Ourania Varsou   *Editor*

Teaching, Research, Innovation and Public Engagement

Springer

New Paradigms in Healthcare

In the first two decades of this new millennium, the self-sufficiency of Evidence-Based Medicine (EBM) have begun to be questioned. The narrative version gradually assumed increasing importance as the need emerged to shift to more biologically, psychologically, socially, and existentially focused models. The terrible experience of the COVID pandemic truly revealed that EBM alone, while being a wonderful scientific philosophy and containing the physician's paternalistic approach, has its limitations: it often ignores both the patient's and physician's perspectives as persons, as human beings; it pays relentless attention to biological markers and not to the more personal, psychological, social, and anthropological ones, removing the emotions, thoughts, and desires of life, focusing on just the "measurable quality" of it.

Health Humanities, Medical Humanities and Narrative Medicine are arts intertwined with sciences that allow to broaden the mindset and approach of healthcare professionals. helping them to produce better care and more well-being.

Aim of this series is to collect "person-centered" contributions, as only a multidisciplinary and collaborative team can meet the challenge of combining the multiple aspects of human health, as well as the health of our planet, and of all the creatures that live on it, in a common effort to stop or reverse the enormous damage committed by humans during our anthropocentric era: a new paradigm of healthcare, education and learning to create a sustainable health system.

Ourania Varsou

Editor

Teaching, Research, Innovation and Public Engagement

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Foreword

It is a privilege to be the series editors of such an innovative book, needed now more than ever to innovate the paradigms of teaching medical and scientific subjects. I myself, Maria Giulia Marini have the honour of teaching both at the Masters in Applied Narrative Medicine, first founded in Italy in 2013, and another Masters, called Scientists entering the Working Organisation. The former is dedicated to senior professionals whilst the latter to postgraduates who wish to enter the job market. In the former, we use the Health Humanities as a basis, from reflective writing to inspirational literature texts, from group reading to other visual arts, including cinema, photos, and paintings. It is fascinating to observe the awe of Evidence-Based Doctors and Nurses who at the start of the programme are very sceptical but then, after a few hours, their vision begins to transform, and they say, "But I can use this analogy when explaining a specific condition to my patients", or "If I only had known the role of the right hemisphere earlier (the creative one and intuitive one)[1] I would have been a different carer".

The real challenge comes from the young postgraduate students, in Biotechnology, Biology, Physics, Biomedical Engineers, Pharmacists, and other Life Sciences that belong to the STEM disciplines. As we already know that they have come to our Business School to find a job, we teach subjects such as General Management, the Health Care Organisation in Italy and abroad, and the role of Life Sciences Companies. When students come, they still have to accept that they might not become the new "Marie Curie" or "Carlo Rovelli"; they feel like ordinary people who must find an ordinary job. My first task is to embrace this feeling and make them look forward and relish the future: not easy at all by only using words and simply technical subjects. We found out that if they can divert their thinking to something far away from the routine subjects that got them engaged and fascinated, then they can produce very interesting work. This is the meaning of the Analogic Project work, made by groups chosen by the students. One month of parallel works on such topics as the Greek Myths, Women in the Sciences, Health in the World according to Traditional

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[1] Iain McGilchrist, The Master and His Emissary, Yale University Press, 2009.

Societies, Tips to be Brilliant (from Dante to the Beatles), and Disasters (from the Great Smog in London to NTEK plant breakdowns in Siberia). The students also have to imagine/create a video of storytelling related to the event. Usually, on the first day, when I launch the title on the third day of the Masters the nonverbal language of many of the students is very clear; they wish to run away, "come on we are scientists", "why should we play with this analogical story?", they implore.

Let me explain the power of analogical reasoning. It is the implementation of a process of recognising the similarities between different objects and relations and linking them to different situations, often referring to experiential contexts that are also distant from each other. When this recognition process takes place, the situations are said to be analogous. What emerges from the recognition of an analogy is the objectification of a sort of identity of the relationships between the objects in the two distinct situations, with the differences between the characters of the objects themselves being zeroed out. The power of analogical reasoning lies in its ability to trigger the transfer of relationships and properties from one given experiential context to another, lesser known one, when the latter is recognised as similar/analogue to the former. From our point of view, there is a common demand, that is what the people would learn from this analogy and bring to our contemporary world, starting from the civil society including the working organisation and the healthcare setting.

Just a few final words; after one month of positive stress (the fear to address an unknown field), the students do write and produce "masterpieces" and, more importantly, become more self-confident, so that they have been taken out of their comfort zone (science), but always being tutored, and never left alone to face the *new*.

Therefore, this book which brings so many analogies into teaching, from the Visual Arts for Anatomy to the Theatre for Physics is a critical and essential breakthrough, which we believe should be read by teachers, influencers, and professors of scientific and medical subjects. And perhaps even teachers of the humanities to carry them away from *their* comfort zone.

I myself, Jonathan McFarland, strongly believe that the humanities need to be introduced both into the medical sciences ***and*** into the basic sciences, which nourish medical education in such a decisive way; we have the famous saying from "bench to bed", which implies how integrated the basic sciences and the medical sciences are or should be. On the other hand, I am sometimes a little concerned when teaching first- and second-year medical students, who, when asked whether they are scientists are nearly always adamant in their affirmative response. That is, they believe they are scientists, and *only* scientists. I beg to differ and wholeheartedly agree with Iona Heath when she writes,

> "Most clinicians are not scientists; they have a different responsibility—to attempt to relieve distress and suffering and, to this end, to enable sick people to benefit from biomedical science while protecting them from its harms".[2] This dichotomy between the scientific culture and the lay culture is positive and enriching for both sides of the coin.

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[2] Heath I. How medicine has exploited rationality at the expense of humanity: an essay by Iona Heath. BMJ. 2016 Nov 1;355:i5705. doi: 10.1136/bmj.i5705. PMID: 27802938.

As a final note, it is interesting to quote one of the great scientists of our modern age, the aforementioned Italian quantum physicist, Carlo Rovelli, who wrote the following, "A science that closes its ears to philosophy fades into superficiality; a philosophy that pays no attention to the scientific knowledge of its time is obtuse and sterile. It betrays its own deepest roots, which are evident in the etymology of philosophy: the love of knowledge".[3]

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[3] Rovelli C. Does science need philosophy? Corriere della Sera, 30 August 2016.

Preface

Dear readers,

First of all, I would like to thank you for kindly choosing to read this edited volume. I hope you find it a useful and insightful addition to your book collection, especially when it comes to considering alternative, and innovative, approaches to teaching and research in Higher Education along with novel practices for public engagement/science communication activities with a focus on medical humanities.

Before I embark to discuss what this book volume offers, I would like to express my heartfelt thanks to Maria Giulia Marini and Jonathan McFarland, the series editors of New Paradigms in Healthcare, for their continuing mentorship and encouragement throughout this project. I would also like to thank Donatella Rizza, the publishing editor of New Paradigms in Healthcare, and the production team from Springer Nature for their support and advice. Without the above people, I would have not been able to navigate this editing journey. I would like to thank all the chapters authors who provided a truly unique range of topics; their excellent contributions made this book possible. Last but not least, I would like to thank Filip Zmuda, my amazing partner, who sustained me physically and mentally while I was spending long hours to complete the editing process and my wee baby boy, Benji, who was an absolute star while I was working on this volume.

So what does this book offer that is different? This edited collection of 14 unique and separately authored chapters covers a range of topics, exploring new approaches and paradigms in healthcare and science, under the following three parts: (I) Scholarship of Teaching and Learning; (II) Research and Innovation; and (III) Public Engagement. This thematic approach not only provides a comprehensive compendium of professional and practical knowledge, which is currently missing from the Higher Education market, but it also appeals to a wide audience including healthcare, biomedical and physical sciences discipline specialists active in teaching, along with their students, science communicators associated with the above subjects, and academics involved in relevant research. The chapter authors are all renowned experts in their respective fields, bringing together a wealth of knowledge, further enriching the narrative of this book. I have briefly discussed below the topics covered, under each of these three parts, as a snapshot of what this book covers.

Part I. Scholarship of Teaching and Learning includes the chapters by Bellis and Ives (Teaching Medical Humanities in Medical Schools with Open Education Resources), Batistatou et al. (The Power of Real-World Observation), Irene Cambra-Badii et al. (The Value of Cinemeducation in Health Sciences Education), Josep E. Baños et al. (The Usefulness of the Humanities in Teaching Pharmacology), Tseligka (Employing Greek Laments for the Dead ["moirologia"] to Facilitate Medical Students in their Encounters with Patient Death), Carpineti (Theatre as a Tool for an Inquiry-Based Physics Teaching), and Mackenzie and Olsson (Alive Together—Interdisciplinary Practice in Human/Non-human Relationships). This part of the book volume focuses on pedagogy/teaching including professional knowledge/expertise, reflections, literature reviews, and evidence on a wide range of healthcare (e.g. medicine), biomedical (e.g. pharmacology), and physical (e.g. physics) sciences topics interweaved with humanities such as theatre, films, visual art, and Greek laments along with discussion of interdisciplinary practices. The aim of this section is to explore and share pertinent knowledge in this field and inspire educators to pursue similar medical humanities endeavours in the future.

