make any claims about how their vision for the digital competencies teaching would be received in an international context, in particular

with regard to the perspectives of other cultures and educational systems.

The next section discusses our findings with regard to educational and societal consequences and the implications for digital education in schools in the future.

7.2 Conclusion

Our results show that experts think phenomenon-based learning for multiliteracy, inoculation theory and civic online reasoning are appropriate educational interventions for secondary schools in Austria with regard to countering disinformation. Nonetheless, they highlight potential barriers to implementation, including cumbersome bureaucracy, the need to redesign curricula and for teachers to adopt positive mindsets. The experts agreed that it should be mandatory to train pupils in digital competences, but stressed that this should not be left to separate, dedicated lessons; training should also be holistic, cross-curricular and recurring, ensuring that all subject-specific teaching addresses digital competence starting from the age of 10.

To ensure that the necessary skills are acquired, teaching and learning to counter disinformation must include the *perspective of pupils* themselves. Otrel-Cass and Fasching (2021) discuss the competences pupils believe they and their peers should have: Information management, opinion management and identity management. *Information management* describes critical analytical skills, *opinion management* suggests that pupils should under-

stand how filter bubbles, algorithms and echo chambers work, while *identity management* entails the construction of healthy online and offline identities in different environments. In an era of disinformation, "educators but also parents and caregivers will need to 'walk' with young people to learn together how different digital materials are produced and shaped and experienced" (Otrel-Cass/Fasching 2021: 105). According to the experts, awareness-building should begin at the time of pupils' first contact with digital devices, even though in Austria they are legally not allowed to create social media accounts until the age of 14. Such training should start at the latest in secondary school, at the age of 10. For older pupils, it would be helpful to continue deepening their understanding of disinformation throughout compulsory education. This should encompass basic science education and media law. The main point here is that the needs of pupils mentioned above are in line with the views of the experts we interviewed; this is a strong argument for taking up and further developing these ideas.

In order to address the use of digital technologies and rapidly changing media consumption behaviours, *teachers* could usefully be supported to move from an application-oriented approach towards digital competences, placing at least as much emphasis on social and cultural issues including digital wellbeing and healthy digital identities. We therefore propose a redesign of pre-service and in-service teacher education to support teachers to develop positive mindsets. Teachers should avoid shifting responsibility

for this area on to other subjects. Older and younger teachers, and pupils, can learn from each other by using, reflecting on and creating digital artefacts together on an equal footing. It should be mandatory to train pupils to develop digital competences, but as highlighted above, training should not only occur in specific, dedicated lessons; it should be offered as part of all subject teaching.

Teaching content should include interactive and entertaining elements with a focus on real-life scenarios. Meaningful activities include using tools, classifying information, trying out, creating, reflecting on, sharing and deconstructing digital artefacts. Following the experts' recommendation to use fact checking tools, we suggest educational or serious games that can be used to increase digital skills:

- Digital? Sicher!, online at: https://digital-sicher.at/digitalsicher/ (last access: 15 September 2022).
- Fake it till you make it, online at: https://fakeittomakeit.de/ (last access: 15 September 2022).
- Troll bunker escape game, online at: https://yle.fi/aihe/artikkeli/2021/03/26/troll-bunker-escape-game (last access: 15 September 2022).
- Cranky Uncle, online at: https://crankyuncle.com/ (last access: 15 September 2022).
- Factitious, online at: http://factitious-pandemic.augamestudio.-com/#/ (last access: 15 September 2022).
- Bad News Game, online at: https://www.getbadnews.com/en (last access: 15 September 2022).

- goviral, online at: https://www.goviralgame.com/books/deutsch/ (last access: 15 September 2022).

The main argument here is that teachers need systematic support within the school system. However, there is no need to reinvent the wheel. Approaches already exist that are considered useful by experts and/or that have already been shown by empirical research to be effective (Lonka et al. 2018; Cook et al. 2017). Phenomenon-based learning for multiliteracy, inoculation theory and civic online reasoning need to be contextualised to make them suitable for secondary school teaching.

Further, *policymakers* need to invest the necessary resources to provide information tailored to young people to prevent them from getting trapped in fake news. This includes investment in qualitative journalistic digital products as well as the provision of public information by the state. In addition, policymakers should provide resources to support teacher education, schools and educational institutions to ensure that pupils' needs are met. Our main argument here is that disinformation must be countered with qualitative information. Communal responses are required to address the challenges associated with disinformation and this should involve expert groups going beyond education, including e. g. journalism, media law, science and policymakers. We need more suitable digital information tailored to young people.

Many initiatives on digital competences, including this paper, contend that education is a cure for fake news. News media and many other commentators consider fake news as a problem re-

lating to specific beliefs. This problematizes people who hold certain opinions. However, from a democratic viewpoint, the idea of making 'them' believe in the 'right' news is deeply concerning (Monsees 2021). This is a critical reminder that disinformation arises not only from the absence of digital competences education.

7.3 Outlook

What does this imply for the future? This article has outlined promising ways of developing digital education in secondary schools in Austria going forwards. As a next step, we aim to use our findings to put these frameworks into practice in secondary schools, broadening the perspectives of teachers and pupils and testing the interventions through a design-based research approach (Bell 2014).

Further, it is crucial to develop (educational) digital tools to assist with the detection of fake news (Huber et al. 2021). Educational institutions need to respond to these challenges by making the development of digital competences – by pupils and teachers – a mandatory part of curricula. Current research highlights the importance of making digital competences an integral aspect of education, along with reading, writing and mathematical skills (Huber et al. 2021), as soon as pupils start reading, texting and interacting online with others. What we have not covered in this work, but which has been highlighted by the experts, is the need to develop digital competences in other target groups, e. g. primary schools, older people and even kindergartens. Education

needs to take a holistic, cross-curricular, regular and transdisciplinary approach that tackles all aspects of disinformation, focusing on technology, creation, circulation and the target audience (Jahnel et al. 2021).

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Appendix

Interview guidelines

- Personal details:
  - Please briefly describe your activities in the context of digital literacy/fake news/disinformation?
  - What do you understand by 'digital competences' in general? What does it mean to be 'digitally competent'?
  - What do you understand by disinformation/fake news?
- Young people and teaching:
  - What might a regular digital literacy lesson against fake news in school look like? How often should it take place? Who should teach it? Where else can young people learn about it?
  - What is your view of "digital literacy" in current school practice? Strengths/weaknesses?
  - Which teachers should be responsible for teaching digital literacy? How do you see the passing on of responsibilities?
  - At what age should young people start exercising digital competences?

- Content: What do you think pupils should know/be able to do in relation to Fake News? What is particularly important?
    - Example nude photos: How can you encourage young people to take action? How can moral courage (e. g. intervening in cyberbullying) be increased? Example: Contact with strangers – how can pupils be made aware of this?
- With whom do young people talk about this?
    - Who do you think young people should talk to (dangers)?
    - What is the role of teachers?
    - How can parent-child dialogue be strengthened?
    - What advice do you give parents on media education?
- What is your opinion on the inclusion of smartphones in school lessons? What opportunities and risks do you see? How can they be used in a meaningful way?
- How can young people develop a healthy digital identity?
- Example – Influencers: How do you evaluate the influence of advertising and influencers on young people?
- Do you see differences between female and male pupils in terms of internet/cell phone use? Digital competences?

● Digital competences as a framework

- What might a Fake News lesson look like?
- Explanation of Phenomenon-based Learning and Multiliteracy
- How do you evaluate this approach to digital literacy?
- How practical do you think this approach is for schools?
- What are the strengths/weaknesses of this approach?
- Measures for older pupils to go deeper?

- Debunking
    - What strategies are there for dealing with false news?
    - How important is it to you to assess the trustworthiness of sources?
    - What strategies or tools are you aware of for learning to assess trustworthiness?
    - Difference: Passive recipients? Active – directly addressed?
    - Resistance – Is it worthwhile for education to address Fake News? If yes, how?
    - Approaches to journalism education for young people? Science Education?

4.3. **Article 3**: In Pictures We Trust: Phenomenon-based learning about disinformation in secondary schools.

Reicho, M., & Otrel-Cass, K. (2024, submitted): In Pictures We Trust: Phenomenon-based learning about disinformation in secondary schools. Video Journal of Education and Pedagogy. Brill (submitted 28.02.2024).

In Pictures We Trust: Phenomenon-based learning about disinformation in secondary schools

Michael Reicho and Kathrin Otrel-Cass

University of Graz, Institute for Educational Research and Teacher Education, Austria;

Abstract

The existence of disinformation in online environments increases the risk of young people being exposed to manipulated content. In this article, we present research from a classroom intervention where teachers used a phenomenon-based learning (PhBL) approach to build pupils' multiliteracy and address disinformation. The study took place in six secondary school classes in Austria, where we conducted video-based classroom observations with 107 pupils and interviews with pupils (n=36) and their teachers (n=8). We were surprised to see the role visual information played when pupils made decisions on whether to trust in online information or not. We found that greater proximity to human actors creates trust, while facilitated access to visual information enhances trust in digital information. Our results showed also that phenomenon-based pedagogy supported pupils' developing multiliteracy through reflective dialogue, technical skills, as well as the ability to self-manage.

Keywords: *Disinformation, Phenomenon-Based Learning, Multiliteracy, Visuality, Secondary School, Fake News;*

Introduction

The importance of digital and social media platforms as an important source of information have increased around the globe in the last decade. Compared to traditional media - such as radio, printed newspapers or television - digital online information and materials are characterised by their fluidity (Sørensen, 2009). These services transform the characteristics of distributed information towards being highly dynamic. In particular, the approach of user-generated content means that users can easily generate their own materials as well as manipulate existing information to add their own views or even modify the meaning (Bühler et al., 2020). Digital information, including texts, images, audio- and videos have emerged in great numbers and can be easily disseminated, shared and spread, through digital tools and platforms including misinformation (Carr et al., 2020).

The excessive spread of fake news and disinformation in online environments poses an increasing threat to social and democratic structures (Wardle & Derakhshan, 2017). In response, education policy makers and providers around the world have highlighted the importance of teaching and learning about disinformation already at

a young age in school (Grizzle et al., 2021). From a pedagogical perspective, the most important principle in dealing with disinformation is to promote and cultivate critical thinking and engagement in and through education (Carr et al., 2020). A recent study highlights that information literacy substantially enhances the chances of recognising disinformation (Jones-Jang et al., 2021). It seems relevant and important to identify ways to build pupil's critical literacy (Burnett & Merchant, 2011). This article refers to the term 'multiliteracy' that covers concepts such as critical media literacy, digital literacy, advertising literacy or advertising competence (Kangas & Rasi, 2021).

Against this background and in the context of disinformation, we propose an educational intervention utilising a phenomenon-based learning approach to teach and learn how to identify and avoid fake news. Phenomenon-based learning (PhBL) utilises an open pedagogy approach, and is related to other open formats such as inquiry based learning (IBL) or problem based learning (PBL) (Schaffar & Wolff, 2024). At its core PhBL has a focus on collaboration, responsibility and reciprocity, this means that the phenomena that are being investigated are researched in teams and this should encourage dialogue and reflection. This should in turn support intersubjective learning. PhBL has had a tradition in Finland where it is part of the core curriculum (Schaffar & Wolff, 2024) and its application has been reported in the context of multiliteracy (Lonka et al., 2018; Kangas & Rasi, 2021, Scheibenzuber et al., 2021). Set in the educational context of Austria, where this pedagogical approach has little tradition, we decided to investigate how the implementation of phenomenon-based learning supports learning on how to examine information and evaluate its trustworthiness. We focus in this article on the following research questions:

- How does the 'phenomenon-based learning' approach support building pupils' multiliteracies?
- What role plays visuality and trust when pupils work with different digital sources?

We will present qualitative data analysis from classroom observations undertaken in 6 Austrian lower secondary school classrooms (n=107) and from semi-structured interviews with teachers (n=8) and pupils (n=36).

The structure of this article is as follows: We start with a presentation of the concept of fake news and disinformation and explain the need for suitable pedagogical approaches. Then, we detail the relevance of multiliteracy and connect it with phenomenon-based learning. After explaining the methods and the research design, the results are presented in the form of video vignettes with a focus on trust and visuality. The article concludes with a discussion of the results and an outlook.

Fake News and Disinformation

Scholars agree that we arrived in the post-truth era and in the age of disinformation (e.g., Bennett & Livingston, 2020; Otrel-Cass & Fasching, 2021). The age of disinformation describes the increase of factual incorrect digital information (Shu et al., 2020). Post-truth means that objective facts have less influence on public opinion than feelings and personal beliefs. Post-truth has become a social concept that threatens traditional values of democratic knowledge and social decision-making (Peters, 2017). Jandric (2018) defines post-truth as "a poisonous public pedagogy" (101) that becomes a "complex mashup of signals, data, information, knowledge and wisdom; truth and deceit; fact and emotion; reason and instinct" (110). This highlights the difficulty of encoding a complex mix of digital information and to decide on who to trust.

But the phenomenon of fake news is not new. Nowadays, fake news are defined as "fabricated information that mimics news media content in form but not in organisational process or intent" (Lazer et al., 2018, 1094) or as information, "that is intentionally and verifiably false, and could mislead readers" (Allcott & Gentzkow, 2017, 213). Nielsen and Graves expand that "narrowly defined" understanding of fake news with an audience perspective that widens the definition with "poor journalism, political propaganda, and misleading forms of advertising and sponsored content" (Nielsen & Graves, 2017, 1), because "there is often no clear agreement on where to draw the line between fake news and news" (Nielsen & Graves, 2017, 3). The term 'fake news' also suffers from a more fundamental problem, meaning that "any notion of 'fake' depends upon an equal conception of 'real'." This assumes that there are authentic or legitimate practices for news, which are rarely present today (Baym, 2005, 261).

The digitalisation of information leads to very personal and individualised information-consumption manners:

> *"Technology has led to an abundance of information and facilitated access to it, leading on the one hand to the random, non-linear consumption of information and making it possible to select the sources, direct or indirect, institutional or personal, from which information is received. We create our own information ecosystem, a very personal world, parallel to other personal worlds and a breeding ground for post-truth" (Núñez, 2018, 212).*

Since fake news has become a popularised buzzword, researchers tend to use the term disinformation instead (Egelhofer et al., 2020). More precisely, scholars distinguish between disinformation, misinformation, malinformation or misleading information: Misinformation is when false information is distributed but no harm is intended. Disinformation is when false information is knowingly circulated to cause harm and often based on rumours, stereotypes, prejudice and fear as a tool of

deception, manipulation and persuasion (Carr et al., 2020). Disinformation is characterised by extensive, uncontrolled or even systemic dissemination (Bradshaw, 2021), and is, in many cases originating from populist groups (Hameleers & de Vreese, 2021. Malinformation occurs when genuine information is spread in order to cause harm, for instance when information that was intended to remain private enters the public discourse (Wardle & Derakhshan, 2017). Summarising misleading information, in contrast, is not necessarily factually incorrect, but may misrepresent facts, ignore relevant contexts or contain logical fallacies (Roozenbeek & van der Linden, 2022).

