EMERALD POINTS

USING INTERACTIVE DIGITAL NARRATIVE IN SCIENCE AND HEALTH EDUCATION

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INVESTOR IN PEOPLE

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LIST OF ABBREVIATIONS

AMR	Antimicrobial Resistance
CCE	Climate Change Education
Co-I	Co-investigator
GP	General Practitioner (medical)
h-ACE	Holistic Agentic Climate-Change Engagement Model
HEI	Higher Education Institution
IDN	Interactive Digital Narrative
IS	Infectious Storytelling
MDR-TB	Multi-drug Resistant Tuberculosis
NHS	National Health Service (UK)
NW4T	No World 4 Tomorrow
OAN	Only Always Never
PI	Primary Investigator
REF	Research Excellence Framework
Scicomm	Health and Science Communication
SEN	Special Educational Needs
SENCo	Special Educational Needs Coordinator
STEAM	Science, Technology, Engineering, Arts, Mathematics/Medicine
STEM	Science, Technology, Engineering, Mathematics/Medicine
TB	Tuberculosis
WHO	World Health Organization
WNMA	Welsh National Memorial Association
YCO2	You and CO_2

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ABSTRACT

This book offers initial insights and lessons learned from two pilot studies using interactive digital narrative (IDN) as educational interventions seeking to effect positive behaviour change regarding topics of global social issues: climate change and antimicrobial resistance.

'You and CO_2' is a series of workshops for secondary school students: the researchers led hands-on sessions in the chemistry of carbon footprints, reading a climate-change-themed IDN and composing IDNs on the same theme. 'Infectious Storytelling' centres on affecting patient behaviours that contribute to antimicrobial resistance: in this project, researchers examine tuberculosis's (TB) representation in creative media in the Romantic era and post–World War II. This research informed a purpose-built IDN to effect positive change in public behaviour surrounding the current epidemic of antimicrobial-resistant TB (as identified by the World Health Organization).

Both these issues contribute to increasingly urgent 'global challenges': issues of climate change and ineffectiveness of medication for treatment of communicable diseases, particularly with regard to highly mobile and interspersed populations. There is a dire need to instill a stronger sense of personal responsibility to act as individuals to resolve global issues, and these pilot studies present IDNs as possible approaches in these resolutions. The studies presented in this book are an examination of the efficacy of entertainment media, specifically IDNs, to purposefully effect positive behaviour without resorting to obviously 'edutainment' games that students receive negatively.

This book's key contributions are in the areas of interdisciplinary research and education methods, combining arts and science methodologies and approaches to address significant global challenges (climate change, antimicrobial resistance). As such, it will offer insights for a rapidly growing subject area: interdisciplinary approaches. Its methodology and reflective sections on addressing the particular challenges of truly interdisciplinary research (from extremely disparate fields) will be especially helpful to future research teams.

More specifically, this book addresses science communication through interactive digital narratives. *IDNs have been shown to increase the efficacy of teaching on a range of topics, as has entertainment media in general. The IDNs at the foundation of the book's two studies were built to capture audiences' attention through strong entertainment narratives whose underlying informative and persuasive themes regarding climate change and antimicrobial resistance could affect audiences' perceptions and subsequent behaviours regarding these issues. By utilizing an interdisciplinary array of research contexts and methodological approaches, these projects aim to empirically test the effectiveness of 'playful learning' for behaviour affecting global sociological, health and environment issues; the following chapters deliver early conclusions based on the projects' pilot studies and interdisciplinary working.*

Keywords: Health Communication, Science Communication, Interactive Digital Narrative, Interdisciplinary Research, Wide Interdisciplinarity, STEAM, Entertainment for Education, Climate Change Education, Antimicrobial Resistance Education

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INTRODUCTION

Seven researchers in seven different research areas, on two different teams, are working to approach old problems in new ways. That is the foundation of this book, which in a very short space attempts to discuss both how interactive digital narratives (IDNs) can be used for science communication (SciComm) and health communication, *and* how interdisciplinary research teams can work together. Throughout, we offer initial insights and lessons learned from two pilot studies using IDNs as educational interventions seeking to effect positive behaviour change regarding topics of global social issues: climate change and antimicrobial resistance (AMR).