Part II. Research and Innovation includes the chapters by Macdonald et al. (The Art of Serious Storytelling: Using Novel Visual Methods to Engage Veterinary Practitioners in Reducing Infection Risk During Surgical Preparation), Illingworth (Using Poetry to Actively Target the Incubation Period), and McAleer et al. (Seeing Beyond Labels—Staff and Student Perspectives on the Importance of Building Community). This part of the book volume focuses firstly on original research drawing on interactive virtual approaches utilising cutting-edge technology and secondly on innovation with discussions around the use of poetry for the incubation period and student-staff perspectives on building communities. The aim of this section is to share innovative research activities and paradigms as examples for future use/implementation in Higher Education.

Part III. Public Engagement includes the chapters by Finn and Brown (The Hidden Curriculum of Public Engagement for Creative Methods of Instruction), Philp and Smith (The Fabric of the Human Body), Ross and Hoskins (Quilts 4 Cancer: Quilting the Chemical Sciences for Pancreatic Cancer Patients), and Earley and McGregor (Reframing Heritage Delivery and Engagement). This part of the focus is on practical knowledge and examples from a wide range of healthcare (e.g. medicine) and biomedical (e.g. anatomy) sciences topics interweaved with humanities such as visual art and textiles while also discussing the hidden curriculum and heritage practices through the lens of equality, diversity, and inclusion. The aim of this section is to explore relevant science communication paradigms that can be transferable to other settings and applications.

I hope you enjoy reading this book volume and find it a helpful compendium of professional knowledge and practices in the fields of Scholarship of Teaching and Learning, Research and Innovation, and Public Engagement.

Glasgow, UK   Ourania Varsou
September, 2022

Contents

Part II   Research and Innovation

Part III   Public Engagement

Glossary

Alive Together	Interdisciplinary approaches, in human/non-human relationships, based on collaborative practices.
Cinemeducation	Movies or television series used in health sciences education to convey complex scenarios and situations.
Community	Effective communication, open door policies, and seeing beyond labels to promote a sense of connection, socially and academically, in Higher Education.
Heritage Delivery and Engagement	Practices with the aim of reviewing and reframing heritage collections to address issues of equality, diversity, and inclusion through collaboration and digital engagement.
Hidden Curriculum	Unarticulated and unacknowledged learning.
Incubation Period	Stage in the problem-solving process where attention is distracted from the problem in question.
Inquiry-Driven Approach	Engaging students to drive curiosity in learning.
Medical Humanities/Health Humanities	The use of humanities in health sciences.
Moirologia	Lament songs for the dead from the Greek folk tradition.
Open Education Resources	Generic open access material that can be used for teaching and learning.
Real World Observation	The art of observation using real-world nature images.
Serious Games	Games with an educational purpose.

| Serious Storytelling | Storytelling beyond the context of entertainment. |
| Textile Art | In the context of this book, knitting, stitching, quilting, etc. |

Part I
Scholarship of Teaching and Learning

Chapter 1
Teaching Medical Humanities in Medical Schools with Open Education Resources

Richard T. Bellis and Jonathan Ives

Introduction

The benefits of medical humanities (alternatively termed health humanities) for medical students are numerous, but they can nonetheless be difficult to include within the crowded medical curriculum in the United Kingdom (UK) context. Such difficulties are notable in the way that introducing more medical humanities into curricula has occasionally been discussed by scholars in terms of 'infiltrating' it or alternatively replacing other subjects within the curriculum with medical humanities [1–3]. As Harvey et al. suggest such a strategy has been successful '*in gaining a foothold for humanities in medical curricula*', but reinforces a binary where the animating factors of medicine are represented by the humanities and the scientific expertise by biomedicine ([4] p. 6, [5]). They suggest, in line with the Wellcome Trust's support for '*critical medical humanities*', disciplinary '*entanglement*' that foregrounds '*the required knowledge, reasoning, and thinking practice that makes for good clinical practice*' which involves both scientific knowledge and an ability to understand context and uncertainty [4, 6]. The corollary for medical students of such a critical medical humanities approach is that engagement with humanities approaches is potentially relevant at any point of their medical education: patient encounters are rarely reducible to either solely biomedical knowledge or contextual interpretation, but typically involve both. The corollary for medical educators is to

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provide ways for students to encounter humanities approaches throughout the medical curriculum. As it stands the only mandatory requirement in UK medical curricula that would typically be considered 'humanities' is the teaching of medical ethics and law, which is clearly indicated in the UK General Medical Council's 'Outcomes for graduates' ([7], p. 9–10). There also exists a consensus statement on core curricula in the UK for medical ethics and law [8], but the extent to which this is implemented in full will vary from medical school to medical school. Other humanities subjects tend to be included in the medical curriculum at the discretion of the institution to varying degrees, based on the interests of staff and the added value they are felt to bring. Specialist intercalated degrees in medical humanities are offered by several UK institutions but these are naturally taken by a minority of students. Several institutions offer no sustained engagement with medical humanities outside medical ethics and law at all.

However, even including the mandatory ethics and law teaching, within UK medical schools, the onus has typically remained on individual academics integrating medical humanities within curricula at points perceived to be particularly amenable to such integration. Such an approach is pedagogically sound and sensible, but reduces the opportunities for entangling medical humanities more broadly across UK medical curricula. We suspect that a broad approach to entangling medical humanities within the medical curricula will need to involve a wider range of medical educators than simply subject specialists (though specialist medical humanities scholars are certainly a benefit to any medical school). Precisely because medical humanities approaches are so relevant across medical curricula, relying on specialist individuals to cover the whole curriculum is impractical. At the same time, there should be room for educators focused on the more overtly 'scientific' aspects of medicine to include more or less medical humanities content as they view appropriate for relevant learning outcomes. One size will not fit all in this context, but we advocate including at least some medical humanities material across all aspects of the medical curriculum. To facilitate the inclusion of appropriate content, we further advocate the use of open education resources developed by medical humanities scholars for broad and flexible use within medical curricula. This takes the onus on developing medical humanities content away from non-specialists whilst enabling them to include such content within teaching materials as they see fit.

The myriad ways that medical humanities can improve medical education across the curriculum have been well explored by scholars elsewhere [4, 5, 9–16]. Our purpose in this chapter is to suggest ways that medical educators can utilise the potential of open access education resources to entangle medical humanities within UK medical curricula. In other words, we are less concerned in this chapter with the why and what questions and are more concerned with the how. How can medical educators, broadly conceived, use open education resources to entangle medical humanities throughout the medical curriculum? In answering this question, we first provide a short overview of what open education resources are, before outlining a set of such resources developed as part of the ALCMAEON project (alcmaeon.pixel-online.org), which both authors participated in at the University of Bristol. We

then provide three broad and flexible strategies through which we (identified where appropriate as RTB and JI) have used open education resources with examples from our own teaching.

Open Education Resources and ALCMAEON

Open education resources are free to access teaching and learning resources that can be used by any teacher, usually anywhere in the world (as appropriate). They vary widely in scope, comprehensiveness, and quality and might include, *inter alia*, any combination of learning outcomes, curriculum design, lesson plans, teaching slides, handouts, images, and audio-visual resources.

Open education resources are in principle a very positive thing and can offer many pedagogical benefits, including exposure to different teaching practices, increased opportunity for collaboration, and improved access to materials [17]. Particularly relevant to the latter, these resources can be helpfully time saving for educators, can provide a structure to base teaching on, and they are to a greater or lesser extent 'validated' (in the sense that they are ideally produced by both educational and subject experts). As a result, they might be particularly useful for educators who are not themselves subject experts, but are nonetheless required to develop teaching in subjects outside their direct expertise for their institution. This is often the situation that educators in medical schools find themselves in when required to deliver medical humanities education. Whilst some medical schools have access to a full range of humanities subject experts, others do not, and educators will have to teach outside of their disciplinary expertise. Non-specialists may often find themselves having to design and deliver medical humanities content, and open educational resources can be especially helpful to them. Alternatively, a lack of subject experts may often be used as a reason for not including medical humanities in the medical curriculum, despite its value being acknowledged, and the availability of open access educational resources in medical humanities can help circumvent a lack of expertise and allow inclusion of medical humanities in the curriculum when it is wanted but when expertise is lacking.