In this article we refer to disinformation including an intention to harm. We are all frequently confronted with disinformation, however, a special challenge arises when disinformation is shared via social media. Since everyone can distribute information and disinformation to some degree, it is up to the recipient to decide whether the content is factually correct or not. The recipient has to base their decision on whether they trust in what is being viewed or read, whether it matches expectations, preferences and/or values (Taddeo, 2017).

A popular strategy for deciding on what information to trust online is to cross-check with a search engine and their ranking systems. However, most search engines use sophisticated algorithms to tailor their results to our individual preferences. This means that we do not receive random answers to our questions. The results presented match our own opinions, intentions or the questions we have searched for (Loos et al., 2018) and this can become problematic. As a UK study showed, young people did not want to actively choose what they watched and were glad to be presented with a choice of algorithmically suggested content (Ofcom, 2022). It is easy to understand how this process of algorithmic suggestions creates filter bubbles and echo chambers (Pariser, 2011; Shu et al., 2017) and why it is necessary to build multiliteracies to develop information management skills (Otrel-Cass & Fasching 2021).

A key element of disinformation is to deceive users, as elaborated in the definition earlier. According to Jandrić (2018), deception has become a pervasive and ubiquitous feature of human and digital interactions. Persons of public interest, such as actors, influencers, politicians and other artists, present themselves with high-quality images and videos and send elaborate messages that make them appear in the best possible light (Jandrić, 2018).

Young people's media habits

In a late-modern media society, young people live with a constant inbound of digital information, pictures and sounds. The media use behaviour of young people is often portrayed in contradictory ways: On the one hand, young people are often seen as vulnerable and in need of protection. On the other hand, young people are portrayed as digital pioneers with an almost natural talent for media use (Hagen, 2003). The use of social media by older people has increased in recent years and the older age group is responsible for creating and distributing a significant amount of

disinformation (Loos & Nijenhuis, 2020). But young people are tasked to identify reliable and unreliable content that was (often) created by adults. Thus we need to use pedagogical strategies to build young people's multiliteracy that echoes the challenges of online environments present.

Young people consume information mainly online. A survey of secondary school pupils aged 11 to 16 has shown that pupils get their information from social networks, television and their family or peer groups (Herrero-Curiel & La-Rosa, 2022). More specifically, around 38% of 9-12 year olds and 60% of 13-16 year olds read and consume news online (Sonck, 2011). Very recent results from Austria, where the implementation of this article took place, show that the most popular social media platforms among young people aged 11 to 17 - that are Whatsapp (96%), YouTube (94%) and Instagram (75%) - are used as a source of information (saferinternet, 2023a). But some scholars even state that pupils' media consumption is uncritical and fuelled by compulsive consumption of audiovisual and digital media (Herrero-Curiel & La-Rosa, 2022).

In order to keep track of the flood of digital information, the pupils' level of engagement with news on social media sites largely consists of reading only the headlines (Gabielkov, 2016). A study of internet users showed that 47% of 16-24 year olds admit to making a 'formal' judgement about an article even before they have looked at the details of the content they are reading (Ofcom, 2016). This is what makes young people vulnerable to misinformation.

In fact, it has been reported that young people give too little thought to disinformation and potentially manipulative content in the media and think that as individuals they cannot change this situation (Trninić et al., 2022). More than 50% of secondary school pupils aged 11 to 16 (n=1651) are unable to distinguish between real and disinformation, although they consider themselves capable of distinguishing between news and hoaxes (Herrero-Curiel & La-Rosa, 2022). A study from 2007 showed that only 11% of pupils recognized a fake website (Save the Pacific Northwest tree octopus). A repetition of that study ten years later found that only 7% of pupils classified the website as fake (Loos et al., 2018).

In everyday life, it shows that ignoring unreliable information is the most common strategy in dealing with disinformation (57 %). 7 out of 10 young people say that it is difficult to find out whether information from the internet is true or false. 49% of the pupils are often unsure whether information on the internet is true and 62% of the young people do not know any fact-checking websites (saferinternet, 2023b).

This is particularly problematic when young people also share misleading content. 50% of the pupils between 11 and 17 years share news on current topics unchecked while 53% feel that checking information sources is a hassle (saferinternet, 2023b). When disinformation is seen as news in an attractive format or an outrageous discourse, this content appeals to the emotions of young people and tempts them to

spread it impulsively. All this is made possible through smartphones, where the act of sharing becomes a matter of trust. Therefore, young people are more likely to forward content without checking it first if it comes from people they know and trust with the intention of informing others. Results from a study confirmed that young people are (1) more willing to share content if it is related to their interests - regardless of its truthfulness. (2) That trust influences the credibility of information and that (3) newsworthy information is more likely to be shared with other young people, regardless of the type of content (Herrero-Diz et al., 2020).

But what are the reasons for that? Although young people have incorporated social media in their daily routines, evidence has shown more than a decade ago that the term "digital natives" - saying that all young people are literate in the use of digital information - is a myth (Bennett et al., 2008). A report on the evaluation of online information of high school, middle school and college students summarises that *"our 'digital natives' may be able to flit between Facebook and Twitter while simultaneously uploading a selfie to Instagram and texting a friend. But when it comes to evaluating information that flows to social media channels, they are easily duped"* (Wineburg & McGrew, 2016, 4). The image of young people being naturally tech-savvy users is most likely based on the fact that they grew up with access to new digital technologies and most of them were surrounded by them from birth - a notion that reflects a kind of technology determinist view of the way young people are expected to use new media. With the widespread use of ICT and increased access to new media across all segments of the population, simply having access to technology is not the main factor affecting the nature of young people's multiliteracy (Loos et al., 2018).

Even though pupils are portrayed as an engaged group in using ICT, various empirical studies suggest that they tend to be overconfident in their ability to use web applications, when in fact they lack the basic skills to do so (Herold, 2012; Loos et al, 2018). However, Herold (2012) found that pupils are less interested in acquiring knowledge about the tools they use and more interested in the outcomes - how they can gather information and apply it in educational outcomes.

In conclusion, the identification of disinformation requires elements related to the evaluation and analysis of different media contents in order to assess their authenticity, reliability and truthfulness, in terms of making responsible choices, as well as media literacy education for all generations, as a solution for building resistance against disinformation and potentially manipulative contents (Trninić et al., 2022).

Navigating truth through trust

Truth and trust are two different concepts, yet they are closely connected. To trust is an attitude we hold towards people and materials and is often based on subjective markers (we might trust our parents or what is printed by a reputable publisher). To

trust something or someone is always connected to a degree of risk or dependance on those who we trust not betray our trust or hurt us (Mc Leod, 2023). Jøsand and Pope (2005) offer more details about the meaning of trust, they differentiate between *reliability trust*, often connected to welfare (a child depending on their parents) and *decision trust* or the willingness to depend on someone else's decision even if that might come with negative consequences. "Trust is a facilitator of interactions among the members of a system, would these be human agents, artificial agents or a combination of both (a hybrid system)" writes Taddeo (2017, 565), drawing attention to trust and digital materials. However, trust is usually preceded by truth or truthfulness (Kohring & Matthes, 2007).

Truth is one of the great concepts in philosophy and has been discussed in the context of the practical value of truth (e.g., Charles Peirce), the anchoring of a proposition with reality (e.g., Ludwig Wittgenstein), or that truth must be a function of the relation between propositions (e.g., Harold Joachim) and more recently, that there can be multiple truths (e.g., Crispin Wright & Michael Lynch). Key though is that truth depends on language which is why language is also described as a truth-bearer (Glanzenberg, 2015). This is particularly important in the context of disinformation. If truth is dependent on language, truth is also dependent on the ability to understand the meaning of words or semantics (Pietroski, 2005).

Trust can lead to 'truth bias', which means that individuals believe information presented to them without displaying immediate scepticism. The context in which this bias occurs is important, as it is more prevalent in situations characterised by trust. Truth bias can lead individuals to believe any information they come across, and this can result in the acceptance of disinformation (Pantazi et al., 2018).

Distrust can paradoxically also lead to belief in disinformation due to the spontaneous consideration of alternatives that comes with a distrustful mindset. Individuals with a mindset of distrust may be more likely to consider alternatives, which can result in decreased belief in accurate information and increased belief in disinformation (Mayo, 2023). For instance, a study involving individuals who were anti-COVID-19 vaccinations were more likely to believe in 'alternative facts'. Although distrust can counter truth bias, it may also result in a greater acceptance of disinformation because of the tendency to entertain alternatives (Newman et al., 2022).

Ideally, individuals have an evaluative mindset that prioritises accuracy and critical assessment of incoming information (Pennycook, 2021). Individuals who adopt an evaluative mindset are better equipped to distinguish between true and false information, more likely to identify errors, and less likely to share false information. A critical thinking mindset may therefore reduce the likelihood of accepting and/or sharing false information (Mayo, 2023).

Trust in Visuality

The communication of information is socially and culturally bounded (Luhmann, 2000). Luhmann reminds his readers that communication is a complex interplay of experiences in the past and the present, that may be stored, while new information that is presented is added, combined, re-presented or may be amplified or perhaps corrected. Information as language may come in a variety of 'text' formats, including spoken, written as well as visual forms and different media formats carry different semiotic characteristics. Aiello (2020, 368) explains that to understand semiotics in text is to unpack their "hidden structures, underlying cultural codes, and dominant meanings of such texts both visible and intelligible".

In this article we take a specific interest in visuality, especially when the language of information communication is transferred through and perceived as images (still or moving) and the connection of visuality and educational practices around the topic of disinformation.

It has been documented for instance, that educational online users tend to trust the content presented in online images. Wineburg and McGrew (2016) found in their study that most high school students accepted photographs as facts without verifying them. Similarly, an exploratory study based on college students conducted by Kasra et al. (2018) showed that online users had a tendency to trust images on the web. Knowledge about the nature of the internet, combined with photo editing experience, and social media use were significant aspects to increase the evaluation skills of images. However, most social and heuristic indicators for online credibility, such as trustworthiness of the source, did not have a significant impact while trust ratings are positively influenced by people's existing attitudes towards a depicted topic (Shen et al., 2019). These observations support Luhmann's thinking. He points out that the "technology of communication […] constitutes a medium which makes formations of forms possible" (Luhmann, 2000, 2). Communicative exchange and what is received is thus dependent on the social and cultural experiences and how this entangles with the nature of the information shared. Returning then to visualisations, Luhmann's ideas explain how subjective the nature of experiences with imagery can be.

Visual communication, regardless of truthful content or manipulated images, has a subconscious affect on memory or attitudes and visuals are often perceived as more trustworthy. Visual information offers also shortcuts to obtain summaries of information, for instance, Zinko et al. (2020) examined the practices of academic reviewers when they are looking at text and visual content. They report that when there is too little written information people tend to trust images and when there is too much written text readers skip to visuals.

However, what happens when the content of the visual information has been deliberately tampered with or is used in ways to shape or distort the truthfulness of

content? The level of richness of audiovisual modality, i.e. whether still or moving images are used, may have an effect on the meaning that is being carried or distorted. Visual information may also be manipulated with varying degrees of creation methods (Weikmann & Lecheler, 2022). Infographics and data visualisations can increase the deception of visual disinformation if they are manipulated to distort or hide relevant data (Cairo, 2014).

The most severe form of visual disinformation are manipulated deepfake videos which operate at an increasingly sophisticated technological level typically involving artificial intelligence to fake audiovisual information to deceive viewers (Karnouskos, 2020; Sundar, 2008). Such an imitation of reality is concerning as it may erode people's trust in visual information presented by online media providers. This, in turn, can increase trust in visualisations created by journalists, politicians, and scientists, which can be dangerous (Weikmann & Lecheler, 2022). Weikmann and Lecheler (2022) argue that visual disinformation should be considered as a severe form of deception due to its unique format of production, processing, and effects when compared to textual disinformation.

Facing the Digital Turn: Pedagogy in an Age of Disinformation

Many scholars agree that education is the best antidote to the threat of disinformation (McDougall et al., 2019, Herrero-Diz et al., 2020). Roozenbeek, Culloty and Suiter (2023) structured counteracting interventions on a system level or individual level with four categories: “boosting (psychological inoculation, critical thinking, and media and information literacy); nudging (accuracy primes and social norms nudges); debunking (fact-checking); and automated content labelling” (Roozenbeek, Culloty & Suiter, 2023, 1).

Digital media technologies have intensified the complexity of the question of agency in relation to the young people's potential vulnerability to media - or their competences to use media (Dezuanni, 2017). ‘*Agency’* encompasses here the skills and knowledge about how media work and how to participate through media (Kotilainen & Arnolds-Granlund, 2010). Teaching multiliteracy means to recognise the extensive changes of consumption and media production practices. For example, participation in social media often involves the production and dissemination of images of oneself and of others, which raises new questions about responsibility, ethics and safety. Dezuanni (2017) emphasises that the media literacy or multiliteracy classroom must be a safe environment for performative variation. That means when we feel secure enough to express ourselves in different ways that we are likely to alter norms. Creating safe spaces in classrooms to promote differentiated perspectives, viewpoints and practices seems to be particularly important in connection to young people's participation in and with social media (Dezuanni, 2017).

Westheimer (2018) suggests the following steps for teachers: 1) teach students to ask questions, not to avoid controversial issues and that there is no single truth; 2) familiarise students with different perspectives to ensure they do not believe their own reality is universally valid; and 3) make global connections and encourage civic engagement.

Bühler et al. (2020) defined in their concept of social media information literacy (SMIL) a set of competences for individual social media users: 1) Recognize the need of information, 2) search information, 3) obtain information, 4) understand information, 5) evaluate information, 6) create information, 7) communicate information and 8) re-evaluate information. To apply SMIL to the context of learning about disinformation the authors add three sub-items: a) Identifying differences between headline and text-body of news, b) distinction of satire and fake news and c) identifying automated accounts or bots spreading information (Bühler et al., 2020). Heiss et al. (2023) expand on the SMIL concept, highlighting that certain dimensions can be developed through frequent use of social media, while other skills (such as evaluation and understanding) require formal education and training. This suggests that growing up with social media alone is insufficient for the development of multiliteracy (Heiss et al., 2023).

Counteracting disinformation through multiliteracy

Digital competences have been described as essential life skills, that include an understanding who and what is co-shaping one's digital identity and how one can safely navigate through online environments (Abu-Fadil, 2018). Increasing hate speech, xenophobia and attacks on refugees or humans of 'other' religions, ethnicities, sexual orientation or of skin colour, based on stereotypes fuelled by manipulated statistics, populist rhetoric and misleading news that do not address the standards of journalism, contribute to a toxic mix that digital competences should tackle. The development and use of artificial intelligence makes this goal even more difficult to achieve (Abu-Fadil, 2018). UNESCO's work on digital competences covers news literacy, advertising literacy, computer literacy, intercultural literacy, privacy literacy, civic literacy, social media literacy, social and emotional literacy; etc (Grizzle et al., 2021). Key elements of media and information literacy are described as defining information needs, locating and accessing information, assessing information, organising information, making ethical use of information, communicating information and using ICT skills for information processing (Grizzle et al., 2021).

