

From the classroom to the newsroom: A critical route to introduce AI in journalism education

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Abstract

From a computer vision application to monitor elections transparency in Argentina to automated real-time texts in Norway, and everything in between, Artificial Intelligence-powered tools are changing journalism. Scholars have taken note, and the academic production of AI in journalism has gained considerable ground in the last five years. However, research on how journalism education deals with AI influence in the industry is scarce. Based on a self-training method using available online free courses for journalists and a review of university teaching initiatives, this article proposes key elements to trace teaching trajectories to introduce AI into journalism curriculum. Included are recommendations for drawing a path to teaching journalism students to think critically about AI and, at the same time, to understand the available tools for reporting and investigating in a complex context where journalism lives in a profound state of crisis.

Keywords: artificial intelligence, journalism pedagogy, future of journalism

Resumé

De la salle de classe à la salle de nouvelle : une voie critique pour introduire l'IA dans l'enseignement du journalisme

D'une application de vision par ordinateur pour surveiller la transparence des élections en Argentine à l'automatisation des textes réels en Norvège, et tout le reste, les outils alimentés par l'intelligence artificielle font évoluer le journalisme. Les universitaires en ont pris note, et la production académique de l'IA dans le journalisme a considérablement gagné du terrain au cours des cinq dernières années. Cependant, les recherches sur la façon dont l'éducation du journalisme traite la question de l'influence de l'IA dans l'industrie sont rares. Basé sur une méthode d'auto-formation utilisant des cours gratuits disponibles en ligne pour les journalistes et un examen des initiatives d'enseignements universitaires, cet article propose des éléments clés pour tracer des trajectoires d'enseignement pour introduire l'IA dans le curriculum du programme d'étude du journalisme. On y trouve des recommandations pour tracer une voie vers l'enseignement des étudiants en journalisme pour penser de manière critique à l'IA et en même temps comprendre les outils disponibles pour le reportage et pour enquêter dans un contexte complexe où le journalisme vit dans un état de crise profonde.

Mots-clés : intelligence artificielle, pédagogie du journalisme, avenir du journalisme

INTRODUCTION

From news production to audience engagement, the cases compiled by the London School of Economics and Political Science Journalism AI project (LSE, 2022) show the many ways AI is changing journalism. De Lima and Ceron (2022) identified Machine Learning and Computer Vision as the AI subfields most commonly used in newsrooms. AI applications in journalism can include machine learning to identify audience trends, language generation to automate article writing, natural language processing to caption audios and videos, and computer vision to spot keyframes (Peretti & Rinehart, 2022). These are but a few examples of how journalists take advantage of AI in big organizations and small newsrooms. There is no doubt about the extent of AI's impact on the industry.

Concerning “the state of mind and state of play of AI regarding artificial intelligence and associated technologies” (Beckett, 2019, p.7), journalists from 71 news organizations in 32 different countries pointed out a great need for education and training and a change of culture to successfully adopt AI solutions in newsrooms. While initiatives promoted by institutions like Google News, LSE AI Journalism Project, AI @AP, Newmark School, or Knight Center are focused on filling the need for education and training among professionals, one could argue that the change of culture toward AI would also require extensively introducing AI in journalism education.

Acknowledging the relevance of AI education for future generations of journalists means recognizing that “Artificial Intelligence is a journalist's best friend – but only if AI is fully integrated into every class, course and semester” (Orosz, 2019, p. 27). Consequently, this article will propose some critical elements for drawing possible trajectories for introducing AI to journalism education.

LITERATURE REVIEW

The adoption of AI in newsrooms has drawn strong scholarly attention. With the aim of offering a broad picture of this production,

I will briefly sketch some key topics found in the literature regarding AI in journalism.

One foundational idea tackled by the literature is the need to understand the AI–journalism relation from a historical perspective. This means remembering that “AI technologies, regardless of how transformative they yet prove to be in the short, medium, or long term, may be understood as part of a broader story of journalism's reconfiguration in relation to computation” (Broussard et. al, 2019, p. 673). This is a critical consideration to ground the debate and to be able to see its two sides: what journalists do with AI and how they shape public perceptions of AI through reporting. In the latter topic, there is a fruitful discussion related to algorithmic transparency and the role of journalists in what Diakopoulos (2019a) called *algorithmic accountability*, a “reorientation of the traditional watchdog function of journalism toward the power wielded through algorithms” (p. 207). This deals as well with issues like algorithm fairness and bias, part of the debate on AI ethics.

Among the studies concerned with AI in journalism, those focused on the implications for the newsmaking pipeline occupied primary attention (e.g.: 2019; Diakopoulos, 2019a; Marconi, 2020). Determining how newsmakers are using AI, from data gathering to audience outreach, seems to be a common concern.

Using machine learning models, some organizations have deployed tools to predict subscription cancellation or build paywalls that bend to the individual reader. A notorious example is the computer vision model created by the small Ukrainian news organization, Texty. The model was capable of analyzing large amounts of satellite images and detecting land that turned into lunar-like landscapes due to illegal amber mining in the country. Unsurprisingly, automated journalism dominates the field of planning, scheduling, and optimizing news, the third AI subset often used in the newsrooms that have adopted such technologies (de Lima-Santos & Ceron, 2022). Well-known examples span from the *Los Angeles Times'* QuakeBot, which can create a write-up within minutes of an earthquake, to the famous *Washington Post* Heliograph, used to automate content production during the coverage of the Rio 2016 summer Olympic games.

The adoption of AI-related technologies in the

newsrooms revealed zones of tension that have been acknowledged by scholars: first, the ethical challenge of reporting with AI while ensuring the transparency and reliability of the tools; second, the uneven distribution of AI adoption worldwide (Beckett, 2019); and third, the dependency on big tech companies to pursue innovations. “Most of the applications that use AI in the news industry rely on grants from big tech companies such as Google and Facebook to develop them,” note Lima-Santos and Ceron (2022, p. 23), citing the findings of Rashidian et al. (2018). This challenge is embedded in the broader financial crisis that challenges the journalism industry.