In general, the open and generic nature of these resources almost always means that they can be used flexibly to suit the teaching and learning contexts in which they are used. However, that same generic character means that they will be rarely directed towards specific learning outcomes, and therefore educators might struggle to fit them into teaching programmes, or have to alter their own learning outcomes and curricula in order to fit the resources available, or modify aspects of the resources to fit with inclusivity criteria. There are a number of strategies that might be used to do this (some of which are described below), but ultimately it will always be the case that the materials may not have the same character, or level of integration, as bespoke materials designed and developed specifically for a particular programme.

The ALCMAEON project was an EU (ERASMUS +) funded collaboration between project partners across five European countries (Spain, Italy, Greece,

Romania, UK) that sought to develop open education resources to support the teaching of medical humanities [18]. Focusing primarily on the history of medicine, the project aimed to create resources that spanned ancient to contemporary medicine, separated into discrete periods that each contain a set of matching resources that include (adaptable) lecture slides and lecture notes in all five partner languages, a digital museum comprising significant historical objects from the period (with notes, case studies, reading lists, and assessment questions), and a video library of experts discussing specific objects and talking about their significance. Each partner was responsible for a specific number of periods and, importantly, each partner could use their historical period as a jumping off point to explore other areas of medical humanities. For example, at Bristol we chose to link one of our modern medicine units 'From the Asylum to Care in the Community' with best interests decision-making in ethics and law, which reflected both our teaching and research interests.

The success of projects such as ALCMAEON can be difficult to evaluate, but the endeavour is certainly worth reflecting on. Such reflections can serve to highlight the strengths and weaknesses of open education resources in general, provide insight into how specific resources could be improved, and stimulate thinking about how such open education resources can be effectively utilised. Thus, in the rest of this chapter, we present various ways that we have used the ALCMAEON open education resources in our teaching, and present learning points from our experience. We outline three strategies for using open education resources that we have tried ('curating resources', 'entangling subjects' and 'introducing voices') and, focusing on the latter two, provide examples and reflect on each.

Our Strategies

Curating Resources

Our first example is our simplest: using the online platforms through which students engage with course materials to provide a curated set of medical humanities materials relevant to that module/course. Platforms (i.e., virtual learning environments) such as Blackboard and Moodle (as well as bespoke platforms such as Galen used by the University of St Andrews School of Medicine) are commonly used to provide students with an interface through which they can find and engage with course materials. Educators populate module pages with core course material, typically organised on a week-by-week basis, with each week covering a different subject or topic. This structure provides an excellent opportunity to include selected elements of open education resources as part of existing modules. The existing structure to the module enables educators to provide a curated set of additional resources directly relevant to that week's subject or topic. This might simply take the form of

providing a bibliography or links to further readings, or may include embedding material, such as videos, into module pages. As this material is supplementary to the core course, the range of materials that can be incorporated into the module is greater: journalism and museum objects can sit alongside one another as examples of how the subject being discussed are related to the real world of opinions, feelings, and things. Such material is intended to open up the possibilities of exploring the subject at hand to medical students, outside of the core focus on biomedicine. Crucially, the context in which this material is provided to students allows educators to ensure that such opening up is facilitated by quality materials chosen with this purpose in mind.

Of course, this way of using open education resources frames them as additional material that students can choose to look at, but does not ensure engagement. Accordingly, it is important that when such material is included on online platforms, its purpose and potential for aiding student learning are made clear. Alongside providing the title of the resource in question, we would also recommend providing a short description of a few sentences that explains the resource's relevance to the core learning outcomes, including an indication of how it might open up the subject to students. Doing so not only flags to students that the resource has been suggested for a purpose, but enables students to direct their study to areas that they are most interested in.

Because the resources are supplementary to the core course, it should be expected that not all students will use them. Instead, the purpose of including such resources is to enable flexible and dynamic engagement with subjects by students. Where they want to entangle the biomedical aspect with different complicating factors they can do so, using curated resources that they can be confident are of a sufficient standard and quality. Whilst it would clearly be desirable to enable such entanglements throughout the whole university education of medical students, practical constraints realistically preclude this. But by making open education resources available to students in a structured but open way, students can take charge of their education to incorporate a broader engagement with medicine into their education, where it suits them.

Such engagement is supported when educators advertise the availability and relevance of additional resources to students during contact hours or course communications. We have found that highlighting the relevance of the supplementary materials available on the online platform to students allows educators to point to ways in which the core subject at hand is more complex than can be presented in a lecture or tutorial, without having to go into detail about that complexity within the confines that the limited time/brief communication makes available. This acts as both a further endorsement of the material provided and a prompt for students to use them.

The significant advantage presented by open education resources here is that they do not require substantial additional labour on the part of the teacher—only the effort to signpost to them. When time and resource is limited, it can be very difficult for an educator to prioritise creating supplementary resources that are non-essential

and will likely not be used by all students. Open access education resources allow the benefit of supplementary resources to be reaped, without the cost.

We have used a variety of open education resources, ranging from the material made during the ALCMAEON project outlined above (particularly the museum objects and expert videos) to further readings of various kinds: academic papers, patient memoirs, opinion pieces, and BMA guidelines have all featured on our module pages. We hesitate to offer hard and fast advice regarding what to use precisely, as this depends entirely on context. However, we do recommend ensuring the resource is of a sufficient academic standard (i.e., no Wikipedia), and considering the following: where resources lead to external websites, outside of the bounds of the online platform, what will students encounter there? How might students move on from the initial resource to others on this platform?

Ultimately, using external resources in this way does create some uncertainty around what will be accessed and how it will be used, and so we would also recommend that educators engage with students about how best to use such material and have an open discussion about the benefits and risks, so that they can develop their own learning strategy that incorporates these supplementary materials in way that most benefits them.

Entangling Subjects

Open education resources can be used to modify existing, or to develop new, core teaching in order to entangle medical humanities subjects with the biomedical. As discussed in the introduction, one of the main advantages of using open education resources to bring medical humanities into medical education is that using them as part of a course does not necessarily require individual expertise in the manner that producing bespoke content does. In this section, we provide two different examples, both related to the history of medicine, of how open education resources can be integrated within core teaching.

Resources may be integrated in different ways and for different purposes, so here we only provide a brief comment on the possibilities available, focusing more on the advantages of doing so and typical teaching scenarios like lectures and tutorials. Unlike the 'curating content' strategy, here the educator takes direct control of how the resource is used as part of the core course. It is crucial, however, to make the resource available to students so that they are able to revisit and revise with the appropriate material. For example, lecture slides are typically made available to students for various pedagogical purposes. Embedding a hyperlink within the slide ensures that students can not only revisit the lecture, but have access to further resources in the manner outlined in the previous section. Building in open access resources in such a manner does much more than providing arresting examples and interesting anecdotes; done well it can emphasise the multifaceted and complex nature of medicine.

Example 1—Lecture

At the University of Leeds, the 'History of Science in 10 Objects' course run by the School of Philosophy, Religion, and History of Science attracts students from across humanities and scientific studies, including medical sciences. Whilst the focus of the module is on the historical study of science, the use of open education resources from the ALCMAEON project to enhance lecture materials in the course is relevant and applicable to the work of medical educators.

For example, in a lecture RTB gave on the development of the forceps, he used the 'Anatomical Preparation' in the ALCMAEON museum collection; the skeleton of a woman who suffered from rickets and died during a caesarean section operation in 1800. As Fig. 1.1 shows, the slide RTB used to show the 'Anatomical Preparation' presents the skeleton from several different angles in order to show the warping effects of rickets on the skeleton, and to illustrate clearly to students why rickets was a major cause of obstructed birth during the period in which the forceps were developed. The slide links a physical manifestation of the disease, and a real case, to the development of medical technology. Moreover, because that technology (the forceps) was unable to aid the patient in this particular case, the limitations of new technology in providing universal answers to medical problems are demonstrated to students. The image and attached case history thus entangle scientific information with the various needs and limitations of medical practice.