As it is beyond the scope of this article to discuss the variety of definitions of critical digital media literacies, this article refers to the understanding of multiliteracy. Since the skills and knowledge required for educational interventions span a range of areas, the term multiliteracy is helpful as an "umbrella term encompassing concepts such as media literacy, visual literacy and advertising literacy" (Kangas &

Rasi, 2021, 3). Multiliteracy is described as the ability of using different tools to combine, acquire, modify, produce, understand, present and evaluate information in different contexts, ways and situations. One aim of teaching multiliteracy at school is that pupils are able to use digital technologies for self-expression and interaction as well as to learn to operate responsibly in the use, production and sharing of content in different formats (Kangas & Rasi, 2021). Implementing multiliteracy in schools increases the development of critical thinking and building skills while using traditional media as well as in digital environments. Dimensions of multiliteracy encompass the use and assessment of different sources as also further the production, presentation and dissemination of information (Rasi et al., 2019). While some researchers see multiliteracy as a pedagogical approach, we understand it as a set of various digital competences and critical media literacy.

The next sections will describe the evaluation of the above-mentioned theoretical aspects of the revised framework applied in a practical implementation in secondary schools, together with pupils and teachers.

Multiliteracy through Phenomenon-Based Learning

The question of pedagogy is closely connected with the discussion of teaching and learning of multiliteracy. Scheibenzuber et al. (2021) conducted a study on students' trustworthiness towards disinformation news using a problem-based literacy training course. The results indicated a significant decrease in undergraduate students' fake news credibility. The study suggests that problem-based online courses can be effective in combating disinformation illiteracy. Open learning environments have been demonstrated to facilitate the acquisition of both conceptual knowledge and abilities in a variety of domains. These approaches promote the development of skills such as information reception, analytical processing, source reliability assessment, acceptance, cognitive integration, including cognitive dissonance, and knowledge sharing (Scheibenzuber et al., 2021). Hintermann et al. (2020) took a similar approach with geography lessons, where pupils in Austria worked independently on a project question. The aim of the project was to increase critical media skills. The results show that students say they would interpret media stories more critically, rethink their social media practices and be more careful about the content they like or share (Hintermann et al., 2020).

Similar to problem-based learning, phenomenon-based learning origins from constructivism with strong connections to inquiry-based learning. Phenomenon-based learning (PhBL) describes a pedagogy where students work in groups and explore a phenomenon. To understand the meaning of a phenomenon based approach it is useful to revisit cornerstone ideas from phenomenologists like Maurice Merleau-Ponty or Edmund Husserl who focus on consciousness as embodied that requires “perception, thinking, and judging” (Schaffar & Wolff, 2024, 3). Thus taking a team

based approach to investigate a question is essential to PhBL since this should encourage the exchange of different perspectives. Phenomena are typically not reducible to a single subject, and solving complex challenges affords input from different (cross-curricular) disciplines. The pedagogical approach then focuses on learners investigating and solving problems using their own research questions. Phenomenon-based learning suggests that pupils identify information by themselves, evaluate and compare sources of information and summarise their findings possibly creatively for instance by using digital tools.

Set in a 21st century classroom, where investigations usually demand the use of online information this should support the acquisition of basic multiliteracy. Teachers take on the role as facilitators, collaborators and at times as co-investigators (Lonka, 2018; Kangas & Rasi, 2021) because working on complex real world problems requires high pedagogical flexibility and the realisation that teachers will not know in advance what knowledge, attitude or skills their students will need in the future (Schaffar & Wolff, 2024). And teachers never know what bodies of knowledge, cognition and attitudes future students will need. It is crucial to highlight that the success of phenomenon-based learning depends largely on the right balance between pupils' prior knowledge and problem solving skills as well as their experience in collaborative self-regulated learning, on the one hand, and the instructional support by the teachers, on the other (Scheibenzuber et al. 2021).

We are presenting here a study set in the Austrian school education context where a phenomenon-based learning approach is still largely unheard of. Based on the the suggestions of Kangas and Rasi (2021, 354), we followed suggestion for a practical teaching intervention of phenomenon-based learning of multiliteracy through the following steps:

> (1) Teachers Co-Design: Before teaching, two (or more) teachers get together and define their topic, goals, teaching and learning strategies and criteria of evaluation.
>
> (2) Teachers explain the procedure of the project and start with a stimulus to arouse pupils’ interest.
>
> (3) Planning: Pupils start to work independently in small groups, choose their project question and create a timetable.
>
> (4) Checkpoint: Whenever needed, pupils and teachers discuss questions.
>
> (5) Exploration: Pupils search for online information and compare different sources, trying to answer their project question.
>
> (6) Analysis and report: Pupils try to find an answer to their project question. They produce a report with the creative use of digital tools, such as a podcast, a blog or a video.

(7) Lessons learnt: Results are presented in class and published online. Pupils reflect their learning process and the results. Teachers assess the digital reports and pupils evaluate themselves and/or classmates.

(8) Teacher reflection: Involved teachers discuss the learning process and compare the results with the defined learning goals from step 1.

These steps of PhBL strongly connect to disinformation literacy: On a *pedagogical level*, these practical steps align with the theoretical areas presented above, including teaching pupils to ask questions, familiarise pupils with different perspectives and to make global connections (Westheimer, 2018). On a *competence level*, these steps address the required skills elaborated in the theoretical SMIL concept above: Recognize the need, search, obtain, understand, evaluate, create, communicate and re-evaluate information (Bühler et al., 2020). Or, in other words, to assess, analyse and evaluate different forms of media content (Trninić et al., 2022).

We will now present the details of the study.

Context and Research Design

The implementation of phenomenon-based learning on the topic of disinformation took place in Austria, in the federal state of Styria, between May and June 2023 with 3 schools.

The project started with an initial meeting with the teachers at each of the three schools, to discuss the details of the planned teaching sessions including ways to detect disinformation. The project topics the teachers had planned included migration, climate change, and literary history. The researchers provided a practical teaching guide (in German) that included a list of digital tools, lesson plan blueprints, and a handout on fact-checking for children. Following the teacher's input on a given topic, pupils worked independently in small groups on a self-selected subtopic, such as climate change, migration and asylum or history of literature. The pupils choose their own project question from the subtopic. They were asked to explore a variety of information sources, including social media, and to present their findings. The researchers observed only and did not participate in the lessons.

The first school implemented project work on ‘climate change’ with the subjects geography and computer science (with 13 pupils and 2 teachers). The second school implemented a project on ‘migration and asylum’ in geography and German (with 23 pupils and 2 teachers). The third school implemented a project in four classes on ‘literary epochs’ in German (with 71 pupils and 4 teachers). 8-10 teaching lessons per class were observed. Two classes implemented the unit over a 4 week period, one class blocked two half-days.

The study was conducted as a video ethnography, with the goal of comprehending the realities encountered by the individuals (Brewer, 2000). We conducted video observations and recorded fieldnotes from 6 classes, observing a total of 17 teaching lessons in 2023 in 3 different secondary schools in Austria (Styria). There were a total number of 8 teachers and 107 pupils.

	School 1	**School 2**	**School 3**			
Class	1.	2.	3.	4.	5.	6.
Project Topic	Migration, Asylum	Climate Change	History of literature	History of literature	History of literature	History of literature
Pupils	n = 23	n = 13	n = 21	n = 17	n = 16	n = 17
Age	14-15 years	12-13 years	16-18 years	16-18 years	16-18 years	16-18 years
Duration	13 hours	10 hours	9 hours	8 hours	10 hours	9 hours
Subjects	Geography, German	Geography, Computer Science	German	German	German	German
Teachers	n = 2	n = 2	n = 4			

Table 1: Overview of project classes in secondary schools during the project.

After the implementation, we conducted semi-structured interviews with 36 secondary school pupils (16 male, 20 female) aged 12 to 18 years. In the interviews, pupils were asked about their experiences of the phenomenon-based teaching lessons. Additionally, 8 teachers were interviewed (6 female, 2 male) aged 26-45 years who had between 2 to 20 years teaching experience. The teachers were asked about their impressions using a PhBL approach to learn about disinformation.

The video ethnography started the analysis with the observer's subjective recordings (fieldnotes) during classroom observations (Nunn, 2011) before working with recorded episodes in order to examine or re-examine situations, to highlight the underlying fundamental connections, actions and interactions (Otrel-Cass, 2018; Klette, 2009).

We conducted a content analysed of the interviews and the fieldnotes using the following inductive categories (Mayring, 2014): positive and negative aspects of PhBL

project, role of pupils and teachers, planning, implementation, motivation and effort, multiliteracy and sources, digitaltools, support, learning environments, materials and handouts, learnings and suggestions. In the next step, we selected the lesson videos and written observations according to moments of trust. In the following analysis, we differentiated between trust in human and technological actors.

We selected the participants through an initial contact with three interested teachers from Styria, who then informed their teacher colleagues about the project idea. The teachers asked for the approval of the principles. The teams of teachers then jointly selected suitable classes with pupils.

Results and Findings

The results section is divided into two parts: First we present our findings highlighting moments of trust in connection with visuality of digital information. Then, we summarise the findings from the phenomenon-based learning observations.

Trust and Visuality

In our analysis of the video-based and written classroom observations, we identified six themes:

- Trust based on Professional Layout and Design
- Distrust through Unprofessional Layout and Advertising
- Visual Attraction and Holding Power
- Copy-Paste Visuals
- Social Media and Emotions
- Accelerated Information Processing

The following video sequences present and illustrate the themes. All names used are pseudonyms.

VIDEO VIGNETTE A - Trust based on Professional Layout and Design
The evaluation of sources was often based on a professional looking visual design of websites. The following examples show sequences where pupils appeared to trust professional looking visual information and trust symbols.

VIDEO VIGNETTE B - Distrust through Unprofessional Layout and Advertising
Pupils were less trusting if the websites looked unprofessional and if they contained a lot of advertising.

VIDEO VIGNETTE C- Visual Attraction and Holding Power

In addition to trust and distrust, the observations showed that pupils spent a significant amount of time with visual information. Visuals seemed to have ‘holding power’ (Lim et al., 2011). The sequences show pupils looking at pictures and videos for a long time.

VIDEO VIGNETTE D- Copy-Paste Visuals
We observed that many pupils instead of typing information, took screenshots of text and picture information as part of their data collection and pasted it into their working documents.

VIDEO VIGNETTE E - Social Media and Emotions
In the observations it emerged that emotionally charged content has strong effects on pupils’ opinions, especially when they include information from social media. Emotions can trigger strong reactions and also unconsciously influence opinions and attitudes.

VIDEO VIGNETTE F - Accelerated Information Processing
During their search for information, we observed at times superficial and accelerated search behaviour. It seems that the speed of finding information is more important than checking the quality of the information. A pupil said for example: "I take any websites that come up and click on the first or second link. That usually works", said a 17 year old girl. Another 17-year old boy said: "All that reading is difficult. First you have to find out what's important and correct". A 12-year old boy commented: "Google ranks the right sources higher. The search results further back are often wrong". Artificial intelligence (e.g., Chat GPT) is used like a search engine and they trust the results.

Classroom Implementation
This section summarises the implementation of phenomenon-based learning (PhBL) as a practical teaching intervention to address disinformation in secondary schools. We implemented a revised adaptation of the pedagogical framework to the Austrian context in secondary schools. The interviews with pupils, teachers and the observations indicate that PhBL is a practical teaching intervention for enhancing multiliteracy and addressing disinformation. Based on the observations and interviews we saw that PhBL supports pupils' development of multiliteracy, technical skills, and time management. Pupils' autonomy enhances their motivation and critical reflections on online sources. Teachers were able to provide individual support as expert coaches although they needed time to feel confident in that role. After the intervention, pupils reported increased scepticism towards online and social media information. Teachers suggested a project to last 8-12 lessons and appropriate for students aged 12/13 years and above.

Teachers reported difficulties in convincing pupils to adopt new ways of learning and to motivate them to use new digital tools. However, the time and effort required for

PhBL is similar to that of regular lessons. The teacher suggests using best practice examples to inspire pupils. At the end of the project, teachers were impressed by the creativity and quality of the pupils' digital results. They highlighted that PhBL is a cross-curricular and subject-unspecific teaching intervention. Multiliteracy was practised, allowing the simultaneous teaching of subjects' content. Therefore, PhBL appears to be suitable for almost every school subject. According to the teachers, it was nice to see pupils working independently and discussing intensively - "that rarely happens in regular classes" (T1). Phenomenon-based learning is an approach that is "very suitable and sustainable and should be done repeatedly" (T8) and is - beside the training of multiliteracies - also well suited to prepare pupils for a digital future.

The pupils reported enjoying independent project time management, working in small groups, and having the freedom to choose their project topic. During the group work phases, pupils were challenged to ask questions about the given topic. They emphasised that they rarely have to make their own decisions, but that this is a valuable "preparation for real life". As one pupil puts it, tt is beneficial when "pupils are taught to make their own decisions" (P9). However, they experienced difficulties in narrowing down their chosen topic, finding their own questions and to evaluate different sources. Despite this, pupils said they felt more motivated and productive compared to regular lessons. The primary search strategy involved comparing various websites to find reliable information.

During the source evaluation phase of the projects, pupils assessed, analysed and evaluated different forms of media content from different sources. This has encouraged pupils to engage with different opinions and perspectives. Especially for younger pupils it was not so easy to "compare sources, because there was often not the same information on the websites - we wrote down when we found the same information twice" (P13). Information found on social media was also cross-referenced, but its low quality was taken into account. The pupils were initially sceptical about experimenting with new digital tools, but they emphasised the benefits of mutual learning in small groups. Following the project, they reported an increased willingness to try out new tools and to be more critical of online sources. The pupils learnt about new tools and also created and communicated their results creatively. At the end of the project, they were happy to have "tried out something new" and enjoyed the creative work (P8). They also had to embed the results in a complex context of the topic and create connections. One group, for example, addressed the topic of deforestation in the rainforest and its relation to the use of palm oil in food in their report.

Discussion

In this article we set out to answer two questions. This first question was: How does the “phenomenon-based learning” (PhBL) approach support to build pupils’ multiliteracies?