You and CO_2 (YCO2) is a series of workshops for secondary school students: the researchers led hands-on sessions in the chemistry of carbon footprints, reading a climate change–themed IDN and composing IDNs on the same theme. The goal of this pilot phase of the project was to examine the feasibility of integrating 'STEAM' (science, technology, engineering, arts, mathematics/medicine) (Ge, 2015) and blended learning (PERC, 2014) approaches, specifically chemistry and IDN, to climate change education in secondary schools, specifically in the New Curriculum for Wales (Donaldson, 2015). The project's overall aim is to effect observable attitude changes in the students regarding elements of their lifestyles that contribute to climate change.

Infectious Storytelling (IS) centres on affecting patient behaviours that contribute to AMR; in this project, researchers examine tuberculosis's (TB) representation in creative media in the Romantic era and post-World War II. The former period presents TB as a romanticised affliction leading to public perception of the disease as contributing toward creative genius; the latter examines how popular film representations of effective antibiotic treatment affected public perception and behaviour. This research informed a purpose-built IDN to effect positive change in public behaviour surrounding the current epidemic of antimicrobial-resistant TB (as identified by the World Health Organization).

Both these issues contribute to increasingly urgent 'global challenges': issues of climate change and ineffectiveness of medication for treatment of communicable diseases, particularly with regard to highly mobile and interspersed populations. As issues of health and environment become global issues, the problem of *diffused responsibility* (Wegner & Schaefer, 1978) arises; the more people perceived to be responsible for resolving an issue, the less each individual feels they need to act. Despite climate change resulting from human activity, most humans feel their contribution is minimal; thus, any effort made toward reducing individual carbon footprint is futile. Likewise, individual patients feel their health is their own problem; current increases in outbreaks of formerly controllable diseases like measles show that this is not the case, and the COVID-19 pandemic has shed a harsh light on the effects individuals' actions have on collective health. There is a dire need to instil a stronger sense of personal responsibility to act as individuals to resolve global issues, and these pilot studies present IDNs as possible approaches in these resolutions.

Specifically, these studies seek to evaluate the efficacy of entertainment-based IDNs for effecting personal perception and behaviour change on these topics. As using gameplay for teaching increases, students may develop resistance to obvious 'edutainment', or media specifically created to educate (Resnick, 2004), while pure entertainment can be shown to have significantly demonstrable effects on the public – such as the television show *CSI*'s possible effect on jury behaviour (Heinrick, 2006) and celebrity endorsement of 'anti-vax' stances leading to decreases in vaccination rates and increases in outbreaks of vaccine-preventable diseases (Hoffman et al., 2017). The studies presented in this book are pilot approaches to examining how entertainment media, specifically IDNs, could purposefully effect positive behaviour without resorting to obvious 'edutainment' games that audiences receive negatively.

IDNs have been shown to increase the efficacy of teaching on a range of topics (Cai et al., 2006; Gee, 2007; Huffaker & Calvert, 2003; Mayer, 2014; Mayo, 2009; Squire, 2011b; Wright & Sandlin, 2009), as has entertainment media in general (Hoffman et al., 2017; Wright & Sandlin, 2009). The IDNs at the foundation of the book's two studies were built to capture audiences' attention through strong entertainment narratives whose underlying informative and persuasive themes regarding climate change and AMR could affect audiences' perceptions and subsequent behaviours regarding these issues. By utilising an interdisciplinary array of research contexts and methodological approaches, these projects' long-term aims are to empirically test the effectiveness of 'playful learning' (Resnick, 2004) for behaviour affecting global sociological, health and environment issues.

APPROACHES TO EDUCATING THROUGH ENTERTAINMENT

Many creatures – humans, dogs, dolphins – learn not through rote but through play (Boyd, 2009). A kitten chasing her mother's tail is learning to stalk; team-based sports have grown from tribal games honing us for war. Similarly, humans evolved narrative to convey information in oral cultures that had no other means of recording community knowledge (Boyd, 2009; Ong, 1982). If we remember advertisement jingles and film quotes better than we do the memorised facts of a lifetime of schooling, it is simply because the medium of those messages is far better suited to the way our minds retrieve and store knowledge, shaped as they were by thousands of years of oral culture versus only a few hundred years of print culture.