This case is rich and multifaceted. The link underneath the images provides students the opportunity to explore further in their own time, as outlined in the previous section. Additionally, because the link is provided *within* the central course

Part 1: Rickets

- Rickets – a deficiency disease – was an additional cause of obstructed delivery in the early modern period

- Causes bones to weaken and warp – including the pelvis

- This woman died from the results of a – extremely unusual – caesarean section operation in 1800

You can find out more about this particular case here - https://alcmaeon.pixel-online.org/DM page3.php?sid=35
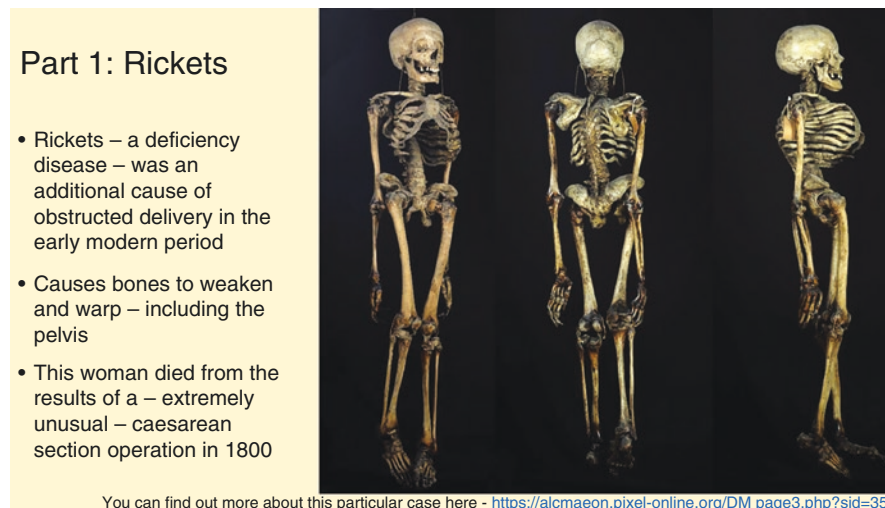
Fig. 1.1 Lecture slide by RTB using ALCMAEON resources and including hyperlink. Image reproduced with the kind permission of Surgeons Hall Museums, The Royal College of Surgeons of Edinburgh

materials, it indicates the value of exploring this case further. Students who do will find information on the development of anatomical preparations, the problems with operations before anaesthesia and antisepsis, patient safety and the risks of child-birth, and the wider implications of the case. This incorporates not only ethical issues, but also decision-making in different medical circumstances and offers the opportunity for the student to explore the emotional responses of the medical prac-titioners involved, as well as reflect on their own emotional response to the case. As the description on the ALCMAEON online museum website puts it (which RTB originally wrote as part of his work on the project):

> *"What is perhaps most striking about this story is how the woman chose to undergo surgery that would almost certainly result in her death in order to give birth to Caesar. We might reflect on how this makes us feel, and about what might have motivated her to sacrifice her own life for that of a child that she would never know. We might also reflect on whether it was a good decision to make, and what kinds of ethical issues arise from it"* [19].

The various meanings that can be attached to the object show how incorporating medical humanities through open education resources can create the kinds of entan-glements we have discussed. Furthermore, the richness of this particular case emphasises the flexibility that such educational resources can bring to the medical curriculum.

Example 2—Tutorial

As part of a second-year medical ethics tutorial on research ethics at the University of St Andrews School of Medicine, six scenarios on the subject are provided to students to examine. Tutors are encouraged to use the cases as they see fit. The cases are not intended to be 'solved', but rather act as prompts to considering the complexity of different real-life situations that might be encountered as part of medical research. Scenarios range from ethical issues surrounding research fund-ing, through issues of study design and privacy, to the potential uses of social media for research. Thus, they provide a broad and varied set of ways to think about the broad field of medical research and the multiple ways that ethical issues might arise.

The first case presented relates to the potential use of Eduard Pernkopf's *Topographische Anatomie des Menschen* (*Topographical Anatomy of Man,* 7 vol-umes, 1937) in research today, centring around whether or not this work ought to be held by medical libraries and used by medical researchers [20]. The atlas was made in Nazi Germany, with the cadavers of non-consenting political prisoners, so pro-vides a striking and easily understandable case to reflect on. A broader related ques-tion asks what should be done with any data if it is subsequently discovered it was collected unethically. The material given to students explains the case and its broader implications in a few lines and also provides a link to a discussion article published by the BBC on the unethical use of data [21]. Material provided to the tutor (and not to the students prior to the class discussion, but introduced to them during discussion) includes further information on the Pernkopf atlas that includes

an insert placed into the book at Vienna University informing readers of the work's past, and also a comparison to the making of Henry Gray's *Anatomy: Descriptive and Surgical* (1858)—now more commonly known as *Gray's Anatomy*—which would also be considered unethical today but is still in use [22].

Much of this material is available from open education resources—both Pernkopf and Gray's atlases are available on Internet Archive, for example—but were shaped to suit the needs of the tutorial. The use of the real-life scenario creates immediacy for the issue at hand as well as emphasising the history of medicine as a resource for understanding both the context and the content of the ethical problem. It is central to the case that Pernkopf's research was legally conducted at the time, but that the ethical problems inherent to it are not resolved by that legality. The link to the research context in which Gray's *Anatomy* was made is intended to show that the problems with Pernkopf's atlas cannot simply be dismissed by pointing to Pernkopf's Nazism, but were part of a broader research context. In other words, the complexity of the problem is emphasised and becomes difficult to resolve simplistically. This is further compounded by the relation between this example and the use of historical data as a problem—how to reconcile using past research that we might consider unethical by current standards is explored in several ways, and different problems emphasised.

Furthermore, students have several additional resources available to explore as outlined in the section above: the Declaration of Helsinki, a two-part podcast on the Tuskegee Syphilis Scandal, and a museum object from the ALCMAEON project—a film of patients with 'shell shock' before and after their treatment during the First World War. These support the main aims of the tutorial by increasing the potential breadth of the subject and ethical issues related to research that students can consider.

Introducing Voices

Another potential use of open education resources is to introduce new and different voices into the classroom. This can increase the range and diversity of experts that students encounter as part of their core teaching on a subject, which can directly illustrate to students how different disciplines can interact to improve medical knowledge and practice.

Example 3—Pre-recorded videos

Pre-recorded videos can be embedded within lectures or module pages. Including them within core course material can be a way to help improve the focus of students on the material being presented. It is common pedagogical wisdom that students can concentrate well for around 20 min, after which their attention wavers and learning are less effective, and either a break or change is needed. As a result, student focus can be maximised by using videos to introduce new voices at key junctures.

We have used videos recorded as part of the ALCMAEON project flexibly in our teaching. Several interviews were recorded with experts that were designed to discuss current ethical issues through the lens of historical ideas and objects. For example, one interview was conducted with Richard Huxtable, Professor of Medical Ethics and Law at the University of Bristol School of Medicine. The interview explored the historical development of the legal apparatus of living wills, and the ethical issues associated with their use in medicine today. We have used this video as supplementary material and to bring more voices into classroom discussion, as discussed below in our next example.

Example 4—Collaboration

Our final and most complex example is using open education resources as a point of collaboration between academics in different disciplines, to enable them to contribute directly to the education of medical students as part of core teaching. The authors—a bioethicist (JI) and medical historian (RTB)—used ALCMAEON materials as a shared resource to guide their collaboration in teaching iBSc Bioethics students at the University of Bristol. Specifically, we developed a week of material that explored the ethical issues regarding respecting autonomy in healthcare, particularly focussed on end-of-life decisions and mental capacity. To do this coherently, we used the open education material as both a baseline and jumping off point for the development of the course material. By using open education material as the starting point for our collaboration, we were able to understand more easily where our counterpart was coming from in their approach to the subject, without having to commit to extensive reading and synthesis outside of our existing expertise. We could then develop material based on the open education resources, confident that it would be intelligible to both our counterpart and the medical students encountering it.

The week's teaching was designed to include the history of the deinstitutionalisation of the mentally ill in Britain over the course of the twentieth century in order to inform students' perceptions of the move away from paternalistic models of healthcare, and explain the contingent nature of current mental health provision in the UK, particularly in relation to autonomous decision-making for those with or without capacity. As the module was taught online in the year 2020–21, teaching now consisted of two short lectures: one focusing on ethical and legal issues pertaining to current practice around respecting autonomy in healthcare and considering the issues and best practice around those without autonomy (organised by JI); the other on the history of deinstitutionalisation in Britain and the development of the social and legal apparatus around which binding documents such as living wills and Do Not Resuscitate Orders have been invented (organised by RTB). ALCMAEON course material was used to inform the content of both lectures and provided a consistent point of reference throughout for both collaborators and medical students.

Thus, the material was the backbone of each lecture. The lecture material was further supplemented by the inclusion of the interview with Professor Richard Huxtable on the development of living wills, and the reading assigned to students for that weeks' class, B. Hudson's article, 'Deinstitutionalisation: What Went Wrong' [23].

The authors therefore provided material that was academically rigorous at the same time as being diverse, and emphasised the complexity of the ethical issues that were the focus of the module. The use of open education resources as a baseline for the week's material facilitated an interdisciplinary approach to the material for students, and exposed them to different kinds of expertise. To be comprehensive about this, we provided the students with additional resources as described in Curating Resources section and worked to entangle the subjects discussed as described in Entangling Subjects section, in line with the other strategies discussed in this paper.