As mentioned in the introduction, one of the biggest concerns raised by the respondents to the Beckett (2019) survey is the need for AI literacy and a change of culture. The comments highlighted not only the need for AI education and training for journalists but also for future journalists. This leads to the next part of this review, exploring the still-scarce literature tackling AI in journalism education.

AI in journalism education

Aimed at engaging scholars in the conversation about AI in the broader scenario of communication education, Luttrell et al. (2019) shared five considerations to address the introduction of AI in the classroom. Although the authors do not provide practical experiences (it is not their aim), these considerations, based mainly on the scholarship of teaching and learning in communication, provide a great base to reflect on the specific necessities of introducing AI in journalism education. Their proposal suggests considering the ethics of introducing technologies in the classroom; combining theory and practice (e.g. using AI technologies as examples to discuss the classic media theory); leveraging instructors’ knowledge regarding emerging technologies; creating partnerships to provide students access to news platforms and enhancing media literacy in learners (Luttrell et al., 2019). They conclude that “AI is an essential addition to the classroom as educators look to send the next generation of job-ready professionals into the industry” (p. 476). In this article, I contend that it is critical to see

beyond the technology and look at the set of ideas that support AI development and its broadest computational context. I expand on this idea in the discussion section.

The Luttrell et al. (2019) call for revising the curriculum in light of this scenario echoes the recommendations of Gomez-Diago (2022). On reviewing international teaching and research experiences, Gomez-Diago discerned two main aspects: “a critical perspective that pays attention to the social consequences of its use in the media context and an applied perspective aiming to train journalism students fundamentally in three competencies: data collection and processing, automated content creation and content verification” (p. 30). The conclusions are also drawn from insights obtained by the author at conferences where the topic was discussed. Although this diversity can be methodologically challenging, the results show the viability and necessity of widening the scope of experiences to obtain the most comprehensive look at the state of the art of AI journalism education. Gomez-Diago’s (2022) findings remind us of the old tension between humanistic and technological perspectives regarding journalism education. Recent investigations regarding the introduction of AI in journalism education bring this conversation back. Bosley and Vallance-Jones (2022) make reference to the “tension between technical instruction and the development of ‘softer’ skills such as critical thinking and interviewing” (p. 3). Assuming an approach strongly technical or uniquely critical would mean taking a position at the extremes of this tension, the present proposal will reveal that a different approach is needed.

While adopting an AI literacy approach, some Chinese journalism and communication programs have radically changed media education (Luan & He, 2019). Although the technical approach seems to have a strong influence, by reviewing the title of the courses offered by universities and faculties, one notices an intention to combine the critical and the technical perspectives. In those programs aimed at developing an AI literacy perspective, Luan and He (2019) identified that big data, artificial intelligence, virtual simulation, and media applications were the three main categories in university courses.

Gordon and Lule (2019) point out the need

to “prepare students to report on the coming transformation of AI and equip them to help shape that transformation for society and journalism” (p. 800). The current industry’s necessities and state allude to the inevitability of combining AI-related technical skills (Marconi, 2020) and critical thinking for the future generation of journalists. The 43% of journalists worldwide who answered the London School of Economics AI Journalism Project survey noted the need to recruit people with new skills regarding adopting AI in the newsroom (Beckett, 2019). Promoting this change in the future generation of journalists could be part of the change of culture mentioned by the journalists.

Seeking to distance from the traditional humanistic perspective, Pantserev (2021) argues:

due to the active implementation of AI technologies in journalism, media education ceases to be purely a humanitarian one, and it becomes essential for journalists to obtain a set of technical competencies to be able to set tasks for technical specialists to write AI-based algorithms and to manage appropriate hybrid intellectual systems. (p. 511)

Consequently, Pantserev (2021) proposes incorporating disciplines like Introduction to Data Sciences, Basics of Statistics and

Probability Theory, and Basics of Mathematics for Data Sciences at the bachelor’s level. Although helpful for exploring the current perspectives, this approach is positioned at the edge of the technical instruction perspective and pays little attention to the societal viewpoint. This proposal raises questions related to the computer science expertise among communication and journalism faculties. Reflecting on this issue, Diakopoulos (2019) proposes the creation of graduate programs combining computational and journalism education, suggesting the creation of a Computational Journalism Ph.D. program.

Although scarce, the literature concerned with AI in journalism education provides key insights: first, the need to introduce AI in the curriculum to equip students with the tools (applied and critical) to enter into a changing industry; second, the relevance of combining theory and practice in the teaching experience; and, finally, the inevitability of the debate on the ethics of being a journalist in times of AI.

DATA AND METHODS

This work is a pilot exploration of AI journalism training and teaching experiences. The data comprises two groups of six courses each. To form these groups, a search using the Google search engine was conducted from January to June 2022. Different

Table 1
Online Open Courses and Resources for journalists

Courses/resources	Institution
Introduction to Machine Learning/Hands-on Machine Learning	Google News Initiative
IA para periodistas (AI for journalists)	Prodigioso Volcán
Editorial Algorithms: The Next AI Frontier in News and Information	National Press Club Journalism Institute Program
News Algorithms: The Impact of Automation and AI on Journalism	Knight Center
AI Journalism Starter Pack (resources)	London School of Economics
A Crash Course for Journalists on AI and Machine Learning	International Journalism Festival

Table 2*Courses for journalism and communication students*

Course	Institution
AI & Society	Carnegie Mellon University School of Design
Topics in Journalism & Society: AI, Automation & Journalism	Northern Illinois University
Computational Journalism	Stanford Journalism Program
Algorithms and Automation	School of Journalism and Communication, University of Oregon
AI in Media and Society	University of Florida
AI and Digital Communication	Hong Kong Baptist University

combinations of the keywords: “AI,” “Artificial Intelligence,” “algorithm,” “machine learning,” “courses,” “training,” “computational journalism,” and “news” were used for the search.