So, it is not really a new idea to use games and narrative for educational purposes; we just seem to have drifted away from it, pedagogically speaking. As we have (re?)discovered in the massive cultural upheaval that is 2020, while we think of schools as centres of education, they also (perhaps primarily?) fulfil purposes as childcare, socialisation and enculturation (Dorn, 2013; Gibb, 2015; Idris, Hassan, Ya'acob, Gill, & Awal 2012).[1] A common lament of artists, scholars and innovators is that today's students are taught only to take tests, to regurgitate facts and repeat interpretations as dictated by the state; they emerge from school with little capacity for creative or critical thinking, leading to a scarcity in creativity and innovation. This idea is encapsulated in Ken Robinson's extremely popular TED Talk, *Do schools kill creativity?* (2006). Rather than the lovable, rebellious icons of page and screen, who constantly work and think outside the norms of society to solve their predicaments (Han Solo, Kevin McAllister, Lisbeth Salander, River Song, Pippi Longstocking, Fox Mulder…), our structured and measured system trains our youth to conform, punishing them when they do not.[2]

1 In case of any doubt, we are referring to the COVID-19 pandemic/dumpster fire, compounded by astonishingly poor governmental decision-making about how to manage it in both the United Kingdom and the United States, the first author's home countries.

2 An anecdote from the YCO2 workshops: year 10s (14–15-year-olds) were the most difficult to teach, as hormones and other distractions often made them 'too cool' to participate. Dr Skains worked with a particular group of Y10s for at least 30 minutes to get them to write something – *anything* – for their Workshop 3 Twine piece; they finally responded with an absurd narrative they were certain she would denounce, and thus let them discontinue any work. In contrast to their expectations, she responded 'Great! What happens when people with eggs for heads live on the moon?' Surprised, they carried on with their story and actually had good responses to it from YCO2 team members, until their headmaster appeared and dressed them down for being 'silly', effectively stifling all that hard-earned creativity in those students. If this is what many students deal with, day in and day out, it is no wonder they shut down their own creative capacities for the sake of survival.

Pedagogical research, perhaps not unexpectedly, shows pockets of recognition of this paradigm. Rather than eschewing stories and games as simply 'entertainment' or 'time-wasting', many studies have emerged examining the health and educational benefits of narrative reading, writing and playing. As both of the IDNs for the projects in this book built on the foundations of these research insights, it is worth a brief overview of each: bibliotherapy and its counterpart, expressive writing; knowledge conveyed through mass media entertainment; the educational applications of interactive media; and persuasive communication techniques.

Bibliotherapy and expressive writing primarily fall in the reading-and-writing-for-therapy category. Bibliotherapy is a clinical therapeutic technique used as a psychological intervention for patients of all ages, using the reading of both fictional and nonfictional narratives to improve emotional states and well-being (Barker, 1995; Doll & Doll, 1997; Pardeck, 2014). Expressive writing is similar, though narrative writing (fiction and nonfiction) is used as the psychological intervention (Bolton, Field, & Thompson, 2006; Mugerwa & Holden, 2012; Pennebaker & Seagal, 1999).

We formed these projects on the foundation of health communication and SciComm, in general, and specifically how entertainment media can educate even if that is not a text's primary or intended purpose. Quite often this can include misleading or hyperbolic information; examples include the 11 April 1996 'Dangerous Foods' episode of Oprah Winfrey's talk show regarding bovine spongiform encephalopathy (BSE) infected beef that resulted in a stock market crash for beef cattle (Terry, Macy, Owens & Womble, 2016); the oft-referenced 'crime scene investigation (CSI) effect', as the popularity of so many forensic investigation TV shows gives real-life jurors false expectations about forensic evidence (Heinrick, 2006); and every positive example of a child or bystander who learned cardiopulmonary resuscitation (CPR) from TV and movies using it to save someone's life (Eisenman, Rusetski, Zohar, Avital, & Stolero, 2015).[3] As has always been the case, humans store (and use) knowledge implicit in stories, whether or not that knowledge is accurate. SciComm advocates have been pushing, as a result, for creators to take responsibility for scientific authenticity in their work, given the significant effects mass media can have on cultural knowledge and individual behaviour (Chambers & Macauley, 2015; Kirby, 2011; Kirby, Chambers, & Macauley, 2015).