Our collaborative work began with direct discussions regarding the learning outcomes, aims, and content of the week's material, before we worked individually to prepare that week's material. We then reconvened prior to that week's teaching to review our respective lectures and provided feedback to each other. In doing so, we focused less on the specific content of the lectures—because we had an agreed baseline located in our shared open education resources this was largely unnecessary—and focused on the coherence of the two lectures with each other, modifying our lectures as appropriate following discussion. We felt that including this step was important to ensure that the material remained intelligible for the students. A potential danger with collaboration can be that the different parts do not line up particularly well. Our second discussion headed off that potential problem.

Conclusion

There are significant benefits to incorporating medical humanities into medical curricula, but there can also be significant barriers to doing so. Open education resources present a way to overcome some of those barriers, and provide an opportunity to entangle medical humanities within the existing curricula. In this chapter, we have outlined three strategies that medical educators can use to do so: (i) curating resources, (ii) entangling subjects, and (iii) introducing voices.

Whilst we have not provided an exhaustive list as to how such resources can be utilised, our reflection on our own experiences has shown that these strategies can enable a broad approach to entanglement, by a wide range of medical educators, who need not be specialists. Our experiences have, further, highlighted various strengths, opportunities, and potential pitfalls with these approaches, which hopefully will be of benefit to any medical educators considering the use of open resources to enhance their delivery of medical humanities in a likely overcrowded, and possibly under-resourced, curriculum.

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Chapter 2
The Power of Real-World Observation

Anna Batistatou, Maria Zoubouli, Maria Kapitopoulou, and Maria Syrrou

Seeing comes before words. The child looks and recognizes before it can speak. But there is also another sense in which seeing comes before words. It is seeing which establishes our place in the surrounding world; we explain that world with words, but words can never undo the fact that we are surrounded by it. The relation between what we see and what we know is never settled. Each evening we see the sun set. We know that the earth is turning away from it. Yet the knowledge, the explanation, never quite fits the sight.

John Berger, Ways of seeing, 1972 [1]

Introduction

Scientific observation is an expert form of observation that takes place in several contexts: in the laboratory or in the natural environment, with or without experimentation. This observation also has the meaning of surveillance, of examining

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phenomena, but also of formulating the findings and conclusions that result from it. It is different from psychological, sociological, or even the participatory observation in the field of anthropology.

There is a constant interaction and exchange between the observer and the environment during the process of identification of the object of observation. Thus, the ability of the observer to apprehend the environment is important since it affects the observability of the object.

In the history of science, "observation" has been linked to "experimentation" and thus to the quest of objectivity and exactitude [2]. The experiment is a structured active observation where the researcher is also the observer. This association is well anchored in our intellectual *habitus*, at risk of forgetting that observation is a skill in itself. This skill is very important to the practice of medicine.

Observation is fundamental in medical training and practice and includes inspection, clinical, macroscopic and microscopic examination. Accurate clinical observation provides insight to physical and behavioural information, the very first clues to accurate diagnosis [3].

Observation can be cultivated, and recently relevant training has been included in medical curricula via the introduction of Medical Humanities [4–8]. The inclusion of arts and visits to art museums has been shown to increase empathy, encourage reflection and improve observation skills [9–14].

The Paradigm of Simonides' Method of the Loci

The poet Simonides (556–469 BC) is famous, among others, for the mnemotechnic method of the "loci", that he invented in the course of a tragic event: Allegedly during a symposium, just as Simonides was leaving, the building collapsed, leading to the death of all guests, whose corpses were unidentifiable. The poet was able to identify everyone by associating each person with his sitting place [15]¹. This is his method about what he calls *"artificial memory"*, which includes locations and images: *"By locations I mean such scenes as are naturally or artificially set off on a small scale, complete and conspicuous, so that we can grasp and embrace them easily by the natural memory—for example, a house, an intercolumnar space, a recess, an arch, or the like. An image is, as it were, a figure, mark, or portrait of the object we wish to remember"* [15].

Regarding memory, Simonides examines in fact the way our visual faculties are associated with the ability to give meaning to what we see. By paraphrasing his quotation, we can distinguish two kinds of procedures, *"one natural, and the other the product of art"* [15]. The natural one *"is imbedded in our minds, born*

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¹The story is related on three surviving works from the Roman period: the De Oratore by Cicero; Ad C. Herennium, by an unknown author (although in the Middle Ages it was attributed to Cicero); Coidilianus' Institutio oratorio.

simultaneously with thought", while the artificial *"is strengthened by a kind of training and system of discipline"* [15].

This mnemonic technique, the method of loci, has been used for centuries, in the Antiquity and the Middle Ages, as the key for the rhetoric, the principal intellectual activity giving birth to *logos*, the reasoning. The most important point to consider is whether the visual skills and the use of images, real or imaginary, constitute the essence in organising perceptions and produce a meaning.

The Impact of Image in Medicine

The medical specialties where diagnosis heavily relies on images are pathology, radiology and dermatology [16–20]. The first step in medical expertise in these fields is accurate observation [21–23]. Appreciation of morphology is important in pathology diagnosis [24]. Attention to details is important but before that exercise in appreciation of size, shape and colour is necessary. Image pattern recognition is one of the most important cognitive steps to pathology diagnosis, and traditionally residents follow "apprenticeship" training, particularly in the first years of training [21, 25]. Known visual traps include illusion of size, perception of brightness, colours and hues, lateral inhibition and inattentional blindness [26].

In the medical students' teaching process, observation of the real world using natural images not only can enable the detection of significant details that easily go unnoticed, but can also enable the understanding of the complexity and the power of the milieu. In other words, the challenge for medical students is to learn to dissociate "loci" from images, enabling their visual autonomy and simultaneously acknowledge the importance of the whole. The system "observer—object—milieu" is a dynamic interacting complex system. This practice is more than a visual exercise, along the lines and beyond Simonides' method.

Real-World Observation

As Simonides states *"the natural memory must be strengthened by discipline so as to become exceptional, and, on the other hand, this memory provided by discipline requires natural ability"* [15].

It is very didactic to engage medical students and young residents in the art of observation by using real-world nature images, as they can easily relate to natural scenes and these can be used for stressing the importance of observation and draw attention to potential pitfalls. Careful observation of real-world images can introduce students to the ideas of complexity and diversity, namely the many different "layers" of each "image", the role and interactions with the

surrounding world (background) and of details that might be hidden or cryptic. There is not only one interpretation of the image applicable, but also different explanations and causes corresponding to differential diagnoses in medicine. Moreover, the accurate interpretation of an image depends on the image resolution and limitations of the means or technology used (e.g. the eye potential differs in the 10× and 100× microscope lens magnification). By analogy a sub-microscopic detail could escape due to the resolution limitations of the diagnostic method used [27, 28].

In medical practice, the background that often adds or even changes the picture might be a carefully taken and detailed family or patient history including lifestyle (nature and nurture). A person's phenotype and putative pathology are the result of the interaction of the individual genome's architecture (e.g. genetic background, presence of protective or deleterious risk alleles) with environmental triggers (lifestyle, diet, stress, pollution, etc.). Therefore, two individuals with the same mutation could present with different clinical phenotypes [29–34].

Paradigms

The paradigms below are from nature and resemble situations encountered during microscopic evaluation of human tissues for pathology diagnosis, which can lead to pitfalls. All of them have been photographed as they were found, without any intervention/staging. Herein, they are grouped in nine paradigms.

Paradigm 1: The key feature, the important clue to diagnosis, may be partly hidden and/or difficult to discriminate from the environment (Fig. 2.1).

Paradigm 2: The key feature may be visible, but only in higher magnification (Fig. 2.2).

Paradigm 3: The important clue to diagnosis is the dissimilar feature (Fig. 2.3).

Paradigm 4: Brightness, particularly at the object's edges, interferes with perception (Fig. 2.4).

Paradigm 5: Perception of size varies according to the surrounding objects (Fig. 2.5).

Paradigm 6: Careful observation of the environment provides clues to the nature and origin of objects (Fig. 2.6).

Paradigm 7: Detailed scanning of the image is necessary, particularly when the finding is unexpected, and as such it might be overlooked (Fig. 2.7).