Our results indicate that phenomenon-based learning (PhBL) seems to be a practical teaching intervention to support pupils' development of multiliteracy, technical skills and time management. We were able to witness the stages of exploration and analysis, as part of the PhBL process as outlined by Kangas and Rasi (2021). The authors highlight the importance of those steps to acquire the competences required to be aware of disinformation. The results illustrate the practice of searching for information, evaluating, reflecting, analysing and creatively presenting information using digital tools (Bühler et al., 2020). This included that pupils had the freedom to ask their own questions, to reflect on different perspectives from different sources and to find conclusions on complex issues (Westheimer, 2018). The autonomy - that the PhBL approach gave pupils during this project supported self-management skills and motivation. Pupils were not presented with the answers, but instead had to work them out for themselves. In contrast to subject-specific literacy interventions, PhBL is subject-unspecific. This implies that multiliteracy can be addressed not only in computer science subjects, but in all subjects (Kangas & Rasi, 2021).

We also identified challenges in this teaching intervention. The topic of disinformation and the pedagogical approach of PhBL were new to the participating teachers and pupils. They need exercise and practice to apply open pedagogy and practice in interrogating online information. This became clear when we observed that most groups completed their tasks collaboratively, while in some cases tasks were divided amongst group members and completed 'side by side' (cooperatively). However, collaboration is necessary in PhBL to support the dialogic exchange of thoughts and discuss and reflect with each other (and with teachers) in case of irritations and uncertainties (Lonka et al., 2018).

Teachers observed also that some pupils relied on a single source in their investigations. It is unclear if this was simply because the pupils wanted to complete their tasks quickly, were satisfied that the information could be trusted and enough to answer their questions or if they were too uncertain about other information they came across. However, is crucial to use and compare multiple sources during the source evaluation process to develop fact-checking skills (Bühler et al., 2020). This practice is essential for identifying and being aware of disinformation.

Each lesson started with an introduction by the teacher sharing an checklist about dealing with disinformation. The handout included a brief overview of topics such as searching for sources, evaluating online sources and tips on recognising disinformation (handout in the appendix). But the pupils reported that they rarely if

ever used this handout. They appeared to make decisions, based on their experiences. At times though they checked with their teachers. This highlights the importance of the teacher's role to develop the multiliteracy of the pupils.

Studies suggest building multiliteracy as early as possible (Fasching & Schubatzky, 2022; Herrero-Curiel & La-Rosa, 2022). However, in the initiation phase for this research, some teachers or principals felt that younger pupils (10/11 years) did not yet have the necessary maturity. They said that their pupils still needed to learn about digital basics (opening browsers, saving documents, etc.) before evaluating different information sources. However, this ignores the fact that many young people consume information of different kinds earlier on and would need media education at a younger age (Herrero-Curiel & La-Rosa, 2022).

The second question we had was: What role plays visuality and trust when pupils work with different digital sources?

We found that pupils faced challenges in identifying what seemed a reliable source to them. Although information was easily available, it was difficult for pupils to discern trustworthiness. In our first vignettes we identified that professional layout, symbols and design during the source evaluation created trust amongst pupils, regardless of the quality of the content (Aiello, 2020). Conversely, unprofessional design and a high number of advertisements seemed to lead to distrust. Generally, pupils were attracted to visual information, resulting in holding times (e.g., the three girls and the polar bear in vignette three). Visualising materials in form of copying of images or taking screen shots was a widely used practice. This observation was characterised by accelerated and sometimes imprecise collecting of information such as using Google Snippets. Additionally, we could confirm that visually conveyed emotions seemed to have a strong influence on pupils, particularly when using social media. This became evident in the vignettes with the girls working on the topic of migration. However, evaluating sources primarily based on visual information may be unreliable and dangerous (Weikmann & Lecheler, 2022).

A core element in raising awareness of young people to disinformation is the evaluation of different sources of information (Heiss et al., 2023; Bühler et al., 2020). The main aim is to find out who they can or should trust using an evaluative mindset (Mayo, 2023; Pennycook, 2021). This is why we focussed in our analysis on moments of trust and distrust during the project. In doing so, we focussed on critical situations in the assessment of trust or distrust among the participating pupils that appeared during classroom implementation. In our analysis, we differentiated between trust and distrust in human and technological actors. We were able to identify two relevant levels for trust during the evaluation of sources by pupils: Proximity and accessibility. We found that a higher proximity to human actors creates trust, while higher accessibility to technology (e.g., visual information) enhances trust to digital information (shown in Table 2).

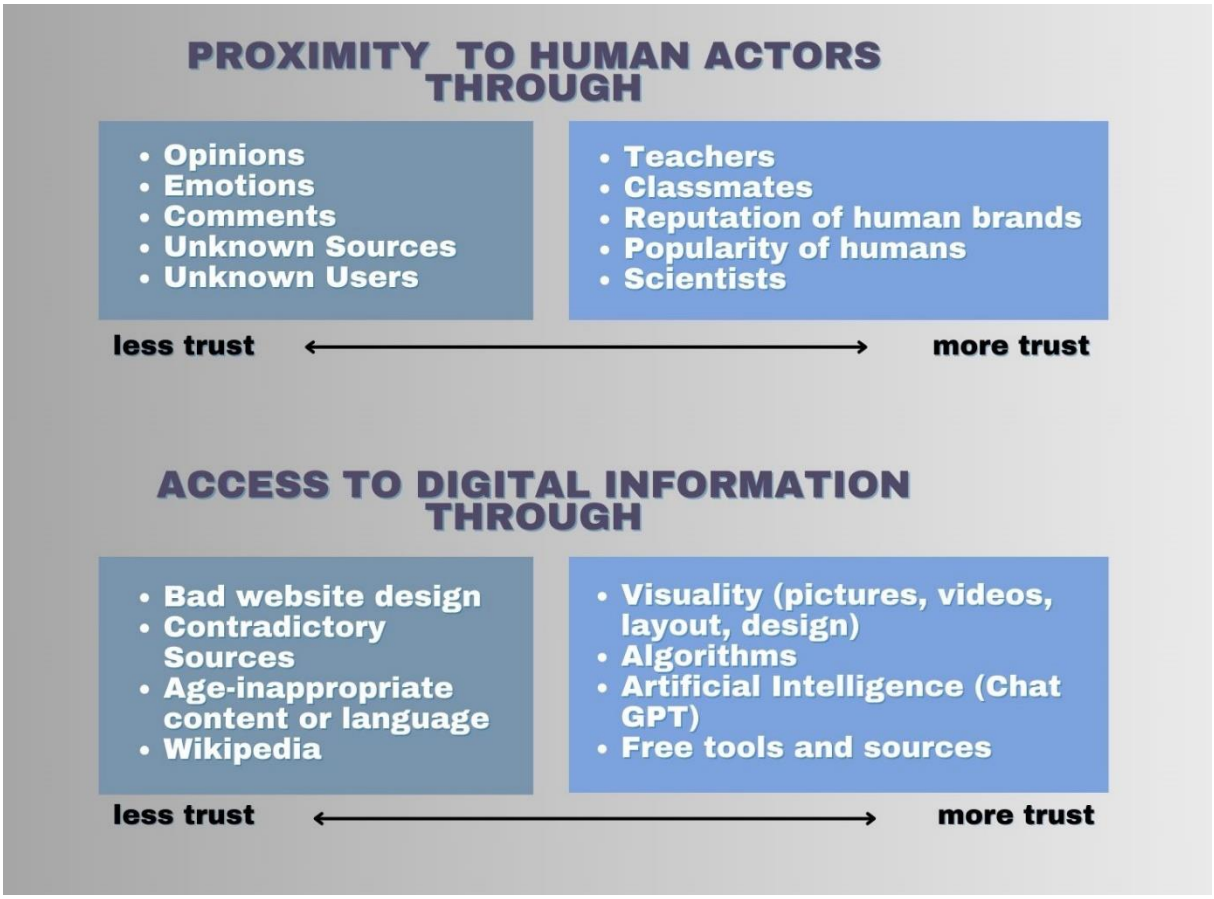

Table 2: Trust in human actors and digital information with the levels of proximity and accessibility.

During project lessons in class, pupils practised evaluating sources together. It became evident in several situations that trust was established through proximity to other humans, whether it be to well-known individuals (such as teachers or pupils) or what was identified as a trustworthy organisation (such as WWF) or reliable media companies (e.g., a local newspaper the Salzburger Nachrichten). Even though it was difficult to identify, the pupils categorised scientific sources as trustworthy. We were able to detect distrust in human actors whose statements were identified by pupils as emotional or as opinions (e.g., social media posts). Pupils also categorised comments (e.g., in forums like netmoms.de) as untrustworthy. The distance to unknown sources or unknown users was also rated as distrustful. This evaluation strategy of the pupils seemed to be practicable in most cases when dealing with disinformation.

Access to technology-provided information played a significant role in developing trust. Visual information in particular (e.g., pictures or videos) had the power to create trust among pupils. The layout and design of websites also contributed to the perception of trustworthiness, often regardless of the content. Pupils frequently chose a source based on its appealing and professional layout. However, the ease of access and findability of the first search hits on Google (or preview snippets), which are prioritised by algorithms, could also create trust. Some pupils even stated that

the first search hits are always trustworthy. Nevertheless, the accessibility of artificial intelligence (e.g., Chat GPT) and the easy consumability and availability of summarised information were also rated as trustworthy by some pupils. In addition, free of cost and accessible databases (e.g., newspaper archives) were frequently used as sources of information. At the technological level, distrust became recognisable as soon as websites were classified as (visually) dubious. In some cases, pupils were even able to find contradictory information in digital sources. Inaccessibility was evident when language or content was not age-appropriate (e.g., complicated language, complex graphs or statistics). A frequently observed distrusted technological actor was Wikipedia.

Conclusion

Our findings show that phenomenon-based learning (PhBL) seems to be a pedagogy that offers ways to support learning about disinformation in secondary schools in Austria. We were able to identify evidence of multiliteracy, technical skills and self management. From the pupils' feedback it seemed that they appreciated the autonomy during the learning process which in turn enhanced their motivation in general and more specifically, dialogic critical reflection of online information they retrieved. In the interviews pupils said that they were more sceptical of online and social media sources after their lessons. The implementation of phenomenon-based learning highlights that Austrian's educational traditions seem to not (yet) support the demanding needs of a cross-curricular approach. It seems obvious that teachers and pupils will need time and practice to feel more familiar and confident in interdisciplinary open learning and teaching (Clinton-Lisell, 2021).

We identified two relevant levels for trust amongst pupils: Proximity and accessibility on a human and technology-based level. Trust arises through proximity to humans, such as teachers or classmates. Easy accessibility also creates trust to technologies, such as visuals or algorithmic provided information.

The findings showed that the information checklist that was provided at to each class about identifying and addressing disinformation was seldomly used. We found that the evaluation of information was often based on the visual aspects and design of websites. Pupils were less likely to trust websites that looked unprofessional or contained excessive advertising. Advertising was one of the things highlighted in the checklist about disinformation. Pupils were therefore already aware of this through their prior experiences. The observations indicate that pupils were at times drawn to visual information, looking at pictures and videos for extended periods. We found that emotionally charged content, particularly when using social media, shaped pupils' opinions not to trust the content. This was another aspect, that was discussed in the information about disinformation. Our observations indicate that, at times, individuals engaged in superficial and accelerated search behaviour during their

information search. The speed of finding visual information appeared to take precedence over verifying its quality. This correlates with the observation that pupils, instead of typing information, took screenshots of text and picture information to include in their working documents. They visualised text blocks and shortened the time to collect information.

However, the pedagogical set up supported dialogue between the pupils. Dezuanni (2017) states that media literacy has the highest impact when young people are able to talk about, through and with media concepts and technologies. In conclusion we found that teachers as well as pupils were motivated to do their online research supported through the open pedagogy set up of phenomenon-based learning. The search process seemed characterised by acceleration (Rosa, 2023). However, visuals seemed to have holding and attraction power that appeared to slow things down. The information about disinformation the pupils received through their teachers was hardly ever used perhaps because it was perceived to slow the process of collecting information down. However, future work may look into emphasising this pausing and checking practice to see how this can prompt pupils to think about the truthfulness of online information.

Limitations

A limitation of the results is the qualitative nature of the analysis. The validity of the collected information is highly dependent on the quality of the expressed reflections of teachers and pupils in the interviews and highlight their self-reflection. Our data doesn't show whether the pupils apply the multiliteracy competences we observed also in other contexts. The participating schools were from small rural towns , maybe pupils in urban schools show different abilities. The youngest pupils were 12 years, it would be interesting to include 10-12 year olds since many of them are already active users of online information. Finally, we were not allowed to film or photograph in one of the three schools and instead collected hand-written fieldnotes. However, those observations aligned with what we observed in the other two classrooms.

Ethical Approval

The compliance with ethical standards was approved by the University of Graz Ethics Committee (reference GZ. 39/79/63 ex 2019/20).

Disclosure Statement

No potential conflict of interest was reported by the authors.

ORCID

Michael Reicho https://orcid.org/0000-0002-1763-6297
Kathrin Otrel-Cass https://orcid.org/0000-0003-2027-0772

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4.4. **Article 4:** How Phenomenon-Based Learning May Help Counteract Disinformation: A case presentation from Austrian Secondary Schools

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How Phenomenon-Based Learning May Contribute to Counteract Disinformation: A case presentation from Austrian Secondary Schools

Michael Reicho[1]

[1] Institute of Education Research and Teacher Education, University of Graz, Austria; michael.reicho@uni-graz.at

Correspondence: Michael Reicho: michael.reicho@uni-graz.at, ORCID: https://orcid.org/0000-0002-1763-6297

Abstract:

The distribution of disinformation in online environments poses an increasing risk for pupils to be confronted with manipulated content. As a pedagogical strategy for schools, phenomenon-based learning (PhBL) is said to train a variety of required digital competences. This article aims to describe PhBL as practical teaching intervention to address disinformation in secondary schools. PhBL is a cross-curricular and subject-unspecific teaching intervention with a suggested duration of 8-12 teaching lessons and an appropriate age starting from 12/13 years. This investigation included that teacher organized project-oriented activities. The evaluation comprised semi-structured interviews with pupils (n=36) and their teachers (n=8) as well as video-based classroom observations in six classes with 107 pupils. The findings indicate that the teaching approach supported pupils compare information sources, evaluate credibility indicators, and act criticaly as online consumers. After the intervention pupils said that they felt more sceptical of online and social media information.

Keywords: Disinformation, Phenomenon-Based Learning, Multiliteracy, Secondary School, Teacher Education, Fake News;

Introduction

A number of recent developments around the world have highlighted that fake news is one of the biggest threats facing the world today. Easy access to online technologies makes young people particularly vulnerable to disinformation, so it is important to equip them with the skills and confidence to identify manipulated content (Grizzle et al., 2021, Skipper et al., 2023). In relation to education, the key principle for addressing disinformation is to encourage and develop critical thinking and engagement through and in education (Carr et al., 2020). A recent study has highlighted that possessing information literacy significantly increases the likelihood of identifying disinformation (Jones-Jang et al., 2021).