3 The crime scene investigation (CSI) effect is largely anecdotal/mythological, as numerous studies (e.g., Alejo, 2016; Eatley, Hueston, & Price, 2016; Shelton, 2008) have illustrated. Nonetheless, the phenomenon demonstrates how popular media can shape how we think about the real world – even for prosecutors and officers of the court.

Plenty of entertainment media are known to educate their audiences, both purposefully and inadvertently. The addition of multimodal interactivity is what differentiates YCO2 and IS from other narrative knowledge conveyances, however; the focus on interactive *narrative* as opposed to gameplay likewise differentiates the projects from serious games, which are the subject of much pedagogical examination (Charsky, 2010; Cheng, Chen, Chu & Chen, 2015; de Freitas & Maharg, 2011; Flanagan, 2009; Glasemann, Kanstrup, & Ryberg, 2010). Work on multiliteracies (Cazden et al., 1996; Cope & Kalantzis, 2009a) has illustrated the benefits of multi-modal and multi-subject pedagogical techniques, combining different learning areas (reading, writing, chemistry, medicine, mathematics, programming) and offering several points of access through diverse media and communication methods (text, visual, gameplay, discussion, etc.). The YCO2 project in particular benefits from use of an IDN as opposed to games, as we enable students to not only read/play an IDN but to create one of their own; more ludologically focused strategies would steepen the coding learning curve too much for the workshop series to be feasible. For IS, the simple interactive mechanics and the web-enabled IDN are more user-friendly to the older audience who may be less practiced or interested in mobile games, as well as being a much lighter download on free public Wi-Fi or mobile data.

The project IDNs also incorporate persuasive communication and effective communicative strategies at their core. Arvind Singhal et al. (2003), in their discussions of various uses of ongoing TV series (e.g., soap operas) for health education, identify several key strategies in the specific use of entertainment narratives for education. Namely, that connection to characters is key to investing the audience in the theme of the story; that message saturation through either mass media, repetition, word of mouth or some combination of all three leads to greater communicative efficacy; that the change sought in the audience be iterative and small, so that individuals feel they can accomplish it; and that the message must comply with the audience's culture. Elements one and three (connection to characters and self-efficacy) are relatively simple to incorporate into IDNs for experienced narrative designers; tools such as narrative perspective, player personalisation, choice-based narrative and use of familiar cultural stories help to connect the audience to the characters and see how they can approach small changes in their lives. Message saturation can be more difficult, depending on who is involved on the research teams; YCO2 and IS have relied upon networking, outreach and old-fashioned hustle to enable these works and the research to gain traction. Cultural alignment, as we discuss in Chapter 2, is perhaps the most subtle and difficult aspect to accomplish. Our research teams, while crossing national, linguistic and socioeconomic boundaries, nonetheless

are fairly monocultural, and our analysis shows that the result of this is a gap between our messaging and audiences that do not reflect the same cultures and attitudes. This is an element we will continue to improve, in order to reach all of our audience members.

APPROACHES TO INTERDISCIPLINARITY

In order to address such global issues involving complex issues of human need and behaviour, we assembled wide interdisciplinary (Kelly, 1996) teams. Interdisciplinary research is not necessarily a new area, and the term has become something of a buzzword for funders and institutions looking for innovative research. Research in higher education institutions (HEIs) is 'siloed', sectioned off into departments and schools by discipline; in the United Kingdom, this disciplinary partitioning begins at secondary school level, as students drop General Certificate of Secondary Education (GCSE) subjects voluntarily, and continues through to PhD level, where candidates carve out a tiny 'original' niche for themselves in a particular subject area. Yet, many real-world problems that we as researchers are seeking solutions for are complex and cannot be addressed by any one discipline alone. Thus researchers are urged, through grant opportunities and training programmes, to work across disciplines, institutions and nations to address issues like climate change and AMR, among many others.