Fig. 2.1 (**a**) A cat partly hidden between tree branches. (**b**) A peacock behind trees. (**c**) A lizard on an ancient rock. (**d**) A grasshopper hidden in a basil plant. (**e**) A caterpillar on a plant branch. (**f**) A yellow butterfly on the red geranium. (**g**) A butterfly on the bush. (**h**) A starfish on the seabed. (**i**) A medusa swimming. (**j**) A crab on the lower left quarter of the image
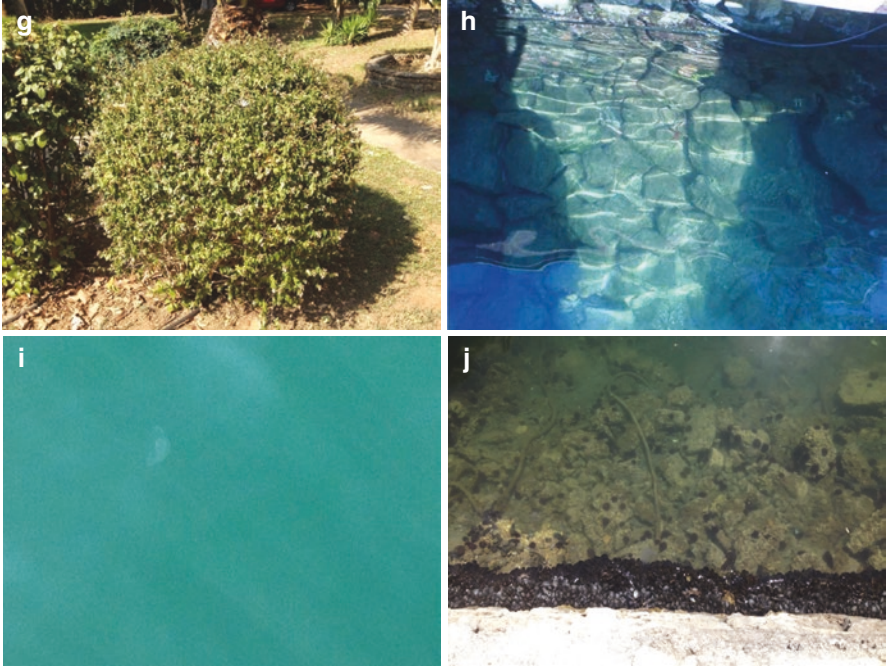
Fig. 2.1 (continued)

Fig. 2.2 (**a**) A bee on a flower. It is easily discernible due to its size and adequate magnification. (**b**) Marble exterior. There are three red bugs, almost undetectable in this magnification. (**c**) One of the red bugs, easily spotted in higher magnification

Fig. 2.3 (**a**) A blue pansy among the white ones. (**b**) Purple bougainvillea flowers among the white ones
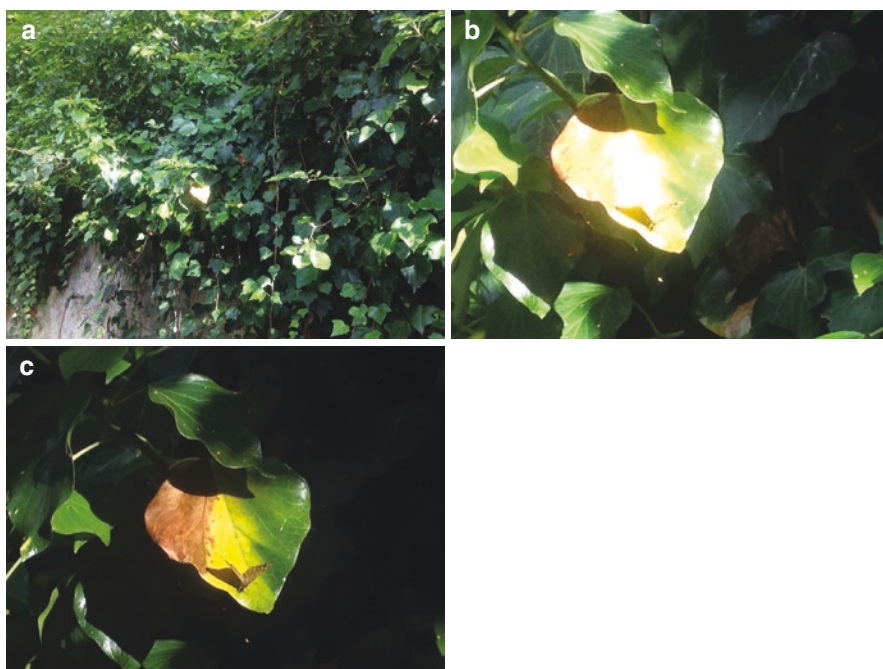
Fig. 2.4 (**a–c**) A brown butterfly on a leaf, in low and high magnification, under different light

Fig. 2.5 The lilliputian plant at the upper left quarter of the image makes the normal sized sea urchin look gigantic

Fig. 2.6 (**a**, **b**) The real yellow leaf on the left upper area of the blue pillow with the printed yellow leaves (**a**) can be easier spotted if one notices that in the surrounding there are plenty of fallen yellow leaves (**b**), presumably from a tree above. (**c**, **d**) The eucalyptus branch on the seabed (**c**) does not make any sense, unless one notices that just above the harbour grows a Eucalyptus tree (**d**). (**e**, **f**) The snail on the pavement (**e**) is easier identified, if under the proper magnification and light its trail becomes visible (**f**). (**g**, **h**) The flying object in **g** is not a bird, it is a kite. This can be easily perceived, if one notices the hand holding the string at the lower left quarter of the image. Very helpful is also the rounded observation of the horizon, where one can see several more kites (**h**)
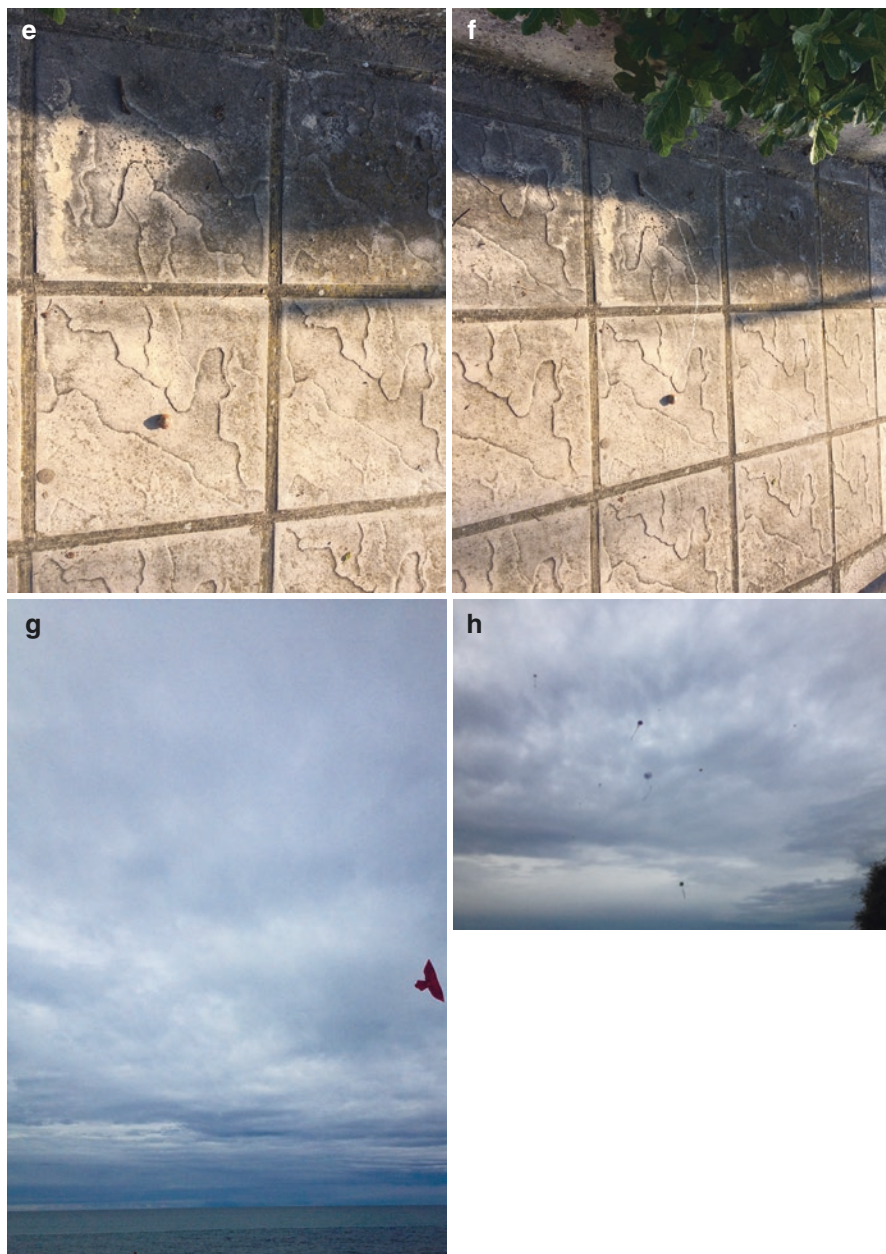
Fig. 2.6 (continued)

Fig. 2.7 (**a**) Watermelon peel at the seashore. It can easily be overlooked, if one admires the beautiful scene. (**b**) A yellow pencil situated within a seaside rock indentation. (**c**) A bird nest on a tree. (**d**) Wild goats on a cliff. (**e**) A stork in its nest

Paradigm 8: Imagination and intuition are important, particularly when interpreting images without an immediately apparent meaning (Fig. 2.8).