The first group gathers online open resources (courses, conferences, or guides) for journalists (Table 1). The second brings together university courses as part of communication or journalism programs (Table 2). The first group gathers courses or conferences based on the following criteria: educational resources explicitly tackling Artificial Intelligence or its subsets (e.g., Machine Learning) for journalists; of free access, self-paced; and offering a practical approach. The second group (Table 2) comprises courses by universities that explicitly include the terms Artificial Intelligence, machine learning or algorithm in their titles or descriptions, are taught in the context of journalism or media programs, and offer open access to the course syllabus or informative material relative to the course. This poses the limitation of not accessing courses that do not provide open online access to the syllabus or explicitly state their main topic in titles or descriptions. Future studies designed to survey Canadian instructors in journalism regarding AI schools may further explore this issue. However, until the date of conducting this pilot study, no courses in Canadian journalism programs met the criteria of the present exploration. While there are courses tackling AI-related topics in media, they

are mainly focused on marketing or entertainment (e.g., Digital Media BA at York University). Further, while Data Journalism courses conform to various Canadian journalism programs, it is important to clarify that there are key differences between data and AI journalism, and therefore, they are excluded from this pilot study. AI journalism, as stated by de-Lima-Santos & Salaverria (2021) constitutes a step further in the use of computational power and thinking in journalism:

In the mythos of data journalism, practitioners were empowered by the superior computational prowess of the 21st century since it allowed them to move beyond the age of big data to the era of artificial intelligence (AI) when principles of computing and data science became ever more pervasive in journalism. (p.5).

While big data is at the core of the development of AI, AI journalism involves the creation or use of an algorithm to develop an AI model.

While both groups included in this study have thematical convergence, because in all cases Artificial Intelligence is at their core, the contrast in approaches offers a rich ground for analysis. Courses for journalists are more situated on the practical side, while the courses at the universities stand mainly from a critical

perspective. The state of AI adoption in the journalism industry worldwide, as seen in the first part of the literature review, confirms the need to look at these practical educational experiences. Analyzing research and teaching initiatives on AI to “provide ways to introduce artificial intelligence in the curriculum of the degrees and masters in journalism and communication,” (Gomez-Diago, 2022, p. 29) demonstrated the viability of using a corpus of diverse data linked thematically, to detect perspectives and common frameworks on AI in journalism education, especially due to the nascent character of these type of studies.

Due to the lack of academic investigation focused on AI in journalism education (Luttrell et. al., 2019, Gomez-Diago, 2022), the data for analyzing the academic teaching experiences (Table 2) was comprised of the course’s syllabus available online and supplementary informative material relative to the course provided by the professors (e.g., interviews, posts, videos, articles, descriptions). An initial review of this data allowed me to summarize the main topics and objectives covered by the courses, the approach undertaken (whether the course was focused on the technical, socio-ethical aspects of AI or combinations), and if the course leaned towards a practical or an analytical approach. The description of the course is included in Appendix 2.

Due to the novelty of this field and the pivotal importance of gaining a better understanding of the technical and societal aspects of AI, this study uses *self-training* as a research method. Tremblay (2003) defines self-training as a research method that is “an educational (pedagogical or adult education), school or extracurricular situation that is conducive to the realization of a project during which the primary motivation of a person is to acquire knowledge and skills (know-how) or to make a lasting change in themselves (self-management)” (p. 80).

For the self-training, I used conferences and courses included in Table 1, which gathers training resources for journalists. Completing these learning experiences allowed me to confirm the gap between the current debate around the state of play in journalism practice and the academic reflection on how the current situation is mirrored in journalism education. An evaluation of the learning process provided information on the

main topics tackled and the approach undertaken by each resource in that group. Appendix I gathers a summary of the main findings in this group.

The initial explorations of the two sets of courses allow me to determine the presence of the following thematic units: *AI history and antecedents*; *AI subfields*; *Data fundamentals*; *Ethics and societal impacts*; and *AI uses in the newsroom*. Although not expressed in the same way, those themes appear through all the resources analyzed. Then, based on those units, a comparison between the two sets was conducted, using a typology of literature review known as *thematic synthesis*. This type of review helps investigators to extract themes, cluster them, and synthesize topics content in those units (Xiao & Watson, 2019). The conclusions obtained from the analysis of the academic course materials and the self-training process were read against the backdrop of AI in journalism education and the AI journalism literature, in order to propose what key elements could entail drawing possible teaching trajectories for journalism instructors.

COURSE CONTENT

Educational Initiatives for Journalists

The courses *Introduction to Machine Learning* and *Hands-on Machine Learning* offered by the Google News Initiative (Google n.d., a, b) focus on the specific journalism uses of Machine Learning (ML) as an AI subfield. While the first course aims to teach the ML fundamentals for journalism, the second has a practical approach, complementing each other. At the end of the second course, journalists will be able to use AutoML Vision in Google Cloud to test a model using data from an actual journalistic project. The first course provides information to understand the steps needed to train an ML model, the types of models, the kind of questions ML can help answer, and how an ML model learns. The second course covers data preparation, model creation, model evaluation, and recaps content included in the introductory course. Together, they constitute an excellent foundation for understanding AI in journalism.

The course *News Algorithms: The Impact of*

Automation and AI on Journalism (Diakopoulos, 2019), offered by the Knight Center, focuses on the way algorithms are changing journalism from news curation to consumption. Positioning algorithms at the core of the course allows Diakopoulos to expand on news algorithms functions like classification, calculation, prioritization, association, and filtering; and explain them within the automation process. It also explains different approaches to automated content production, whether text or visualizations. One critical takeaway is its job in dismantling perceptions about AI taking away journalists' jobs. Diakopoulos (2019) highlights the new roles brought by automation to the newsrooms and the human role in augmenting automated content and assuring reliability. This course looks to develop practical skills to integrate automation in the newsroom while promoting a journalism practice capable of blending algorithms and human expertise. Another essential of this course is introducing the term 'computational thinking' to AI training for journalists. This is a critical aspect, as it is essential to abstract a problem, encode it for the computer, and then use an algorithm to solve it (Diakopoulos, 2019). This chain of tasks will be more frequent in the newsroom as AI and automation gain ground in journalism practice.