We therefore need an awareness-raising of digital competences already at a young age in schools (Loveless & Williamson, 2013; Burnett & Merchant, 2011). Phenomenon-based learning (PhBL) is said to train a variety of digital competences that are required to counteract fake news (Lonka et al., 2018; Kangas & Rasi, 2021). I therefore investigated PhBL with pupils and teachers in Austria to see how open project teaching and learning based on PhBL principles trains critical media literacy and how it raises awareness against disinformation, leading to the following research question: *What effect has 'phenomenon-based learning' on building critical media literacy to counteract fake news?*

Understanding Fake News

Fake news are frequently defined as "fabricated information that mimics news media content in form but not in organisational process or intent" (Lazer et al., 2018, 1094) or as information, "that is intentionally and verifiably false, and could mislead readers" (Allcott & Gentzkow, 2017, 213). Other researchers have expanded the narrowly defined understanding with "poor journalism, political propaganda, and misleading forms of

advertising and sponsored content" (Nielsen & Graves, 2017, 1). Since fake news has become a buzzword to delegitimize opponents, scholars have begun to use the term disinformation instead (Egelhofer et al., 2020). Researchers differentiate between misinformation, disinformation, misleading information or malinformation: Misinformation is the distribution of false information without any intention to cause harm. Disinformation is the deliberate circulation of false information with the intention of causing harm. Malinformation occurs when genuine information is spread in order to cause harm, often by information that should remain private but enters the public discourse (Wardle & Derakhshan, 2017). Roozenbeek and van der Linden (2022) summarise misleading information as not necessarily being factually incorrect, but instead may misrepresent facts, ignore relevant context or contain a logical fallacy. Disinformation is often characterised by an extensive, uncontrolled or even systemic dissemination (Bradshaw, 2021), in many cases originating from populist groups (Hameleers & de Vreese, 2021) and frequently founded on rumours, prejudice, stereotypes, and fear, and is used as a tool for manipulation, persuasion and deception (Carr et al., 2020).

Digital Youth: Between digital native and digital naïve

Young people's media use behaviour is often portrayed in contradictory ways. On one hand, children are often viewed as vulnerable and in need of protection. On the other hand, they are depicted as pioneers who are active, competent, and seem to have an almost natural talent for media use (Hagen, 2003).

A recent EU-funded study from Austria with 400 pupils aged 11-17 years shows that half of young people pass on news on current topics unchecked and 53% feel that checking information sources is a hassle. In everyday life, it is often found that the most common strategy for dealing with disinformation is to ignore it (57 %). 70% of young people find it challenging to determine the validity of information found on the internet. Nearly half of the respondents are frequently uncertain about the accuracy of online information. Additionally, 62% of Austrian youth are unaware of any fact-checking websites (saferinternet.at, 2023).

Although young people have integrated social media into their daily routines, evidence suggests that the term 'digital natives', which implies that all young people are competent in the use of digital information, is a myth (Bennett et al., 2008). A report evaluating online information use among high school, middle school, and college students concludes that "*our 'digital natives' may be able to flit between Facebook and Twitter while simultaneously uploading a selfie to Instagram and texting a friend. But when it comes to evaluating information that flows to social media channels, they are easily duped*" (Wineburg & McGrew, 2016, 4). The assumption that young people are inherently tech-savvy is often based on their exposure to digital technologies from a young age. However, access to technology alone does not fully determine the nature of young people's technological skills (Loos et al, 2018).

Teaching and Learning against Disinformation

Many scholars argue that education is an effective way to counter disinformation (McDougall et al., 2019; Herrero-Diz et al., 2020). Roozenbeek et al. (2023) categorised counteracting interventions into four categories, either on a system-level or individual-level: *"debunking (fact-checking); boosting (psychological inoculation, critical thinking, and media and information literacy); nudging (accuracy primes and social norms nudges); and automated content labelling"* (Roozenbeek et al., 2023, 1). Westheimer (2018) pointed out three ideas that should be taken up by educators: (1) Teach students to ask questions rather than avoid controversial issues and to understand that there is no single truth. (2) Familiarise them with different perspectives to ensure they do not believe their own reality is universally valid. (3) Encourage global connections and civic engagement.

As this paper does not aim to discuss the various definitions of critical media literacies, it will refer to the concept of multiliteracy. Multiliteracy is an "umbrella term encompassing concepts such as media literacy, visual literacy and advertising literacy" (Kangas & Rasi, 2021, p.3). Multiliteracy is the ability to use various tools to produce, combine, acquire, modify, understand, present, and evaluate information in different contexts, ways, and situations. Teaching multiliteracy at school aims to enable pupils to use digital technologies for self-expression and interaction, while also learning to operate responsibly in the use, production, and sharing of content in different formats (Kangas & Rasi, 2021).

Phenomenon-Based Learning to strengthen Multiliteracy

Following these thoughts, phenomenon-based learning (PhBL) seems to address these theoretical demands. Phenomenon-based learning refers to cross-curricular learning activities in exploring a real life phenomenon from multiple perspectives in different disciplines. According to PhBL, learners should seek information independently, compare and evaluate sources of information, and creatively present their findings using digital tools. Teachers are seen as facilitators that encourage their pupils (Lonka, 2018; Kangas & Rasi, 2021).

Following the suggestions of Kangas and Rasi (2021), phenomenon-based learning of multiliteracy might be implemented as follows: (1) Prior to teaching, two or more teachers collaborate to define their topic, goals, teaching and learning strategies, and evaluation criteria. (2) Teachers introduce the project and use a stimulus to engage students' interest. (3) Planning: Pupils work independently in small groups, selecting their project question and creating a timetable. (4) Whenever necessary, pupils and teachers discuss questions in checkpoints. (5) Pupils explore online information and compare different sources to answer their project question. (6) Pupils analyse their findings and produce a report. The pupils try to answer their project question by producing a report utilising digital tools creatively. (7) The results are presented in class and published online, and the pupils reflect on their learning process and outcomes. (8) The learning process is reflected discussed by the teachers involved, and the results are compared with the learning goals defined in step 1 (Kangas & Rasi, 2021).

Other scholars agree to these key aspects, as for example described by Leu et al. (2013): (1) define important questions (2) locate online information, (3) critically analyse and evaluate online information (4) synthesise online information and (5) writing to communicate or distribute online information (Leu et al., 2013). These considerations are also closely linked to the social media information literacy (SMIL) concept (Bühler et al., 2020).

Methods and Sample

This article describes phenomenon-based learning as practical teaching intervention to address disinformation in secondary schools. In a previous step we revised this teaching intervention with expert interviews (n=19) to adapt it to Austrian secondary schools adding the focus of disinformation (Fasching & Schubatzky, 2022). The implementation took place in May and June 2023 with three different schools in Styria.

I conducted video-based and written classroom observations of 6 classes in 17 teaching lessons with a total number of 8 teachers and 107 pupils. After the project I conducted qualitative semi-structured interviews with 36 secondary school pupils aged 12 to 18 years. At the same time, I also conducted semi-structured (online) interviews with 8 teachers aged 26-45 years with a range of 2 to 20 years of teaching experience (Helfferich, 2014). I evaluated the interviews and classroom observations with a content analysis with inductive categories (Mayring, 2014).

Results and Findings

This section describes the main findings from the evaluation and feedback from pupils and teachers. Other details of this research are published elsewhere.

Opportunities and Challenges during Implementation

After the project, the teachers described phenomenon-based learning (PhBL) as a meaningful teaching intervention. PhBL seemed to train multiliteracy and to raise awareness to disinformation. The teachers noted that both they and the pupils enjoyed the independent work and in-depth discussions, which are “not always possible in regular classes” (T1). Some teachers said that they "would definitely recommend it to colleagues" (T7) and in general "are always looking for approaches to keep pupils motivated over a longer period of time" (T2). Phenomenon-based learning is a “sustainable approach that should be repeated” (T8).

Regarding the motivation of the pupils, the teachers reported at the beginning of the project a level of scepticism among the pupils. "It was difficult for them to find their way into the work" (T4). By the end, "pupils

were more motivated compared to regular lessons" (T4) and "pupils invested a lot of time" (T2). Most of the pupils confirmed their teacher's impression, stating that they were more motivated and therefore more productive because they were able to choose topics based on their own interests.

The teachers' biggest challenge was to slip into an unfamiliar 'passive' role as expert coaches and "to take themselves back and let pupils work" (T6). It seems important that teachers learn to trust their pupils - "believe in the pupils, give them freedom and they will surprise you with impressive results" (T8) and even rather weak pupils can "develop and you see qualities that you wouldn't otherwise notice" (T8). The observations showed that the most important tasks of the teachers were to explain how to evaluate information sources, to introduce (new) tools and to answer questions. During the phases of independent work, teachers also had more time for detailed feedback and for coaching pupils according to their individual needs. One teacher "refreshed instructions on how to give good feedback" (T2).

The interviewed pupils said that they appreciated having free choice of topics based on their own interests. Many also valued the freedom to be creative and the contrast to normal lessons. The pupils emphasised that it is good when "pupils are taught to make their own decisions" (P9). At the same time, finding and narrowing down the topics was a major challenge for the pupils. Many pupils said that they were a bit uncertain about the choice of topics and the scope of the results at the beginning. Teachers report that pupils are not experienced in being asked about their personal interests during class.

As one teacher put it: "As teachers, we may sometimes provide answers to questions that do not interest our pupils. This can result in a situation where only one person speaks, and in the worst case, no one listens. However, this threat can be reduced through projects like this" (T2).

Working independently in small groups had a positive impact on most pupils as they were able to assist each other. The "project is perfect to practise working independently" and for many the collaborative "work in small groups is a support" (T4). Some pupils prefer frontal teaching, some like to work freely - so "a variety in general is certainly a good idea" (T5). However, task division was not always efficient and sometimes tasks overlapped. In general, pupils enjoyed the free management of time without pressure. "It is more fun and you memorise more when you work independently" (P1). Pupils admitted that they did other things during the lesson, but in return some of them met in their free time to work on the reports. During project days, pupils also enjoyed the individual organisation of breaks. When they were "in the flow", they "didn't take a break" (P11). In the teachers' perception, pupils' project planning was one of the biggest challenges. One teacher stated, that "some pupils are fully structured, some don't even know what day it is" (T6). Although they were asked to do so, not every group created a time plan.

Critical Source Analysis

According to the interviewed teachers, pupils displayed a wide range of multiliteracy skills. Some pupils seemed to operate indiscriminate and used the first available website they found, while others compared different sources. Especially the age group 16-18 seemed more practised in evaluating online information, while the 12–13-year-olds were often overwhelmed with simple search tasks. "The boys didn't know how to use Google" (T1), commented one teacher.

During the observations, some pupils demonstrated high critical source analysis competences when they considered the reputation of a site. Well-known organisations, NGOs or media companies were considered as trustworthy. Some of the pupils even used Google Scholar to search for scientific sources. When they were evaluating information sources they paid attention to grammar mistakes, to dubious advertisements, to the date or the imprint of websites. Blogs or Wikipedia were typically not considered trustworthy. Occasionally, advanced search skills were observed, such as searching in different languages or searching for sources via references of good texts.

Pupils also showed a lack of critical source analysis competences since they often argued to base trustworthiness on the layout and design of a website. The observations highlighted that pupils often conducted superficial searches, relying on image information or featured snippets without actually reading the page. Pupils chose sources because they provided short and simple texts on their topics. In general, there seemed to be a difficulty in the distinction between objective and interest-driven content. One pupil even

claimed that the first Google search result is always accurate demonstrating reliance on the Google algorithm. Additionally, some pupils came across statistics that they could not explain when asked.

Teachers found that during the research phase, pupils faced challenges and experienced intensity. They encouraged pupils to utilize social media platforms like TikTok and Instagram for information gathering. However, pupils struggled to find reliable information on these platforms. They encountered low-quality content, often conflicting with reputable sources or solely based on opinions. Despite using social media for entertainment, pupils generally distrusted information found there, a significant aspect influencing their critical evaluation of sources.

Of particular concern was the use of artificial intelligence (e.g. ChatGPT) as trustworthy sources. When asked, one pupil said that ChatGPT was very trustworthy as she had never had a bad experience with it. In Google you have to read so much, ChatGPT sums it up well, according to the pupil. However, we also discovered some positive examples of artificial intelligence, as one group utilised an AI image generator to avoid violating copyrights. Another group used AI text-to-speech to add a voice-over to an explanatory video.

In summary, pupils mentioned the following indicators for selecting sources: Comparison of websites, inappropriate advertising on website, naming of authors, structure and layout of the site, contact details or imprint available as well as the level of reputation of the medium (e.g., public service media or international NGOs). Exercising these indicators is a very important learning experience to become aware of disinformation.

In connection to disinformation, the young people said that they felt more critical in analysing information sources after the project activity and that they would be wearier from now on navigating online information (including outside school tasks). We should "not always believe everything that is written on the internet" (P4) and we "should pay attention to good sources" (P9). "With a project like this, you are prepared for life, it supports you" (P11), were some of the statements they made.

Using Digital Tools

Becoming aware of disinformation, the process of acquiring multiliteracy skills includes the use of (new) digital tools that help to detect disinformation (Kangas & Rasi, 2021). At the beginning of the project, pupils were reluctant to use new and unfamiliar digital tools. According to them, this was also due to the perceived extra workload, and the difficulty to estimate the time needed to learn about those tools. With encouragement from their teachers, most of the pupils tried out new tools. Working with digital media "is important for our future" (P11).

Teaching Reflection

Teachers evaluated the preparation and post-processing time as very similar compared to regular lessons. Other teachers think that the project was even less time-consuming. "I would have imagined the (PhBL) project to be more time-consuming at the beginning" (T7). Only the feedback during the lessons and especially for the digital presentations at the end, afforded more time of the teachers. Teachers had difficulties in grading the creative digital reports because the range of pupils' outputs was very diverse. It is like "comparing apples and oranges" (T5).

The eight teachers felt that project-based PhBL teaching is suitable for working with curriculum content and helps to deepen topics already covered or learn about new content. Topics that had current relevance, in combination with language subjects (e.g., migration or climate change) were reported to be particularly suited. This is because it trains text comprehension, reading skills, and language and presentation skills, teachers said.

Suggestions for Future Implementations

The interviewed teachers offered suggestions to improve future PhBL projects. These include showing model examples for orientation, providing more support in narrowing down and identifying topics, allowing sufficient time for final presentations to celebrate results, specifying a minimum number of sources for the digital report, finding a team of 2-3 teachers to combine several professional perspectives, and starting to work with digital tools earlier for faster groups. The teachers propose a grading system consisting of four codes and

school marks ranging from 1-5 for the following areas: content, structure, creativity, and expression/grammar/spelling. These marks could be combined to give an overall grade. To improve the quality of the work, the pupils wish to have more time to prepare the topics thoroughly for future projects.