Paradigm 9: Occasionally, the image makes sense, since it is related to previous memorised similar images, but the interpretation is impossible (Fig. 2.9).

Fig. 2.8 (**a**, **b**) The dim light in the dark (**a**) proved to be a firefly caught in a spider web at the stairs leading to the basement of a house, when the lights were turned on (**b**). (**c**, **d**) The white material on the sides of the road is not snow, as it might seem in lower magnification. It is the fluff from the poplar trees growing in the area. (**e**, **f**) The painting on the cut tree trunk draws the attention, thus one may fail to observe the numerous ants

Fig. 2.9 (**a**) A horse on the pavement? (**b**) A person within the trunk of the tree in the middle? (**c**) A sea-lion?

Epilogue

Herein, we suggest a new pedagogical approach to an issue that is traditional and familiar and calls for reconsideration. There is further meaning, when looking at things for a second time, that are considered self-evident. Modern world and technological advances distant us from natural skills, that are necessary and enhance our medical performance. The real world can teach us the art of observation that can be applied to real-world diagnosis.

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Chapter 3
The Value of Cinemeducation in Health Sciences Education

Check for updates

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29

The Complex Scenario in Health Sciences Education: How to Prepare Students for the Future

In 1910, supported by the Carnegie Foundation, Abraham Flexner published a study on medical education in the United States and Canada. The "Flexner report" promoted the systematisation and homogenisation of curricula grounded in medical sciences without the inclusion of humanistic subjects [1]. This paper had an enormous impact, and its recommendations formed the basis of education in health sciences during the twentieth century. In parallel, scientific and technological advances tipped the scales further toward scientific medicine, and medical training became increasingly remote from its ancient humanistic foundations [2].

One century after the Flexner report, the need to reincorporate the humanities into health sciences became evident [3–5]. One general line of approach to meeting this need, the acquiescence model, uses elements of history, literature, art, or cinema to complement teaching activities to improve students' understanding about patients and the complexity that surrounds them [5]. This model can be framed in the new teaching innovation strategies—defined as a set of relatively intentional and systematised interventions, decisions, and processes employed with the aim to analyse, modify, and improve attitudes, ideas, cultures, contents, models, and practices.

Among the artistic resources used for teaching in the health sciences, cinema has been an important tool from its beginning [6–9]. Cinema has been used all over the world to teach subjects such as medical diagnostics [10], nursing [11, 12], pharmacology [13, 14], psychiatry [15–17], psychology [18–20], and bioethics [21–26], among others. Moreover, many authors have reported their experiences in using commercial cinema to help health sciences students acquire transversal professional skills such as communication [27, 28], understanding disease [29, 30], or solving bioethical conflicts [31, 32].

In the last decade, television (TV) series, especially in English-speaking countries, have reached levels of such high quality that many critics consider that the best stories are currently told on the small screen, in platforms such as Netflix, HBO, or Amazon Prime [33–36]. The new generation of TV series presents stories with highly complex dramatic structures, with innovative treatments of myriad themes. The multiplicity of supports and means to access TV series has reconfigured the audience for these products. Viewers nowadays constitute differentiated audiences willing to allocate the necessary time to address deep content and long-lasting messages, thus enabling them to identify strongly with characters.

In particular, medical series attract millions of viewers, including many medical students and health science professionals [37–40]. These series allow viewers not only to delve into biomedical issues, but also to enter characters' psychosocial spheres and submerge themselves in their personal and emotional contexts. This situation sparks interest in the object of study and favours the assimilation of complex concepts [41]. TV series can also help students understand situations from the points of view of different characters (i.e., doctors, patients, and others) in multiple contexts: professional, personal, and social [42–45].

The series' visual language facilitates students' understanding while engaging them emotionally [46–49]. These audiovisual resources can transport students to

specific situations and complex scenarios that represent a reality that is difficult to grasp through other methodologies.

Our Proposal: A Systematic Approach to Cinemeducation

In the extensive and varied landscape of the use of TV and movies in medical education [32], pedagogical proposals include many activities such as discussion groups and problem-based learning; however, there is a lack of systematisation in the description and development of these activities.

We have undertaken an investigative process to analyse the methodology and measure the efficacy of different teaching activities. Our theoretical-methodological approach to using films for teaching health sciences students does not stem from film criticism or scholarly studies of art or communication. Rather, it is grounded in *Cinemeducation*; in other words, it is based on the application of entire films, fragments of films, or TV series for specific purposes in medical education [50–53].

Cinemeducation goes much further than simply presenting a film in class. It is based on a rigorous methodology that requires a sequence of steps to be followed before, during, and after the class based on the activity [54].

A crucial step before the activity involves selecting appropriate audiovisual material and defining learning objectives that are coherent within the curriculum. Another step, the classroom activity, involves viewing and discussing the material. Assessment is important both before and after the activity (Table 3.1). Discussion

Table 3.1 Typical organisation of a 2-h cinemeducation teaching activity

Stage and duration	Objectives and development
Introduction (20 min)	To introduce the learning objectives of the session, the content and approach, and the limitations of the activities included
Preintervention assessment (10 min)	To assess students' prior knowledge and preparation through a 10-question multiple-choice test
Film viewing (20–30 min)	To critically view the episode/film, focusing on the learning objectives
Timeline debriefing (5 min)	To centre the discussion, summarising and reviewing relevant aspects of the plot
Discussion (30 min)	To deliberate on the material viewed, focusing on the learning objectives
Open-essay questions (10 min)	Qualitative approach (optional)
Postintervention assessment (10 min)	To assess students' knowledge through a 10-question multiple-choice test (the same one used in the preintervention assessment)
Learning achievement survey (5 min)	To gather information about students' opinions regarding their learning through a structured questionnaire. The items consist of rating statements on Likert scale ranging from 1 (totally disagree) to 5 (totally agree)

and assessment should be focused on the learning objectives. Rather than discussing everything that happens in the audiovisual material presented, teachers should guide the discussion to focus on the educational content defined by the learning objectives of the session within the course syllabus. The ultimate aim is to promote the transference of knowledge and skills gained in the activity to future professional performance.

These stages and durations are orientative; the activity should be adapted to the circumstances of the class (i.e. time constraints, teachers' experience and skills, students' situations within the trajectory of their studies, etc.). When it is impossible to dispose of two hours for this teaching activity, the qualitative questionnaires can be eliminated, and/or the length of the videoclip or the debate can be reduced.

To encourage discussion among students, we recommend that groups have no more than 20 students. When this is not possible, students can be divided into subgroups for an initial discussion and then share what was discussed through group spokespersons.

Our Cinemeducation Experiences

In this section, we will share some details of the experiences carried out at the Universitat de Vic—Universitat Central de Catalunya by the cinemeducation methodological group CINESIM (this stands for the words CINE from cinema and SIM from simulation). We developed the activities in these experiences to meet students' needs in different subjects involving complex topics (i.e., patient safety, bioethics, gender issues, or interprofessionalism), considering students' prior level of competency and the level they needed to acquire, as well as the characteristics of the subject being taught. Cinemeducation experiences were designed maintaining the initial methodological scheme and adapting some details of form and content. In all cases, both ethical approval and informed consent of the students who participated were obtained.

Patient Safety in Medicine

Patient safety is a complex subject that is essential in healthcare because errors are inevitable in tasks performed by human beings. Some aspects of patient safety can be taught with simulation techniques [55], but other aspects can be difficult to learn through simulation because they involve complex concepts in very specific situations. In particular, it can be difficult for ordinary simulation resources to represent the complexity of error management in the hospital environment.

We chose the TV medical series *The Resident* (season 1, episode 5—*None the wiser*) because it provides a complex problem scenario that fit our learning objectives. In this episode, poor organisation of the operating rooms and the chief of

surgery's abusive behaviour results in four patients undergoing surgery simultaneously and inexperienced residents being left in charge of coordinating some of these operations. When an emergency arises in one of the operating rooms, the staff fail to correctly identify a patient waiting for a routine surgery, resulting in the wrong testicle being removed. We edited the episode to create a 30-min clip containing the relevant scenes that would facilitate a discussion about the organisational structure of a surgical team, the notion of priority in complex situations, the notion of system error (organisation-centered versus person-centered), and the institutional treatment of an adverse event.