The conference *Editorial Algorithms: the Next AI Frontier in News and Information* (Marconi, 2021), assesses the relevance of infusing the algorithms with editorial principles. Marconi's notion of editorial algorithms adds a new dimension to the algorithm term, discussing their functions in the context of journalism content creation. The conference summed up some new roles AI brings to the newsroom, like automation editors, computational journalists, newsroom tool managers and AI ethics editors. Through case studies, the session focused on the areas where AI is "dramatically" (Marconi, 2022) changing journalism.

The attendees received a general idea about AI-powered tools that can be used for newsgathering, production, distribution, and audience moderation. Like the Diakopoulos (2019) course, this conference paid attention to the role of journalism in algorithm auditing. Also, it discussed challenges like fake news and deep

fakes, and how to address algorithms' biases. While this conference looked into the next future of AI in journalism, combined with other resources in this group, it resulted in a comprehensive approach to AI's role and state in the industry.

AI Journalism Starter Pack (LSE, 2020) is a guide of resources regarding AI in journalism. It focuses on how newsrooms worldwide use AI for news production and audience engagement, among other everyday practices. The guide compiles a list of AI-powered tools and solutions for journalism that can be especially helpful for small newsrooms with limited technical expertise. It also includes resources for building an AI strategy, contributing to newsrooms keen to start the AI journey. Of particular note, the pack shares initiatives developed by newsrooms that employ AI for fact-checking, verification, and content moderation. Those are vital examples of how AI-related technologies can contribute to confronting the "fake news," hate speech, and polarization aggravated by social media platforms. This is an indispensable resource for any journalism professional willing to have a broad picture of the current state of AI in newsrooms globally.

A Crash Course for Journalists on AI and Machine Learning (Peretti & Rinehart, 2022) was a conference held during the 2022 International Journalism Festival in Perugia and accessible online. Unlike other resources in this group, this conference paid attention to the difference between narrow and general AI, which constitutes a critical aspect of configuring AI narratives because it relates to portraying utopian and dystopian scenarios about AI. Another cardinal and commonly overlooked aspect presented here is the precise positioning of AI in the framework of computer science, placing it as part of the broader computational development. The presenters delivered a point of view that encompassed the academic perspective brought by the LSE Journalism AI project and the industry side represented by the Artificial Intelligence @ AP project. The industry-academic blend resulted in an inclusive approach, making this conference a reference for those approaching AI in journalism for the first time.

IA para periodistas (AI for Journalists) is the only Spanish resource in this pilot study. It is

a comprehensive guide that ranges from a brief AI history to examples of how subfields of AI are being used in journalism. This guide answers critical questions in developing a foundational understanding of AI for journalism. The Poderoso Volcán (2020) resource draws attention to three critical aspects of adopting AI in the newsroom: resources, education, and an ethical debate. All of them are linked to the impact of AI in journalism as a profession.

This is a critical takeaway because it reminds us of the necessity to accompany the skills development journey with a critical analysis of AI's ethical challenges for the profession. The guide combines graphics and examples, delivering a clear and easily understandable explanation of machine learning, algorithm functioning, and deep learning. It graphically explains how the AI subfields overlap and converge, helping media organizations understand which tools can assist them in solving specific problems or questions. At the same time, it provides a solid initial AI literacy model for journalists.

Courses at Universities

While the analysis of these courses was made through the syllabi or posts published by instructors, it is necessary to acknowledge this limitation because this pilot study does not include all the information shared in classes.

The University of Florida course titled *AI in Media and Society* (McAdams, 2021), focuses on introducing students to technical aspects like deep learning, reinforced learning, natural language processing, and machine vision, which is consistent with the teaching objectives to “differentiate between machine learning and other types of AI and define and describe fundamental structures related to AI, such as algorithms, models, neural networks” (p. 1). Unlike other courses in this second group, the AI technical aspects occupy a prominent space. This confirms the need and viability of teaching AI technical issues to help future journalists and communicators accurately talk about AI, helping to confront deterministic narratives around AI in the public sphere.

Bringing iconic examples in the history of AI, like the IBM Doctor Watson, Alpha Go, or the most recent self-driving cars, McAdams (2021) contributes to developing a historical perspective of AI and illustrates different periods in its development. Explaining AI biases through examples and how biases could be reduced or eliminated are highlights of this course because system bias is at the core of AI ethics and regulation conversation.

The course *Algorithms and Automation* (Lewis, 2017), taught at the School of Journalism and Communication, University of Oregon, revolves around algorithms and how they shape and are shaped by society. This seminar-based course explores “the interconnected social, cultural, and ethical dimensions of algorithms, automation (bots), and emerging forms of artificial intelligence” (Lewis, 2017, p. 1). Considering the course date, it is unavoidable to highlight its frontrunner status among the courses introducing journalism and communication students to the debate on the social implications of big data, algorithms, automation, and AI. This experience shows the relevance of teaching the conceptual distinctions between automation and AI, often assumed as synonymous in the popular discourse (Peretti & Rinehart, 2022).

The Lewis (2017) course ranges from social media algorithms and data literacy to automated journalism ethical considerations. In the five years since this course was first taught, the adoption of AI in the newsroom has resulted in the creation of new applications and AI-powered tools. However, the discussion around algorithms is still valid (more than ever) and shows the viability of considering those artifacts as critical units while introducing AI in journalism education.

Similarly, the course *AI & Society* at the Carnegie Mellon University School of Design (Steenson, 2020) looks to develop a critical perspective of AI's relationship with society. Although this course is not taught as part of a journalism or media program, it revolves around key concepts for the relationship between AI-journalism like the notions of public, content moderation, trust in AI, fairness, and bias. In general, a critical notion of AI within a strong communicational perspective prevails in this course. Through creative teaching, this experience

proposes an interdisciplinary approach for analyzing questions such as intelligence or making AI fairer. The interdisciplinary approach, achieved through collaboration with experts from other fields, shows the feasibility of embracing inter-faculty cooperation while introducing AI into journalism curriculum.