The teachers felt that phenomenon-based learning was appropriate and doable for pupils aged 12-13 and no problem for the older pupils. Teachers thought that open learning formats can be used for younger pupils if the scope is reduced, if simpler tools are employed, topics are made easier, and sources are suggested. However, the maturity of the pupils is more important than their age.

The chosen duration of the activities lasting 8 to 12 lessons seemed a suitable period for all teachers. Here, both the division into two project days and the division of the lessons into one month worked very well. The teachers chose a suitable time for the project when there was no schoolwork, holidays or tests.

Discussion and Conclusion

Coming back to the proposed research question, the findings show that phenomenon-based learning (PhBL) seems a practical teaching intervention to raise awareness against disinformation in secondary schools because the implementation supported training pupils to compare information sources, evaluate credibility indicators, act as critical consumers of online information, and use digital tools to communicate results (Lonka et al., 2018). In the project, pupils showed varying levels of critical source evaluation, with some considering reputable sources and using advanced search techniques, while others relied on superficial criteria like website design. Many struggled to distinguish between objective and biased content, often trusting sources based on simplicity or Google rankings.

Working independently in small groups enhanced pupils' mutual learning through reflective discussions about sources and tools (Bühler et al., 2020). Pupils reported increased motivation due to the ability to choose topics based on their own interests. Teachers were able to provide individualised support as expert coaches. With PhBL, teachers were able to work with content from the curriculum, either deepening material or to work with new content. PhBL is a cross-curricular intervention and is suitable for any school subject. The invested time for teachers was similar to regular lessons.

Suggestions and Outlook

These findings suggest that teachers and pupils need time and practice for cross-curricular and open project teaching (Lonka et al., 2018). Teachers suggest an appropriate starting age of 12 to 13 years - depending on the maturity of the class. For future implementations, teachers suggest working with best practice examples to inspire pupils (and other teachers). Ongoing research could focus on how to implement PhBL in curricula in Austria. Further, it seems promising to implement and evaluate PhBL in other countries, including outside developed countries. Future research could explore the possibilities of combining subject-specific interventions (such as inoculation or debunking) and subject-unspecific approaches such as PhBL. Another area for further research is the inclusion of older target groups, such as adults or senior citizens.

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4.5. **Article 5**: “Digital? Sicher!”–An Educational Game to Build Digital Competences.

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“Digital? Sicher!” – An Educational Game to Build Digital Competences

Kathrin Marie Otrel-Cass[1][0000-0003-2027-0772], Stefan Thalmann[1][0000-0001-6529-7958], Viktoria Pammer-Schindler[2][0000-0001-7061-8947], Michael Fasching[1][0000-0002-1763-6297], Analia Cicchinelli[2][0000-0003-0435-8838], Eva Griesbacher[1][0000-0002-5804-3922], Christine Malin[1][0000-0001-9462-7311], Julia Mayr[1][0000-0003-3336-3871], Alfred Wertner[2][0000-0002-2552-8261] and Thomas Doppelreiter[3][0000-0003-1895-7954]

[1] University of Graz, Universitätsplatz 3, 8010 Graz, Austria
[2] Know-Center GmbH, Inffeldgasse 13/6, 8010 Graz, Austria
[3] Logo, Karmeliterpl. 2, 8010 Graz, Austria

Abstract. “Digital? Sicher!” is a free educational game designed to build students’ digital competences in cybersecurity, privacy, tracking and datafication. The target group are students aged 14-16, although the educational game can be used by younger or older students. The game was co-designed in Austria by an interdisciplinary team together with 18 industry representatives, 157 school students and 11 teachers. To embed the game in teaching practices we also co-designed a pedagogical concept for teachers on how to integrate the game. Our evaluation showed that the game is functional, relevant and in combination with the pedagogical concept ready for implementation in classrooms. The game supports building young people’s digital competences to operate safely in the digital spaces. The development of critical digital skills at school is urgently needed which was the aim of the learn-app. Consulting with industry representatives and including relevant examples ensures also the importance of safe cyber skills for a future work life. The storyline of the game includes that players have to make decisions through interactive elements. They playfully experience real-life examples exposing risks and dangers the internet entails. We share design recommendations and an outlook based on evaluation results.

Keywords: serious gaming, cybersecurity, co-creation

1 Introduction

The goal of “Digital? Sicher!" an educational cybersecurity game, is to build the data handling awareness of grade 9-11 students (age group 14-16). The learning game was developed for Austrian secondary school students to work through selected cybersecurity topics. The intention was that the game should prepare them for their future lives where they should avoid ICT security incidents caused by human error. In this regard we also stressed the professional perspective by involving industry representatives in our co-creation efforts. The game follows the concept of serious gaming [1, 15] implying that players are asked to play through scenarios that have learning objectives underpinned by entertainment principles. The serious gaming

aspects include narratives that support players engage with an immersive environment. For this game it means that they have to solve challenges connected to e.g. privacy attacks, the nature of algorithms or safety issues related to social networks, etc.

2 Pedagogical / Technological Background

Serious games typically involve that players immerse themselves in a game world environment where they have to apply domain knowledge to solve complex challenges. This should support players in internalising the subject matter embedded in the game [9]. The topic of cybersecurity should be introduced early on in education, and the literature suggests that data handling concepts should be introduced gradually already during school years so young people are better prepared and operate safely on the internet [9].

While policy makers globally push for digital competency development [7], it has been argued that game-based approaches align with the interests of youth who often play with a variety of online games [14]. However, designing serious games for young people, and making them appealing, engaging *and* educational is a difficult task, compared to the commercial games young people play that are often visually highly attractive and include sophisticated levels of interactivity [2].

In preparation for the development of the educational cybersecurity game, we investigated existing gamified approaches for digital competence development. Our research identified the following formats: quiz-based knowledge building (like the Safer Internet Digital Competence Quiz and the "Surfschein Quiz" of Internet ABC), resource management simulations (like "Data Dealer" from Cracked Labs) and scenario-based interactive games (like CyberCIEGE), as well as roleplay-based games (like the "Cyber Threat Defender"). We reviewed the strengths and weaknesses of these existing approaches for digital competence development and decided to develop a scenario-based game that incorporates effective elements of other approaches like quizzes and roleplays [16].

The aim was to design a game that included the following key components: clearly stated rules; clearly stated goals; timely feedback on performance; interaction (clear distinction between student-to-computer and student-to-student interactions); and clearly stated subject or topic of the game [9].

3 The Co-Creation Approach

In participatory design-based approaches it is important to focus on understanding situated practices and change [6]. For that reason, we collaborated with a diverse set of stakeholders early on to design the technology and engage in collaborative practices together with designers and developers [10]. We applied a co-creation approach in order to ensure that the developed technology and surrounding practices would fit into

the larger ecosystems and to create a meaningful game for the target group [5]. This process is presented in Figure 1.

We started the co-creation with an initial concept developed based on relevant literature as well as a survey involving 219 business and company representatives. Focusing on the storyline in the first cycle, we identified relevant trends in cyber-crime and -safety requirements that enterprises place on their workforce [13]. In our industry workshops we checked for the topics and collected content ideas and examples to highlight relevance and make connections to regional companies and future professional careers. Next, we asked school graduates in online focus group interviews how they evaluate the digital education they received at school and propose potential improvements. Finally, we worked closely with students representing the target group of this learning game. The format we used in this collaboration was that of co-creation, that is, the collaborative and joint work to produce a product that fulfilled the aims of both groups [17]. We collaborated in video ethnographically recorded workshops. These sessions included practical test runs of the learning app during school time. As a final result of the first design cycle we established the main storyline. The second design cycle focused on the interface of the learning app. Again, we engaged with industry and students in video ethnographically recorded workshops to co-create a suitable interface. In our third design cycle, we focused on school integration and the development of the pedagogical concept for teaching. In addition to the interaction with students, we engaged with teachers in interviews to ensure a fitting integration into classroom teaching. Finally, we assessed the impact of the learning app through a qualitative inquiry and learning analytics.

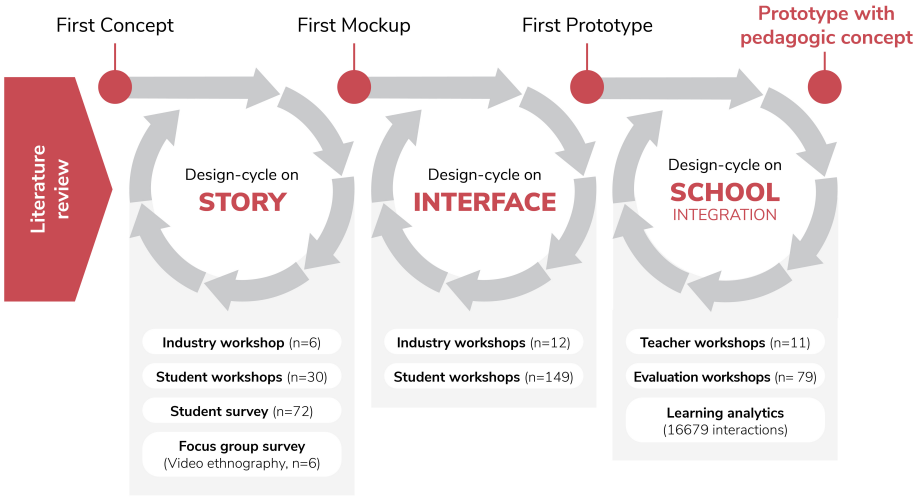

Fig. 1. Summary of co-creation cycles during the project.

The co-creation activities with our stakeholders produced a number of improvements, including: the shortening of text passages, accompanying explanatory videos, the integration of social media and entertaining online content focusing on smartphone use.

In the storyline, we strengthened the focus on experiences in real scenarios and examples from young people's everyday online life combined with the focus on digital careers. A specific wish from the students was to make the game visually more appealing by using more colours, images and improving the visual layout. As a result of this input we collaborated with a design class from a local high school, who developed the graphic design for the learning app based on common social media platforms.

4 Description of the Prototype and Use Case

The storyline of the game places the student at the start of a digital career. The student has to choose a digital profession consistent with current trends, such as influencer, blogger, digital designer, or social media manager. An avatar, Goosy the goose, acts as a guide and explains relevant functions in the game. During the course of the story, the players also interact with other characters. The storyline places the player in diverse life-like situations (botched job interviews, public confessions of love or family issues) where they have to make decisions about their digital behaviour. Their decisions affect their popularity showed with followers and the guidance offered by the avatar Goosy.

The game interface is divided into three areas: On the left side are chat conversations with the avatars. In the middle section is the newsfeed with information, tasks and exercises. On the right side is the profile bar with scores and an individual nickname. A screenshot of the game is presented in Figure 2.

Fig. 2. Screenshot of the game “Digital? Sicher!”.

Guidance through the avatar is designed to make players reflect on what has been learned and how it relates to real-life. The reflection concept was built in the form of prompts after each module, structured in such ways to focus students’ attention on the relevant concepts and on what is important and interesting for them [4]. Two weeks after students piloted the game we invited them to a second reflection session to

promote a long-term effect of learning contents. The concept aims to support the transfer of the learning content to the students' engagement with computer technologies as part of their daily lives.

We used the learning management system Moodle as software platform for the game. Since Moodle is a free, adaptive and easy-to-use platform, it provides for sustainability of the project and can continue to be used after completion of the project. We were able to divide tasks in the project team to create and upload content due to the intuitive operation of Moodle. Another advantage of Moodle includes also that its responsive design allows the application to be operated from a computer, tablet or smartphone. In order to make the learning game as easy to access as possible, we set up a landing page[1], which leads directly to the game on Moodle after logging in. In addition, we set up a project website[2], to provide information for interested stakeholders already during the development phase.

The game was designed to be integrated into classroom activities on the subject of cybersecurity, i.e. it was not developed to be used as a stand-alone game outside an educational context. However, the game is now freely available and could be used in this manner.

The playful approach (through serious gaming) and concrete case studies from the business community were intended to support the development and increase the overall attractiveness of the game [8]. The development and evaluation for the use in schools focused on central guidelines such as EU values, conformity with fundamental rights, consideration of technical and human factors, orientation towards learning goals, gamification, social inclusion and freely accessible software. The "Digital? Sicher!" game is fully functional and openly available online as an open educational resource (OER).

5 Results and Outcomes Achieved

The workshops we conducted in schools showed that students were interested in cybersecurity topics and that they wanted to learn about those at school. However, we found large differences in prior knowledge amongst the 13 to 18-year-olds students we worked with, and therefore we narrowed the band of target age group down to 14 to 16-year-olds to optimally adjust the level of difficulty and topics. Feedback from the students also suggested that they liked the storyline of the game. The degree of difficulty was rated very differently amongst the age groups and depended on prior knowledge.

We conducted quantitative analysis in order to evaluate the game. We compared and analysed the interactions of a subsample of 40 students. This way we examined student activities in regard to the goals of the game and the learning effectiveness of the game.

[1] https://digital-sicher.at/

[2] https://digitalsicher.uni-graz.at/

While the game utilises a cyclic structure allowing students to return to previous stages, we found that the number of interactions across the different modules remained stable. Hence, the game appears to have a stable structure. Analysing responses to reflection questions we found that they align with the learning goals in terms of content. The students' reflections seem to confirm that key concepts were learned. We found no noteworthy differences in the interactions between the number of male and female students. It can therefore be assumed that the basic structure of the learning game does not show any gender-specific interaction differences. The analysis also showed no indication that students with non-German language background were disadvantaged, quite the opposite: students identifying themselves with a mother tongue different to German showed particularly high interaction counts. We detected however, that male students seemed to have greater awareness of the need for secure login information, while female students appeared significantly more aware when dealing with potentially threatening content.

6 Future Agenda

Through the co-creation process and in the testing of the final game we found that the students played the game because they seemed to be motivated to do so. Their engagement with the game was goal oriented and this means they had to understand the game's functionality and stay enthusiastic to play it [3, 12]. The design recommendations and feedback received from students, teachers, business community and the analysis of our interaction data resulting from the project include: a promotion of the use of the game in the lessons of young people in secondary school (for instance through pre- or in-service training workshops), continuation of the modules with new and more difficult content levels for the age group 16+, and a possible expansion of the target groups of the prototype also for adults, senior citizens or people with disabilities. Future topic areas could include e.g., disinformation, bullying, sexting/grooming. The game could also expand to topics with more relevance for professionals, alongside training workshops for professionals. Regarding the reflection concept, students mentioned that they are not used to reflecting as part of their learning activities. However, they found the questions useful and helpful for their learning. In the future, we intend to develop a continuous reflection concept and investigate the effect of reflection on retaining learned concepts. Finally, also internationalisation of the game through translations (e.g. European languages) would be a useful expansion for the game in the future.

Our stakeholder groups emphasised the important role teachers play in this process. Future activities will need to look into the successful integration of digital games into different subject settings [11]. The feedback from the teachers in this project was that they appreciated and needed the suggestions provided in the pedagogical guidelines and similar games should include this as part of the game development process. Finally, the co-creation process increased creativity and produced positive dynamics in this project.