Unfortunately, the long history of disciplinary practice in HEIs has ill-prepared them for fostering interdisciplinary research. Significant barriers to interdisciplinarity continue, including communication structures, disciplinary knowledge and language, research methods, biases about other disciplines, recognition and publication of interdisciplinary work, and even funding for interdisciplinary projects. Many researchers who would embrace interdisciplinarity have found themselves stymied, for example, by grant proposal rejections that continually place their projects *between* funding body subject areas and, thus, offer no success and no alternatives. Most academic journals are subject-specific, making publication of cross-disciplinary work difficult, and measures of research quality such as the UK's Research Excellence Framework (REF) are judged according to disciplines and disciplinary standards. When academics are already overwhelmed by increasing casualisation and teaching/admin workloads, it can be an insurmountable task to blaze new pathways through the venerable mazes of historical HEI infrastructure for interdisciplinary research.

Yet that is exactly what we have achieved on the projects discussed in this book. As recounted in Chapter 5, these projects were enabled by a research

leadership programme that actively sought adventuring researchers and trained them to communicate and work across disciplinary boundaries. In her foundational text on interdisciplinary research, Julie Thompson Klein (1990) notes that few accounts of interdisciplinary work exist, and far fewer of wide interdisciplinary, or arts-science, research. Most discourse on interdisciplinarity, in fact, centres on research that incorporates multiple *science* disciplines and fails to address arts-science research altogether. Indeed, many so-called arts-science interdisciplinary projects are not truly interdisciplinary as we have defined it (combining multiple disciplines to approach a complex problem); rather, they incorporate one subject in servitude to another, such as a textile artist who incorporates replicated DNA into her fabrics or a scientist who writes popular fiction to convey fundamental concepts to wider audiences. These endeavours are laudable and fascinating but are distinct from interdisciplinary research as we have applied it on these projects. Thus, we hope to provide one of those rare inside looks into wide interdisciplinary teams, demonstrating how we overcome the infrastructural barriers to this type of work, and how others can do the same.

THE AUTHORS

Given that the projects and work explored in this book originate from two unique teams across disciplines, we include a brief biography of each researcher here. Each co-investigator has contributed to the ideation, design, implementation, analysis and outcomes of the YCO2 and Infectious Storytelling projects, albeit in different ways according to their areas of expertise and personal skill sets. Without knowing our backgrounds and interests, it would be difficult to parse exactly how crucial and influential each of us are on these projects; thus, we have allowed ourselves the luxury of introducing ourselves in text.

R. Lyle Skains

Primary Investigator, Infectious Storytelling
Co-Investigator, You and CO_2

Lyle researches and teaches Creative Writing and Digital Media, exploring multimodal creativity, genre fiction, writing and reading/playing transmedia narratives, and writing and publishing in the 21st century. Her research is largely practice-based, stemming from her work in creative writing (speculative fiction) and digital writing; her PhD explored how digital writing practice affects writer

and narrative. Prior to her career as a writer, she studied to be a biological anthropologist, studying evolutionary genetics and primate morphology. In her practice-based research and teaching, she builds upon her experience as a professional writer in prose and the film and technical industries. Lyle is interested in exploring the ways that digital media, fiction in particular, can be integrated into our everyday lives, including education, entertainment, communication about specialist topics (science, policy, health, culture, etc.) and personal exploration.

Her specialised work on YCO_2 and IS is to design and create the IDNs for both projects.

Jennifer A. Rudd

Primary Investigator, You and CO_2

Jennifer is a slowly reforming technical scientist. After almost a decade researching technological solutions to climate change on two continents, she had an epiphany in 2018 and realised that the communication of climate change and its solutions were far more important than any lab-based advance she could hope to make. Therefore, with a background in the chemistry of solar panels, water splitting for a hydrogen economy and converting carbon dioxide into the fuel of the future, she turned her attention to climate change education. Jennifer writes climate change education material to suit a variety of ages and uses her communication skills to convey the severity of the climate emergency through national talks, radio and printed media. Besides being the primary investigator of YCO2, Jennifer is the programme manager of the recently funded Circular Economy Innovation Communities project based at Swansea University, which implements 'circular economy thinking into public services [to] help reduce carbon footprint and [form] part of the solution to the global climate emergency' (Newman, 2020, n.p.).

Her specialised work on the YCO2 project is in developing teaching materials for the carbon footprint education component, recruiting schools to participate and engaging in outreach work.

Carmen Casaliggi

Co-Investigator, Infectious Storytelling

Carmen completed her undergraduate degree at the University of Milan and her PhD at the University of Kent. She is now working as a Reader in English literature at Cardiff Metropolitan University with research and teaching