The course engages students in a debate about how algorithms amplify negative bias. During class, Steenson (2020) explains “the ways that this happens and possibilities for change” (sec. 2/5, para.1). The course positions this debate in the broader framework of the human-machine relationship, a connection shaped and being shaped by the data used to feed those algorithms.

While topics such as AI’s impact on labour, ethical challenges, and algorithm bias coincide with other courses, the approach to the trust issue is a highlight in this initiative. It is essential to consider discussion of the public trust influence on the adoption of AI in educational endeavours for communicators and journalists because, as O’Doherty and Einseidel (2012) point out, public engagement is critical in adopting emerging technologies.

With a practical approach, the course *Computational Journalism* (Agrawla et al., 2022) tackles algorithms in three dimensions: as tools to write stories; as tools to discover stories; and as an object of journalistic attention. One key element in this course is its focus on data science. Due to the role of data in AI development, this topic should be a constant in teaching AI to journalism and communication students. “This project-based course explores the use of data science, information visualization, artificial intelligence and emerging technologies to help journalists discover and tell stories, understand their audience, advance free speech and build trust” (Agrawla et al., 2022, para. 1). This comprehensive perspective confirms the relevance of espousing AI education for future journalists in the broader scenario of computer science, where it belongs. This background would contribute to articulating, for instance, the difference between AI and automation or the role of data science in AI development.

The course is a lab to test ideas that can trigger future projects in the newsroom. One of the journalism students pointed out that this learning experience provided a “glimpse of what

it would look like working on future projects” (Tumgoren, 2020, 4:10/5:36). This interdisciplinary cooperation drives a tool-building approach where computer science and journalism students have the opportunity to complement their respective knowledge and learn from each other.

Taught at Northern Illinois University, the course *Topics in Journalism & Society: AI, Automation & Journalism* (Guzman, n. d.), aims to build an understanding of AI’s influence on news production, distribution, and consumption. This course stands out for its historical aspects and focuses on human-machine interaction. It covers issues like ancient intelligent machines and the evolution of data’s role in journalism practices. Both are critical aspects of understanding AI’s influence in journalism.

Most of this course’s expected outcomes involve developing the capacity to explain, situate, compare, and evaluate phenomena related to AI/augmentation/automation and journalism practices, including ethics, prominent trends, and future implications. Another critical aspect to consider from this course is how it points not only to the producers’ side but also to the consumers’ perspective. While algorithms strongly inform news consumption habits and many applications are related to audience engagement (LSE, 2020), this perspective cannot be overlooked in journalism education.

The *AI and Digital Communication* course taught at Hong Kong Baptist University (2020) adopts a literacy approach. This is one of the most wide-ranging initiatives in Table 1, ranging from technical to social aspects of AI. It tackles various AI applications for media, including “data-driven digital marketing, toys and gaming, AI and multimedia production, automatic customer service, computational news production, machine learning, recommender systems and search engines” (HKBU, 2020, para. 1). It is remarkable how this array of applications is related to the changes in the journalism business model, a critical aspect in light of the current state of journalism and the shift of advertising investment to the coffers of Google, Amazon, Facebook, Apple, and Microsoft (GAFAM) (St-Germain & White, 2021), also known as the big five companies of the digital world.

Although this course does not seem to be

intended to develop technical skills, it does look to cultivate an understanding of AI technicalities. The course includes topics like machine learning, deep learning, data mining, and search engines. The combination of AI social aspects and the knowledge about technicalities contribute to making better sense of AI implications for the media industry.

COMPARISON

The comparison between the two sets of experiences was based on the thematic units determined at the initial exploration. These are topics presented alone through the two sets of courses, showing the relevance that both practitioners and academics grant to them. These thematic units can serve as references for designing courses. However, it is essential to annotate how they differentiate between the two sets of resources.

AI History and Antecedents

This topic is prevalent in university courses, especially in those with a strong orientation toward social issues. These courses explicitly mentioned the history or antecedents in their syllabi (e.g., *AI & Society* or *Topics in Journalism & Society: AI, Automation & Journalism* and *AI and Digital Communication* courses). Historical moments such as the Turin Test or the history of machines are familiar discussion points for this area.

Although the training resources for journalists include mentions of AI history (e.g., *IA para periodistas; A Crash Course for Journalists on AI and Machine Learning*), there is less space dedicated to this issue in comparison to the university courses. However, one commonality is the mention of how computational development explains the current state of AI in terms of computer storage capacity and processing power. This is one of the main reasons for including the historical perspective in the course because it explains the evolution of AI in association with the development of computational science and, thereby, social factors.

AI Subfields

This is a topic included in both groups of courses, but with different methodological approaches to explaining the AI subfields. This content is often better structured in resources for journalists. For example, there are clearer mentions of the conceptual distinctions among AI subfields such as machine learning, natural language processing or computer vision in the resources for journalists (e.g., *AI for Journalists Starter Pack; IA para periodistas; A Crash Course for Journalists on AI and Machine Learning*). Some university courses explicitly mention machine learning while explaining unsupervised, supervised, reinforcement learning, and deep learning models (e.g., *AI and Media; AI and Digital Communication; Computational Journalism*).

The content shows how the AI subfields overlap and complement each other, especially in solutions for investigative journalism projects, and why it is essential to teach the distinctions. Applications created to tackle one investigative project commonly do not suit a new endeavour. Adapting a solution to a new project brings ethical and technical challenges tough to overcome (Google, n.d., a). For this reason, teaching the conceptual distinctions among the subfields is critical to showing how to find the best solutions.