7

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Having presented the five articles, I will now proceed to discuss the contributions of the individual authors.

4.6. Author Contributions to the Articles

Article one, written by Kathrin Otrel-Cass and Michael Reicho (formerly Fasching), draws on data from two projects in Austria ('Digital? Sicher!') and Denmark ('One day in my onlife'). Data from Denmark was collected from Kathrin Otrel-Cass, while data from Austria was collected by Michael Reicho. The idea for the manuscript, the development of the research questions, the engagement with theory, the planning of methodology, the analysis and interpretation of video vignettes, the writing process, and the critical revision were divided equally between the two authors (Otrel-Cass & Fasching, 2021).

Article two, written by Michael Reicho (formerly Fasching) and Thomas Schubatzky, draws on data from expert interviews. All interviews were conducted by Michael Reicho, while the data analysis was distributed equally between both authors. The tasks of writing the manuscript, engaging with theory, planning methodology, and critical revision were primarily allocated to Reicho with minor but substantial input from Schubatzky. The majority of sections on phenomenon-based learning were written by Reicho, whereas the sections on inoculation theory and civic online reasoning were primarily written by Schubatzky (Fasching & Schubatzky, 2022).

Article three, written by Michael Reicho and Kathrin Otrel-Cass, draws on data from video ethnography, written field-notes, interviews and focus groups. Data collection was undertaken by Michael Reicho. Interview observations and analysis were undertaken by Reicho with minor input from Otrel-Cass. The idea for the manuscript, the elaboration of the research questions, the engagement with theory, the planning of methodology, the writing process, and the critical revision were divided equally between the two authors (Reicho & Otrel-Cass, submitted 2024).

Article four was written independently by Michael Reicho, taking into account feedback from supervisors. This work included the idea for the research, the elaboration of the research questions, the engagement with theory, the planning of methods and methodology, the organisation of the manuscript, the data collection, the evaluation of the collected material, the interpretation of results, the writing process including revisions (Reicho, accepted 2024).

Article five was written by all members of the project team, including Kathrin Otrel-Cass, Stefan Thalmann, Viktoria Pammer-Schindler, Michael Reicho (formerly Fasching), Analia Cicchinelli, Eva Griesbacher, Christine Malin, Julia Mayr, Alfred Wertner and Thomas Doppelreiter. The co-creation workshops with pupils were conducted by Otrel-Cass, Wertner, Griesbacher, Reicho, Malin, Cicchinelli, Mayr and Thalmann. The co-creation workshops with business representatives were conducted by Thalmann, Malin, Zeiringer and Reicho. Data collection in schools was undertaken by Doppelreiter, Reicho, Mayr, Malin and Griesbacher. Qualitative analysis was undertaken by Otrel-Cass, Reicho, Mayr, Griesbacher and Malin. Quantitative data collection drawing on learning analytics from Moodle was undertaken by Cicchinelli, Wertner and Griesbacher. The writing process included major contributions from Otrel-Cass, Pammer-Schindler, Thalmann, Cicchinelli, Griesbacher and minor contributions from Reicho, Malin and Wertner. Reicho was responsible for the organisation of the manuscript and the revision process (Otrel-Cass et. al., 2022).

5. Discussion and Conclusion

In the final chapter of this dissertation, I will present the discussion and the conclusion of this work. I will begin by summarising the results of each publication and discussing its connection to the research questions in chapter 5.1. I will then proceed to examine the broader implications of this research for both educational and communication research in chapter 5.2. Finally, I will evaluate constraints and identify promising avenues for future investigations. In this cumulative thesis, five publications are presented that contribute to research, practice and policy on teaching and learning to counteract disinformation.

5.1. Discussion of the Articles and Connection to the Research Questions

Before discussing the five publications in detail, I will give a brief summary and overview of the main findings (see in Table 3).

Art.	Title	Research Question	Main Findings

1	'Postdigital Truths: Educational reflections on fake news and digital identities'	*What kind of competences are necessary for secondary school pupils when they are confronted with fake news?*	• Three areas of digital competencies:
			  ○ Information management: understand the interplay and intentions of online agents
			  ○ Opinion management: understand algorithms, filter bubbles and echo chambers
			  ○ Identity management: construction of and reflection on online and offline identities
			• Pupils recognise how our perception is connected to specific viewpoints
			• Adults guide pupils in exploring the production, shaping, and interpretation of digital content.

2	'Beyond truth: Teaching digital competences in secondary schools to counteract disinformation'	*How do experts from different disciplines envision the teaching of digital competences to counteract disinformation in secondary schools in Austria?*	• Lower secondary school (10-14 years):
			  ○ PhBL to train basic digital competencies in open project teaching
			• Upper secondary school (15-18 years):
			  ○ Inoculation Theory and civic online reasoning to deepen resistance to disinformation
			• Training should be mandatory in a holistic, cross-curricular, and reoccurring approach across various subjects

3	'In Pictures We Trust: Phenomenon-based learning about disinformation in secondary schools'	*What role do visuality and trust play when pupils work with different digital sources? How does the approach 'phenomenon-based learning' help build multiliteracies in pupils?*	• Two key factors influencing the evaluation of sources by pupils:
			  ○ Proximity: close interaction with human actors fosters trust
			  ○ Accessibility: easy access to technology reinforces trust
			• Pupils rely on design and layout to evaluate trustworthy sources
			• PhBL trains multiliteracy, technical skills, and self-management

4	'How Phenomenon-Based Learning May Contribute to Counteract Disinformation'	*What effect does 'phenomenon-based learning' have on the building of multiliteracies to counteract fake news?*	• PhBL is an appropriate method for counteracting disinformation, training pupils to compare sources, assess credibility, and critically analyse online information using (new) digital tools • PhBL is not subject-specific and therefore suitable for most curriculum content
5	'Digital? Sicher! – An Educational Game to Build Digital Competences'	*How can a serious game aimed at increasing digital competences for secondary schools be developed together with relevant stakeholders?*	• Development of an open-access serious game for 14–16-year-old pupils • This game enhances critical thinking and reflection on digital competences and cybersecurity issues • A co-creation process enhances creativity, providing a meaningful game for pupils

Table 3: Overview of the main findings of the five articles comprising this thesis.

The first publication is a chapter entitled **Postdigital Truths: Educational reflections on fake news and digital identities**, published in the book *Postdigital Humans: Transitions, Transformations and Transcendence* (Otrel-Cass & Fasching, 2021) and examines *what kind of competences secondary school pupils need when confronted with fake news* (RQ1). The chapter takes a postdigital approach, describing a stage where digital technology is so integrated into everyday life that it becomes invisible (Knox, 2019). This article focuses on the perspective of young people and their views of what they need when confronted with disinformation. It goes on to outline education for digital competencies and learning with information and communication technologies (ICT).

The findings reported in this chapter highlight three areas of digital competencies pupils need: information management, opinion management and identity management. Information management requires the ability to identify and analyse misleading digital information, advertising and politically motivated intentions. It also necessitates an understanding of the complex interplay between different agents, their intentions and the impact of their actions. The development of information management skills also requires the capacity to navigate and coordinate these diverse agents.

Opinion management focuses on a deeper understanding of algorithms, filter bubbles and echo chambers. This encompasses the capacity to recognise how algorithms reflect or reinforce particular viewpoints, to comprehend the mechanisms of filter bubbles and echo chambers and to reflect on the associated advantages and disadvantages.

Identity management is the conscious construction of – and reflection on – online and offline identities and the understanding of their transformation in different environments. It requires the capacity to assess one's personal online presence, how it is perceived by others, how it is expressed, how it shapes individual identity and how online and offline identities are connected. Reflecting on identities plays a major role, especially in the teenage years, when pupils are learning how to establish a healthy identity and adjust an identity.

The chapter also proposes that pupils need to be mindful of their consumption of digital content and recognise how our opinions are shaped by the perception of different viewpoints and perspectives. In an age marked by disinformation, educators, parents, and caregivers should collaborate with young people to explore the production, shaping, and interpretation of a range of digital content.

The second publication is an article entitled **Beyond truth: Teaching digital competences in secondary schools to counteract disinformation,** published in the journal *Medienimpulse*, and explores the viewpoints of experts before suggesting a practical teaching intervention to counter disinformation (Fasching & Schubatzky, 2022). The article starts by analysing recommendations from experts in different disciplines on how *they envision the teaching of digital competences in order to counteract disinformation in Austrian's secondary schools* (RQ2). In this context, 'teaching' refers to what pupils must learn to be aware of with regard to manipulated content. Having analysed the recommendations, the authors aligned them with theoretical and pedagogical approaches. The experts in question included educators, school administrators, and teacher trainers; social workers; journalists; fact-checkers; conspiracy theory and extremism prevention professionals; media law experts; civil servants from bodies such as the Federal Chancellery and the Ministry of Education; individuals involved in criminal justice programmes addressing hate speech; and socio-psychological counsellors aiding victims.

This paper then examines the concepts of phenomenon-based learning, multiliteracy teaching, inoculation theory and civic online reasoning in the context of a study working with lower secondary school pupils (10-14 years) and upper secondary school pupils (15-18 years). The findings indicate that the experts' suggestions are consistent with the theoretical concepts of phenomenon-based learning, inoculation theory, and civic online reasoning. Experts felt that PhBL could support the acquisition of basic multiliteracy skills by younger pupils in lower secondary school, while inoculation theory and civic online reasoning had the potential to strengthen upper secondary school pupils' resistance to disinformation (Fasching & Schubatzky, 2022).

Further, the results of the analysis indicate that phenomenon-based learning to support multiliteracy may help train a variety of basic digital competencies for pupils aged 10-14 years. With guidance from one teacher or a team of teachers, pupils can explore a given topic, formulate their own questions, search, evaluate and compare information and sources and finally produce creative digital products to present their findings. During the learning process, teachers are seen as expert advisors who respond to authentic needs of their pupils, and encourage and guide them to deal with real-life problems. This approach integrates school knowledge with real-life topics, thereby enabling pupils to devise innovative solutions, either individually or in small groups. The findings show that inoculation theory and civic online reasoning are suitable pedagogical interventions for pupils aged 15-18 years. The concept of inoculation draws on the concept of vaccination: pupils get a small dose of disinformation and then develop an awareness that can be likened to 'antibodies' against disinformation. Teachers explain the types and styles of disinformation so that pupils will be able to recognise fake news more easily in the future. Civic online reasoning involves teaching pupils how to judge the credibility of online content (Fasching & Schubatzky, 2022).

The article also suggests that digital competencies training should be a mandatory component of basic digital education. Teaching should be holistic, cross-curricular, and recurring, to ensure that competencies are addressed across various subjects throughout the curriculum. Such training should begin at age 10 and continue throughout schooling (Fasching & Schubatzky, 2022).

After establishing the perspectives of pupils and experts from different fields, the third article, entitled **In Pictures We Trust: Phenomenon-based learning about disinformation in secondary schools** and submitted to the 'video journal of education and pedagogy' (Reicho & Otrel-Cass, 2024, submitted), examines *the role of visual information in young people's decisions on whether to trust or distrust in online sources (RQ3.1)*. This article also explores the delivery of phenomenon-based learning in six secondary school classes in Austria and how this approach *helps pupils to build multiliteracy (RQ3.2).* The article draws on the concepts of truth, trust and visuality and presents video vignettes.

The third article identifies two key factors that influence the evaluation of sources by pupils: proximity and accessibility. The analysis highlights that when pupils interact closely with human interlocutors, this may lead them to trust digital sources. Human interlocutors include classmates, reputable companies or well-known brands. Trust in digital sources may also be increased by easier and facilitated accessibility to technology, such as easy consumable visual information or professional layouts. The manner in which technology facilitates access to information has a significant impact on the development of trust, particularly in the context of visual content such as images and videos, which promote trust among pupils. Website design and layout also plays a crucial role in shaping perceptions of trustworthiness, often irrespective of the quality of the content. Pupils frequently favour sources that are visually appealing and professionally designed. Their preferences tend to align with search engine rankings, when algorithms prioritise search hits, and are quickly convinced by preview snippets, which lead some to presume material is trustworthy. Interestingly, artificial intelligence (AI) tools (e.g. ChatGPT) and summarised information were also perceived as trustworthy sources of information. However, distrust was evident when websites were visually questionable (e.g. having unsuitable advertisements) or when information was inaccessible due to complex or academic language (Reicho & Otrel-Cass, 2024, submitted).

With a focus on project based pedagogy, the teaching case studies utilising phenomenon-based learning (PhBL) helped secondary school pupils in Austria learn about disinformation, and fostered multiliteracy, technical skills, and self-management. This was evident after the completion of the project, when pupils indicated that they would be more critical of online sources in the future, that they were utilising new digital tools, and that they found task management in the small working groups challenging. Pupils valued the autonomy afforded by PhBL, and commented that it increased their motivation to do school work. It helped, they said, that their teachers explained what fake news was and how to identify false information which prompted them to reflect critically on online information. Delivering PhBL in an open learning format requires both structure and flexibility from teachers and requires pupils to work across disciplines. Teachers and pupils who are not used to this format will need to practise and/or gradually open up the teaching and learning process (Reicho & Otrel-Cass, 2024, submitted).

In order to look in more detail at the implementation of phenomenon-based learning, the fourth article, titled **How Phenomenon-Based Learning May Contribute to Counteract Disinformation** published in the European Distance and E-Learning Network (EDEN) Conference Proceedings (Reicho, 2024, submitted), explores the *effects of phenomenon-based learning on building multiliteracy to counteract fake news (RQ4).* This article presents an in-depth analysis of the results from article three with a focus on source evaluation and critical analytical skills.

Feedback from teachers and pupils after implementation suggests that phenomenon-based learning (PhBL) is a suitable way of counteracting disinformation in secondary schools; it trains pupils to compare sources, assess credibility, and critically analyse online information using (new) digital tools. This method has been shown to be motivational for pupils. However, if the intervention is to be delivered in a meaningful way, teachers need a structure, including learning objectives, for instance, or guidance during checkpoints, or an explanation of fact checking (Reicho, 2024, submitted).

However, pupils showed varying levels of skill at critical source evaluation. Some pupils demonstrated high skills levels, and were able for instance to assess the reputation of websites, to trust well-known organisations, NGOs, and media companies, and to utilise Google Scholar to search for scientific sources. Furthermore, they were able to identify and evaluate grammar mistakes, dubious advertisements, and the dates or imprints of websites. Others demonstrated a lack of skills in this area, frequently judging the trustworthiness of a website based solely on its layout and design. Many pupils conducted superficial searches, relying on images or featured snippets without opening the website. Pupils preferred sources with brief and straightforward texts, struggling to differentiate between objective and interest-driven content. Some even exhibited unwavering trust in the first Google search result, indicating a reliance on the search engine's algorithm (Reicho, 2024, submitted).