Data Fundamentals

The aim of explaining the pivotal relevance of data for AI seems to be equally present in both groups of courses. The presence of this topic demonstrates that it is impossible to discuss AI or algorithms without focusing on data, because the massive amount of data production and the development of computational power are the core of AI development. The resources for journalists (e.g., *Introduction to Machine Learning/Hands-on Machine Learning; AI Starter Pack for Journalists; Editorial Algorithms: The Next AI Frontier in News and Information; News Algorithms: The Impact of Automation and AI on Journalism*) are mainly oriented to discussing managing big data sets, scraping data, or data visualization. On the other hand, the universities' experiences deal more with discussions on data

mining or the challenges associated with big data for society (e.g., *Topics in Journalism & Society: AI, Automation & Journalism; AI and Digital Communication; Algorithms and Automation*).

Ethics and Societal Impacts

Analyzing the societal benefits and downsides of AI is at the core of the educational experiences for students. These courses seem mainly oriented toward developing a critical understanding of AI, algorithms, and automation. The university initiatives commonly use examples to illustrate the negative impacts of AI, like polarization or discrimination due to the bias in the data sets. They also provide references that help deepen understanding of this phenomenon in a media context as well as other areas of society, such as healthcare, banking, and education. It is also notable for the purpose of teaching students about the role of journalism in making the tech companies behind algorithmic technologies accountable for their products.

Although all the experiences give great relevance to ethical and societal aspects, the resources for journalists are more focused on how AI informs the journalism profession, mainly around which responsibilities come with the introduction of AI in the newsroom, or the need to bring traditional ethical journalism principles to the adoption of AI (e.g., *Editorial Algorithms: The Next AI Frontier in News and Information; AI Journalism Starter Pack; News Algorithms: The Impact of Automation and AI on Journalism*). There seems to be a consensus on the need for an interdisciplinary perspective to implement AI ethically, including journalistic perspectives.

AI Uses in the Newsroom

This aspect is the main focus of all the initiatives for journalists. In some cases, they revolve around algorithms (e.g., *News Algorithms: The Impact of Automation and AI on Journalism*) or focus on the use of AI-related tools for newsgathering, reporting, news distribution, and confronting disinformation (e.g., *Introduction to Machine Learning/Hands-on Machine Learning; IA para*

periodistas; Editorial Algorithms: The Next AI Frontier in News and Information; News Algorithms: The Impact of Automation and AI on Journalism; AI Journalism Starter Pack).

Some initiatives for journalists are engaged with teaching how to create models using non-coding tools (e.g., *Hands-on Machine Learning; AI Journalism Starter Pack; News Algorithms: The Impact of Automation and AI on Journalism*).

The courses for students are more focused on teaching about the existence of those tools and how they impact the journalistic profession. Still, they are less likely to dedicate time to training the students in using those tools, with some exceptions like the *Computational Journalism* (Agrawala et al., 2022) course.

Based on the findings during self-training, the review of the course materials, the comparison between the two sets of courses and the literature review, in the next section, I will discuss some possible learning trajectories to consider for introducing AI into the journalism curriculum.

DISCUSSION

The introduction of AI in journalism curriculum should consider the experiences from practical courses intended to train journalists and the teaching experiences being developed in journalism, communication, or undergraduate media programs. By analyzing the results obtained while taking, reviewing, and comparing those courses, I would argue that a route to introducing AI in the curriculum could embrace the following: a) a program-wide AI literacy approach, b) training and cooperation efforts, and c) the students' generational positionality. Next, I will elucidate on all of them.

Program-wide AI Literacy Approach

The universities' teaching experiences, along with the learnings from the training courses, show the need to trace teaching trajectories marked by an AI literacy perspective. Embracing this approach would mean *adopting teaching practices capable of developing students' competencies*

and knowledge to use and cooperate in creating AI-powered technologies for journalism and developing in them a critical understanding of the relationship between AI and society. This also implies understanding AI as a collection of ideas, technologies, and techniques related to a computer system's capacity to perform tasks normally requiring human intelligence (Brennen et al., 2018). This proposal encompasses two overlapping streams. One path focuses on introducing students to using AI as a tool for journalism, while the other is dedicated to developing a critical understanding of AI in its sociotechnical complexities. The latter means tackling the social implications of AI, not only in news distribution and consumption but also in the ethical challenges of its adoption. Adopting this approach program-wide means acknowledging the opportunities that AI poses for the journalism curriculum. A broad picture would look like an introductory course to AI covering socio-ethical challenges for the profession and key technical aspects, whereas a second course would be devoted to learning about and analyzing the implications of tools developed by news organizations, covering different aspects of the pipeline. These foundations would then be augmented throughout the program in courses like investigative reporting, data journalism, storytelling, fact-checking (Oroz, 2019), business models, or new media, with the teaching and use of AI-related technologies.

Therefore, this proposal follows Broussard et al. (2019), who suggested that AI teaching initiatives for journalism and communication students can be focused on “the strengths, weaknesses, processes, ethical issues, and various applications of AI-related to our field” (p. 675). The *AI and Digital Communication* course (Nil, 2020) shows the viability of integrating the technological aspects of AI-powered tools with social and historical AI aspects into a course, creating a comprehensive approach that helps introduce students to foundational knowledge about AI. The training initiatives for journalists (LSE, 2020; Google, n.d. a, b; *Poderoso Volcán*, 2020) could also contribute to appreciating the combination of critical thinking development and the introduction of AI tools for journalism.

Orosz (2019) suggests that the journalism curriculum needs to be complemented with “the

knowledge of Artificial Intelligence as well as combining teaching journalism with Artificial Intelligence learning modules” (p. 27). This idea is consistent with the present proposal of adopting the AI literacy perspective with a program-wide approach. Areas such as news consumption and fact verification serve as good examples of how to pursue this path.

Reflecting on the necessity of integrating AI technology for evaluating the credibility of news and/or information sources, verifying, and fact-checking in journalism teaching, Orosz (2019) writes: “As much as Artificial Intelligence is able to evaluate and measure user credibility on social media platforms in the news-flow, the conventional method of verification is to be coupled with AI technology in teaching” (p. 28). This approach focuses on augmenting journalism education with AI tools that have proven helpful in journalism practice.

The Reuters Institute Digital News Report (Newman et al., 2022) found that “many people are becoming increasingly disconnected from the news—with falling interest worldwide, a rise in selective news avoidance” (p. 11). In an effort to fill that gap, some media organizations like “the *Chicago Tribune*, Hearst, and CBS Interactive deploy AI-powered content distribution platform TrueAnthem to determine what stories should be recirculated and when they should be posted across social media platforms” (Marconi, 2020, p. 51). Although it would be necessary to systematize whether using AI applications for news distribution optimization would really influence consumption habits in the long term, engaging students in exploring how AI-powered tools can be used for audience engagement might be a key element in the teaching experiences focused on AI. The examples of news media organizations worldwide using AI-powered tools to understand news consumers' behaviours, optimize content suggestions, and ultimately customize distribution, constitute not only potential tools to explore but also excellent objects of analysis.

The information analyzed for this paper suggests that the teaching initiatives for journalism and communication students could include the following topics: AI antecedents and main historical milestones; algorithms as socio-technical artifacts; the role of big data in AI and

data bias; the distinctions between automation and AI; AI subfields; the principles of general and narrow AI; and AI-powered tools for communication and journalism. Those courses oriented to introduce students to AI-powered tools can focus on tools for newsgathering, content/source verification, content production and distribution to offer a comprehensive view of AI for journalism applications.

In terms of developing a critical understanding of AI, embracing the AI literacy approach means positioning this conversation in the broader scenarios of computational science and the social shaping of technology perspective (William & MacKenzie, 1999).

While positioning the teaching experiences in the computer science framework, the courses could adopt a similar approach to Agrawala et al. (2022), embracing computational journalism's conceptual definitions (Cohen et al., 2011), a perspective that can explain AI growth as a fruit of computational development. The history of personal computing, for instance, shows why acknowledging this wider setting of multiple influences is essential. Inquiring about who invented personal computing, Ceruzzi (1999) reviewed the significant contributions made by pioneers like Steve Jobs, Steve Wozniak, Stewart Brand, and companies such as Digital Equipment Corporation, Intel or Hewlett-Packard, but highlighted that "Ed Roberts and his small groups in Albuquerque deserve credit for engineering the convergence of technical and social forces" (Ceruzzi, 1999, p. 82). Roberts is known as the inventor of the first commercial personal computer. Thus, teaching AI against a computer science background could mitigate falling into the AI buzzword path, and help provide elements for students to understand the convergence of factors gravitating toward its development. With a strong emphasis on algorithms as socio-technical artifacts, the course *News Algorithms: The Impact of Automation and AI on Journalism* (Diakopoulos, 2019) also offers an example of this perspective.

Arguing that AI literacy for journalism students should be led by the social shaping of technology's theoretical approach means bifurcating the arrow in terms of scholarly attention to the relationship between journalism and AI. Even though the influences of AI on journalism have been the

main focus of scholarly attention, embracing this perspective means acknowledging that journalism is also a player in the social shaping of AI. This proposal follows Garvey and Maskal (2020) when they state that AI emerging technologies "are still flexible [and] can be shaped significantly by media representations as well as public engagement with science" (p. 286). In terms of AI in journalism education, it means teaching under the idea that society and technology are mutually constitutive without falling into soft technological determinism and considering how the artifact's technical properties equally enable some options and constrain others (Mackenzie & Wajcman, 1999).

Topics like content moderation in social media, automated flagging of hate speech, or the deepfake phenomenon embrace ethical considerations linked to journalism and AI. Acknowledging those theoretical constructs would be helpful to think about, for example, how the social implications of those phenomena are shaping the big tech companies' responses and what the role of journalism is in the tensions raised by such issues.

In short, teaching AI to journalism students under the umbrella of computer science and within the theoretical framework of the social shaping of technology would contribute to designing courses where AI technicalities and social aspects complement mutually. This approach would help future journalists to know, properly use, and contribute to creating AI-powered tools for journalism while engaging in a critical conversation about the AI role in the society-technology dialogue.

Training and Cooperation

Educating future instructors in AI is a critical step toward introducing AI into the journalism curriculum from a literacy perspective. Reflecting on the future of journalism education and AI, Broussard et al. (2019) asked a critical question: "How do journalism and mass communication instructors who are not trained as computer scientists, statisticians, or data scientists impart AI knowledge to students equally unlikely to have much expertise in computer science, statistics, or data science?" (p. 695). Answering this question will require interdisciplinary cooperation to

strengthen faculty capabilities and incorporate AI-related courses in Ph.D. programs.

The latter poses a significant challenge due to a proven disconnection “between what Ph.D. programs in journalism and mass communication teach and what is demanded by the professional and academic industries in the last two decades” (Royal & Smith, 2019, p. 2). Introducing AI into the journalism curriculum with a comprehensive perspective requires a different model of educating future faculty to develop “a digital scholar-educator and creates a pipeline of academics who will progress through the tenure track and influence future curriculum innovation across the discipline” (p. 10). The digital-scholar educator might be required to teach AI non-coding tools or work collaboratively with computer science instructors in undergraduate courses. This entails developing specific technological competencies, including the capacity to adapt to emerging technologies.

Luttrell et al. (2019) talk about the need for “retooling the educator to meet the needs of the profession” (p. 474) and remind us that “professional development surrounding basic constructs of AI, in addition to how AI is affecting our industry, may require additional support to master the intellectual and methodological dimensions involved” (p. 474). The digital scholar-educator (Royal & Smith, 2019) would also be required to transit the self-training path, receive material support for professional development, and participate in interdisciplinary cooperation. Diakopoulos (2019) goes a step further, proposing the creation of a graduate degree in Computational and Data Journalism “in order to teach a new breed of educator-practitioner-scholar” (p. 251). What is common among those reflections is the call to produce changes in the communication graduate programs as a foundation for future transformations.