Working independently in small groups and having a free choice of project topics enhanced pupils' collaborative learning and motivation. Teachers provided personalised support, acting as expert coaches, explaining how to evaluate sources and introducing new digital tools to the pupils. PhBL proved to be non-subject-specific, adaptable across the curriculum and offered a cross-curricular intervention with time investment similar to regular lessons (Reicho, 2024, submitted).

The fifth article, with the title **Digital? Sicher! – An Educational Game to Build Digital Competences**, published in the proceedings of the ECTEL conference (Otrel-Cass et al., 2022), examines the potential of a *serious game aimed at increasing digital competences in secondary schools to be developed with the relevant stakeholders (RQ5).* The article draws on the concept of co-creation, with pupils, teachers and cybersecurity experts working together to develop a free educational game (Digital? Sicher!) to train digital competences in pupils aged 14-16. The co-creation process within a transdisciplinary project team, involving researchers from different disciplines, pupils, teachers and experts, enhanced creativity and created a positive dynamic in this project.

The co-creation workshops revealed major differences in the level of prior knowledge among the 13 to 18-year-old participating pupils. Consequently, the authors narrowed the target age group to 14 to 16 to optimise difficulty level and topics. This experience also influenced other

aspects of the work. Other findings reported in this thesis have demonstrated, for instance, that the maturity and experience of secondary school pupils vary considerably between the ages of 11 and 18, indicating the necessity for individualised interventions tailored to different age groups (Otrel-Cass et al., 2022).

The results reported in article five indicate that the game is both relevant and functional, and when combined with the relevant pedagogical framework, it is suitable for integration into classroom settings. The game fosters the development of digital competences among young people, equipping them to navigate digital environments more securely. The overarching goal of the learning app was to address the pressing need for the cultivation of critical digital competences within educational contexts. The game's storyline is designed to guide players through a series of engaging, real-life scenarios and examples. These scenarios are intended to prompt players to make interactive decisions and to encourage them to consider the potential risks and dangers associated with internet usage (Otrel-Cass et al., 2022).

While the game is not focused on disinformation per se, it does encourage critical thinking and self-reflection with regard to various digital issues. Interestingly, the results showed that pupils were motivated and interested in learning about cybersecurity during the game. This was also evident during the implementation of PhBL in the studies summarised in other articles contributing to this thesis.

5.2. Conclusion

This final part of the thesis discusses the central research findings in the context of the overarching research question(s). The overarching research question of this dissertation was:

> *What pedagogical interventions for teaching and learning about disinformation have the potential to counteract fake news in secondary schools in Austria*?

To provide a brief answer to the overarching research question, this thesis suggests that pupils learning to identify and understand the mechanisms and drivers of fake news will benefit from open learning formats under the guidance of teachers who can draw on their critical media knowledge. Open learning formats include phenomenon-based learning (PhBL), inoculation theory, civic online reasoning and serious games, since all have the potential to expose pupils to disinformation and how to counteract it in Austrian secondary schools. The findings of the studies presented show that these interventions may help pupils to learn about disinformation, foster multiliteracy, train technical skills, and promote self-management. Counteracting in this context means helping pupils identify and avoid disinformation.

To provide more depth, the following contributions, which are arranged to address the needs of researchers, practitioners and policy makers, will present the conclusions again in the light of the relevant literature. I have summarised the individual contributions of each article in the previous chapter (5.1.). Since this work is constrained by the methodological choices that were made, this thesis will conclude by outlining the limitations of this investigation.

5.2.1. Contributions to Research and Outlook

A key contribution of this work to communication and education research is giving voice to different stakeholders, including pupils, teachers, school administrators and experts outside

the school environment. This approach is crucial to designing and implementing a meaningful and impactful pedagogical approach for teaching and learning about disinformation and digital competences and is strongly connected to the interpretative paradigm of this thesis (Kivunja & Kuyini, 2017).

This work contributes to research by offering proposed definitions of the necessary pupil competences for counteracting disinformation, namely information, opinion and identity management. In recent years, numerous definitions have been proposed focussing on general information literacy, including critical thinking and problem solving (e.g., Doyle, 1992), or technical understanding, including the safe and ethical use of technologies for work, leisure and communication (e.g., Punie & Cabrera, 2006). However, only few definitions emphasise the importance of conscious identity formation and reflection in the context of digital competences (Otrel-Cass & Fasching, 2021).

From a theoretical perspective, parts of the analysis contribute to research by taking a postdigital and socio-material approach to analysis of pupil interviews (e.g. Knox, 2019; Sørensen, 2009). The analysis offers an opportunity to gain insights into the complex connections between online and offline environments and a variety of participants (Otrel-Cass & Fasching, 2021).

Furthermore, the results of this work have demonstrated the need to consider the role of visual information in pedagogical interventions. This is particularly relevant to images and videos, which are becoming increasingly convincing due to the constant improvement of AI-supported manipulation and the growing risk of deception. However, source criticism is also about evaluating information independently of layout or design. This underlines findings from other recent studies that highlight the role of visual disinformation (e.g. Weikmann & Lecheler, 2023).

The findings identify two key factors that influence pupils' evaluation of sources: proximity and accessibility. This could have great potential to shape future interventions relating to source criticism. Proximity refers to all factors that generate trust based on closeness, including proximity to people and familiarity with institutions. Accessibility relates to factors that generate trust when evaluating sources, such as the ease with which information can be accessed, the readability of texts, the selection of algorithms, or the summarised preview of search results (Reicho & Otrel-Cass, 2024, submitted).

This study addresses a gap in education research in Austria. It reveals that secondary schools rarely integrate PhBL with digital competences and the prevention of disinformation. Despite the longstanding tradition of research into PhBL (e.g. Schaffar & Wolff, 2024), digital competences and open project teaching focusing on fake news remain largely uninvestigated in Austria. This contrasts with other countries with different school systems (such as Finland), which already have many years of valuable experience with PhBL formats (Lonka et al., 2018).

Previous findings have shown that experts recommend critical media literacy be built as early as possible (Fasching & Schubatzky, 2022). However, in the initial stages of this research with schools, some teachers and head teachers refused to participate, arguing that their pupils (aged 10/11) did not have the necessary maturity. Their pupils, they said, had only learnt basic digital skills (opening browsers, saving documents, etc.) and were not yet able to develop their own research questions or research them using different sources. This is also highlighted in a

Spanish study by Herrero-Curiel and La-Rosa (2022) on secondary education and disinformation, which noted that some of the teachers interviewed

"*believe that [while] students are not yet mature and that upper secondary school is perhaps the most appropriate time to introduce issues related to MIL, the truth is that this intervention in media education is probably too late, since [...] mobile devices mean young people are accessing media and social networks at increasingly young ages*" (Herrero-Curiel & La-Rosa 2022, 94).

This study demonstrates that the secondary school age group (10-18 years) cannot be treated as a single entity when selecting pedagogical interventions. Instead, it must be differentiated according to the age, actual maturity and prior knowledge of the pupils with digital technology.

With regard to a research outlook, future work could focus on the integration of phenomenon-based learning (PhBL) into Austrian curricula and evaluate its effectiveness in a variety of educational settings, potentially extending outside developed countries. It would be helpful to investigate how subject-specific interventions could be combined with non-subject-specific approaches (such as PhBL) and explore the applicability of this combination to other target groups, such as children in kindergarten, adults, and senior citizens. This would be a promising avenue for further research. Further research could usefully look at the effect of PhBL on a larger sample size and assess its impact on learning objectives.

5.2.2. Learnings and Outlook for Educational Practice

The results of this dissertation highlight the importance of differentiating between age groups in the context of the interventions mentioned. This work distinguishes between two target groups within the secondary school sector, each requiring a distinct pedagogical intervention. The lower secondary school sector, comprising pupils aged 10 to 14 years, was given open project lessons and phenomenon-based learning with the objective of developing the necessary basic digital skills. In the upper secondary school sector, inoculation theory and civic online reasoning, including work with specific examples of fake news, were used to deepen resistance to various manipulation techniques (Fasching & Schubatzky, 2022).

Suggestions for future practice would include phenomenon-based learning (PhBL) projects to train multiliteracy and raise awareness of disinformation. This could include providing examples of best practice with regard to project reports in order to inspire pupils (and teachers), offering more support with regard to topic choice, allocating sufficient time for final presentations, specifying requirements for digital reports, putting together teams of teachers with diverse perspectives, and introducing digital tools at an earlier stage to facilitate more rapid progress. A grading system would help teachers in the future; it would need to be based on four categories: content, structure, creativity, and expression/spelling/grammar. The findings of the present work demonstrate that pupils need more project time in future projects in order to enhance the quality of the work. PhBL was found to be suitable and manageable for pupils ages 12-13 and above, suggesting that open learning formats could be tailored to younger pupils on the basis of maturity rather than age. The project duration of 8 to 12 lessons, with project days and lessons being flexibly scheduled over a period of one month, was found to be appropriate. The timing of the programme was chosen to avoid any potential conflicts with pupils' schoolwork, holidays, or examinations (Reicho, 2024, submitted).

As has been highlighted by various studies in recent years (e.g.; Hill et al., 2020; Alvarez & Djaouti, 2011), serious games represent a promising alternative intervention that can be used to enhance the effectiveness of traditional classroom teaching. The present study makes a fruitful contribution to the field by developing an educational game designed to foster digital competences among German-speaking learners. The process of developing the game underscores the potential value of engaging relevant stakeholders in the design and delivery, as this has the capacity to yield outcomes that are both relevant and practical for the target audience (Otrel-Cass et al., 2022). This approach could serve as a model for future projects in this area. The development of a serious game and a PhBL framework for Austria have demonstrated the importance of involving the target group in the design process and interpretative paradigm (Kivunja & Kuyini, 2017).

Another contribution to teaching practices was the development of a pedagogical framework that enables teachers to independently plan and deliver this type of teaching. The feedback and insights gained from collaborating with teachers have been incorporated into the teaching resource. The materials (in German) have been published in an open-access format.

The outlook for practitioners could be further clarified through an evaluation of the delivery of PhBL in a range of international contexts, highlighting its adaptability and efficacy in different cultural and educational settings. It is similarly vital to integrate the rapid advancements in digital technology into practice in order to collectively assess the potential benefits and risks of new tools.

5.2.3. Outlook and Recommendations for Policy Makers

One part of this dissertation (article two) was published in autumn 2022, when basic digital education in Austria was revised. This was a good opportunity to contribute to the development of conditions and requirements for teaching and learning to counteract disinformation. It represented not only a contribution to science but also to Austrian education policy, enriching the discussion about basic digital education (Fasching & Schubatzky, 2022).

This thesis has examined the connections between young people's online and offline lives, highlighting the importance of preparing young people to deal with online content that may have been manipulated. Educational institutions need to address these challenges by integrating the development of multiliteracy into their curricula. This should ensure that both pupils and teachers receive mandatory training in this area.

The results suggest that awareness-building initiatives should begin at the earliest possible stage, when pupils first come into contact with digital devices. Older pupils should engage in further exploration of disinformation as they progress through their compulsory education.

The delivery of phenomenon-based learning highlights a gap in the current Austrian educational tradition, which currently appears to provide inadequate support for the complexities of cross-curricular approaches. It is evident that both teachers and pupils will require time and experience to become more comfortable and experienced in interdisciplinary, open learning and teaching methods (Clinton-Lisell, 2021). Pedagogical interventions of this nature should start at the age of 10, should be mandatory in schools and should be holistic, cross-curricular and recurring in nature (Fasching & Schubatzky, 2022).

The findings of the present study indicate that in order to effectively enhance pupils' multiliteracy skills, education systems need to invest in the enhancement of the competencies of both teachers and pupils. In order to adapt to evolving consumption habits with regard to digital technology and media, teachers should shift their focus from an application-oriented approach to the development of multiliteracy, with a particular emphasis on social and cultural aspects such as digital well-being and the fostering of healthy online identities. It is recommended that both pre-service and in-service teacher education should be updated in order to address these issues. Teachers need systematic support throughout the education system to enable them to meet pupils' needs effectively.

Further, it is essential that policy makers allocate resources to providing targeted information for young people, with a view to preventing them from being deceived by disinformation. There is a pressing need for more appropriate digital information, tailored specifically to young people. This will necessitate investment in the development of high-quality digital journalism and public information initiatives. It is important that collaborative work be undertaken involving experts from a multitude of fields, including journalism, media law, science, and policymaking (Fasching & Schubatzky, 2022).

Furthermore, artificial intelligence (AI) tools are becoming increasingly accessibility and are being utilised by pupils in the classroom with increasing frequency. Programmes are urgently needed to educate teachers and pupils about the potential benefits and risks associated with AI tools (Karnouskos, 2020).

With regard to serious games, it has been demonstrated that a considerable number of free educational games are already available, which can effectively enhance the multiliteracy of young people. Teacher training programmes should take account of these games in order to help teachers increase pupil engagement with digital topics in a playful manner (Hill et al., 2020).

Moving to the outlook for policy makers, the effective combating of disinformation requires collaboration across various sectors, including government, non-governmental organisations, civil society, education, and individuals (Carr et al., 2020). Kozyreva et al. (2020) identify four key approaches to addressing disinformation: legal and ethical frameworks, technological solutions, educational initiatives focusing on critical media literacy, and leveraging insights from psychology and behavioural sciences. In order to effectively mitigate disinformation in the future, scholars and practitioners must pursue and advance strategies across all four of these dimensions.

5.3. Limitations

The qualitative nature of this research is subject to **limitations**, including subjectivity and bias due to reliance on researchers' interpretations. Additionally, small sample sizes and the time-consuming nature of data collection and analysis could hinder generalisability and scalability. The absence of robust statistical analysis and difficulty in replicating findings further restrict the reliability of qualitative research. In addition, challenges in establishing causality and controlling external variables underscore the need for careful interpretation and consideration of context in qualitative studies.

The results with regard to the effects of phenomenon-based learning only reflect pupils' and teachers' opinions. As I have not conducted an evaluation of learning outcomes, I am unable to provide a definitive assessment. Instead, I have drawn my analysis from the statements made by the participants.

Regarding open pedagogy formats, this paper addresses only phenomenon-based learning, although other approaches to open learning, such as problem-based learning and inquiry-based learning, could also make valuable contributions in this context.

The majority of case studies were conducted in Austria, specifically in the province of Styria, due to the geographical location of the University of Graz. This geographical focus could therefore represent a limitation. Results for other regions of Austria may show slightly different results.

The target group for this work is school-age pupils. However, recent studies have indicated that other target groups are also of significance, as older adults play an important role in the dissemination and amplification of disinformation (Brashier & Schacter, 2020). Future research could look, for instance, at the role played by parents.

While the scholarly focus of this thesis is communication science and education science, other important disciplines may broaden the understanding of how to best address learning about disinformation. Other disciplines that may be relevant include law, computer science and automated technology, psychology, behavioural sciences, and ethics.

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