While changes in the education model for future faculty require long-term interventions, interdisciplinary cooperation is crucial for introducing change in the curriculum. After three terms of teaching *Media and Society* with a focus on AI, Lule and Gordon (2019) praised the value of cooperation networks:

Our institution is fortunate enough to

have a long history of interdisciplinary work. It is not uncommon for professors from four distinct colleges—Arts and Sciences, Business, Education and Engineering—to work together on projects. We ask our colleagues from Engineering to interact with students and show them ways to participate. (p. 799)

The interdisciplinary cooperation model allowed the University of Virginia professors to overcome the lack of expertise in computer science. Exploring different cooperation models (interdisciplinary-interfaculty, industry-academia) would be part of the answer to the question raised by Broussard et al. (2019) about how instructors in journalism and communication would teach AI.

Luan and He (2019) described how journalism and communication programs in Chinese universities have partnered with the journalism industry to establish AI media labs “to equip students with AI literacy under a University-Enterprise Cooperation mechanism” (p. 467). Creating such partnerships could help complement instructors’ expertise with engineer and data scientists’ participation. The University of Stanford experience, where journalism and computer science students pursue a project-based course in conjunction, is worth replicating. This initiative showed how having hands-on experience in finding answers to journalistic questions using AI-powered tools and automation fulfilled students’ needs and expectations (Tumgoren, 2020). These ideas provide a segue to the next section, where I discuss the pertinence of including the students’ generational positionality toward technology among these proposed principles.

Students’ Generational Positionality

The students seated in the journalism classroom today are from a generation labeled Generation Z. Even though it constitutes a controversial category, it is helpful to understand students’ behaviors and attitudes in the classroom. In this case, this term is beneficial to contextualize their attitudes toward technology. I argue that embracing the term while designing a route for introducing AI in

the journalism curriculum might help obtain clues to the student's attitude toward learning AI.

Generation Z is framed as being born between 1995 to 2010 (Seemiller & Grace, 2019). The learning preferences found by the researchers confirm the need to embrace the introduction of AI in the classroom, not only to respond to the industry needs but also to dialogue effectively with this generation's expectations in the classroom. The need for applied learning and learning by example, two of the characteristics found by the researchers, are good motivations to design project-based programs oriented to teaching how to use AI tools to answer specific questions in journalism. The courses shown in Table 1 offer examples of how the training initiatives for journalists have been dealing with this need. The *Computational Journalism* course could provide clues on how to embrace this type of project in a university setting. Those experiences could contribute to meeting some of this generation's professional aspirations if considered.

Among recent journalism graduates from two Canadian universities, survey respondents in Bosley and Vallance-Jones' (2022) study said "they would have been better prepared had they had training—or more training—in areas such as coding, data analysis, and web design" (p. 17). Answers provided by the graduates allowed scholars to acknowledge the need to embrace "technological innovation in a more robust way" (p. 17) in Canadian journalism programs. Again, this consideration is traversed by the debate between traditional journalist skills instruction and innovative educational approaches.

Even though many of the respondents indicated they had not had opportunities to use cutting-edge technology tools in their jobs (Bosley & Vallance-Jones, 2022), the growing use of AI-powered solutions in newsrooms worldwide (LSE, 2020) makes it impossible to overlook the need to take up technological innovation in journalism education. As stated by Orosz (2019), "gaining information about Artificial Intelligence, algorithms and machine learning are not obstacles getting in the way of students that have not taken IT courses previously; instead, they are to be a compulsory amendment to the already existing curriculum" (p. 27). Generation Z's positionality toward technology can help to explain why being

AI-literate is not an obstacle for this generation but a rich opportunity for development.

Along with Millennials, the Gen-Zers are considered 'tech-savvy,' accustomed to using multiple screens simultaneously, and shaped by a constantly connected life (Seemiller & Grace, 2019). However, despite being known as the generation shaped by communication technologies and capable of orienting technologies' use "towards innovation" (Perez-Escoda et al., 2021, p. 125), the technological capabilities of this generation (Bosley & Vallance-Jones, 2022) should be taken as an opportunity to broaden and deepen their technological skills, and not as a synonym with technological expertise. It would be counterproductive to take for granted Generation Z's readiness to acquire, by themselves, the knowledge needed to deal responsibly with AI adoption in the newsroom. Instead, it is advisable to use their attitude toward technology in preparing them to embrace the ethical use of AI tools in the newsroom and contribute to making AI accountable in the social sphere through responsible journalism.

CONCLUSION

This article suggested key aspects to consider for tracing possible routes for introducing AI in journalism education. It discussed the relevance of bearing in mind a transformation in the graduate education of future instructors; embracing different models of academic/industry cooperation; adopting a program-wide AI literacy approach under the umbrella of computer science and the social shaping of technology theoretical corpus; and acknowledging the generational students' positionality toward technology.

The open online initiatives for journalists and available syllabi of courses included in this pilot exploration also provided clues about topics not sufficiently addressed in those initiatives. Issues such as the differences between narrow and general AI, data fundamentals, non-code tools for journalism, algorithms as amplifiers of social bias, and the distinctions between automation and AI are among the questions that need further consideration in journalism programs regarding AI. While I recognize the limitations of this pilot study, which covered a small number of courses and

pedagogical initiatives internationally, I suggest there is a need for empirical studies to identify similar initiatives in Canadian universities and monitor their impacts on students. It is also critical to contextualize the design of future AI teaching initiatives against the background of Canadian news organizations pressed by a profound crisis (Wechsler, 2021).

St-Germain and White (2021) suggest that AI adoption “is in its infancy in Canadian newsrooms,

except the *Globe and Mail* and the Canadian Press/La Presse Canadienne, which is not at all surprising given the state of the press in this country” (p. 12). Both the challenging situation of Canadian journalism and the state of AI adoption add layers of complexity to this already difficult task. However, the situation also makes one think about how introducing AI in the classroom could drive innovation in Canadian newsrooms. 

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