In February 2020, we used this activity for the first time with 70 second-year medical students. We repeated the activity in February 2021 with 85 second-year students. To improve the activity, in the second experience we added a printed Ishikawa diagram [56] on the wall to provide visual support for the root cause analysis. We also inverted the sequence of the debate. Whereas in the first experience, the students "fit" scenes they remembered into the factors in the diagram, in the second the students directly recalled the factors that were represented in the series, and the teacher organised them into the diagram [57].

In 2021, we assessed long-term learning with 59 third-year medical students who had participated in the cinemeducation activity the previous year. Not only did most students remember the key events and situations in the video clip, but they had also learned the concepts elicited during the subsequent debate the previous year and were able to transfer the knowledge to a challenging new patient-safety situation.

Professional Responsibility in Physiotherapy

In the 2021–2022 academic year, we did a cinemeducation activity about professional responsibility in a bioethics course for second-year physiotherapy students. Students had expressed difficulties in applying theoretical concepts in professional practice, especially those related to biolaw and professional responsibility.

Again, we chose to use *The Resident* (season 1, episode 5—*None the wiser*) because it facilitated debate about health professionals' professional responsibility and the roles of professionals in different positions in a hospital in dealing with an adverse event. In the debate, we worked on notions of professional, civil, and criminal liability of health professionals; the risks of inexperience, recklessness, and negligence; and what to do when the rules are broken.

A group of 25 students participated in the activity in October 2021, and another group of 16 students participated in the same activity in March 2022. These experiences were interesting because they helped us learn how to help students identify with the roles of other professionals. The protagonists in medical dramas are usually doctors, and an interprofessional perspective that includes protagonists from nursing, physiotherapy, or mental health, among others, may be lacking. Thus, the discussion focused mainly on examples of how the fragment could be related to the role of physiotherapists.

Multiprofessional Approach

In 2020, during the COVID-19 pandemic, we designed our first online cinemeducation activity. This activity aimed to improve decision-making among health sciences professionals to benefit patients. We proposed a special session in which undergraduate students of health sciences (i.e. medicine, nursing, physiotherapy, speech therapy, and nutrition) and their professors could become acquainted with the cinemeducation methodology.

A total of 13 people (8 students and 5 teachers) participated in the experience. We chose the TV medical series *The Good Doctor* (season 1, episode 6—*Not fake*) because it tells the story of complex decision-making in an emergency situation. The episode starts with residents in the emergency room receiving two dozen patients from a massive car accident. Dr. Shaun Murphy attends to a young patient whose leg was seriously injured in the accident while he was on his way to his wedding with his family. After consulting with the chief of surgery, the residents discuss amputating the injured leg with the family. Dr. Murphy explains an innovative idea: the femur could be replaced with a titanium femur made with a three-dimensional (3D) printer. The patient's parents want to go ahead with the amputation, but his bride wants to replace the femur. The patient's parents file a lawsuit and a judge comes to help resolve the issue. To favour an open debate on the different clinical, rehabilitation, psychological, and legal viewpoints, the videoclip was interrupted before the final decision is known. In the discussion, we worked with the students and teachers from the perspectives of each of the study disciplines, analysing what each specialty contributes and the limits of professional skills. The session benefited from the participation of experts and professors.

Telehealth in Physiotherapy

The COVID-19 pandemic has led to a growth in virtual teaching and virtual interactions in education as well as in the remote provision of healthcare [58, 59], underlining the importance of clear guidelines for professional behaviour in these environments [60]. Learning to care for patients remotely has become a necessity, despite the gradual return to the pre-pandemic "normality". With the aim of fostering the acquisition of the competences necessary for telehealth, we designed an online activity about care and/or follow-up processes that do not require patients and professionals to be present in the same physical space.

For this activity, we chose the TV medical series *New Amsterdam* (season 3, episode 3—*Safe enough*), in which the hospital psychiatrist, Dr. Iggy Frome, attends a young immunocompromised woman whose parents will not let her leave her room to "protect her" from coronavirus infection. The psychiatrist's sessions with the patient are held virtually; this enables him to focus his gaze on his patient's environment, her gestures and expressions, and even on some wounds on her hands. The

selected fragment ends with the therapist himself joining an online therapy group to treat his eating disorder.

This activity was developed in the context of a course that works on clinical reasoning for fourth-year physiotherapy students. The activity took place online, and 65 students participated. To encourage participation, students were divided into subgroups for the initial 25-min discussion of the series, focused on the strengths and weaknesses of telehealth and the competences needed for virtual interactions. This was followed by a debate involving the entire group, based on feedback from each of the subgroups. Most students stated that the session allowed them to identify factors that will help them act in similar situations in the future and to gain insight into the competences needed for telehealth.

Complex Decisions in Medicine

In May 2021, during the COVID-19 pandemic, we designed a virtual activity to teach communication skills within a course for second-year medical students. The activity had two main teaching objectives: to demonstrate communication skills at an interprofessional level (i.e. sharing professional opinions in a context where other professionals might reason differently) and to show how to identify the three dimensions of complexity (i.e. clinical complexity, social or contextual complexity, and system complexity). Eighteen students participated in the activity.

We chose the TV medical series *New Amsterdam* (season 1, episode 2—*Rituals*), where a boy is attended by a psychiatrist and a neurologist. The boy seems to be overmedicated, but his school refuses to decrease his medication because he has been involved in episodes of violence. The two doctors sue the school district, demonstrating the need to coordinate interprofessional work not only among different disciplines—and not only among health sciences disciplines—but also with the courts, school, and family. In the discussion, we worked on the concept of complexity, which is represented in the series through the involvement of different agents, including social workers and healthcare professionals, lawyers, and judges, as well as the young patient and his family. The activity highlighted the importance of coordination among the different people involved in making urgent decisions and the different, seemingly disconnected organisational levels in complex cases.

Medical Residents

Our first experience in using cinemeducation at the postgraduate level was a training course for fourth-year medical residents in the specialty of family medicine in Girona, Spain. The course we designed aimed to promote the development of transversal competencies through reflection and feedback among professionals, with special emphasis on complex situations and multiprofessional decisions necessary

in current medical practice. The program comprised of six two-hour sessions. The teacher in charge worked with a variable number of participants (8–15, depending on learners' availability, which depended on their clinical responsibilities).

In the first session, we framed the course, explaining the methodology for the activity, the importance of critical thinking, and the role of the medical humanities in scientific discourse. We chose the movie *Mary Shelley's Frankenstein* (Brannagh, 1994) to introduce the sessions and initiate reflections on the role of the humanities in the acquisition of soft skills. We selected various fragments of the film (i.e. total duration of 24 min) that provided a panoramic view of the skills that students would work on in the following sessions.

In the second session, we worked on interprofessional teamwork, particularly on professions and new professional roles, interprofessional communication, and shared decision-making. For this purpose, we used the TV medical series *The Good Doctor* (season 1, episode 6—*Not fake*), as in the activity about the multiprofessional approach described above (see Multiprofessional Approach section). The main difference with the previous experience was the composition of the group, which in this case included only doctors, so the teachers encouraged learners to reflect from other professional perspectives in the discussion.

In the third session, dedicated to bioethics, we worked on the importance of ethical reflection, on the values and attitudes involved, and on the ethical criteria for decision-making. For this purpose, we chose the TV medical series *The Good Doctor* (season 2, episode 14—*Faces*), selecting a 24-min fragment in which the doctors connect a young girl who desperately needs a face transplant with a grieving mother who must decide whether to donate her daughter's organs after a car accident. The bioethical issues involved in organ transplantation (i.e. anonymity, solidarity, and the decision-making process) are further complicated by the fact that the patients are minors.

In the fourth session, we addressed gender issues. For this purpose, we chose *The Good Doctor* (season 1, episode 14—*She*), selecting a 20-min fragment in which the surgical team attends a young, biologically male cancer patient who identifies as a girl. This fragment shows the learning process through which Dr. Murphy, at first only able to consider the patient in biological terms, comes to an understanding of transsexuality. This material allows us to work on the difference between sex and gender, care for transsexual people in the health system, and the relationships between medicine and gender.

In the fifth session, about leadership, we worked with the TV series *New Amsterdam* (season 2, episode 15—*Double blind*). We selected a 12-min fragment telling a story from the opioid crisis in the United States and proposing different ways to control the growing epidemic of addiction. With the hospital board's agreement, Dr. Max Goodwin first attempts to authoritatively control the prescriptions issued by hospital doctors. He then proposes an alliance with the directors of other hospitals in the county, and when that fails, he finally proposes to modify the terms of the contract with the pharmaceutical company. This material allowed us to work

on issues related to leadership: types of leadership, shared leadership, and some keys to successful leadership.

The sixth and final session was about communication. We chose a 16-minute fragment from *The Good Doctor* (season 1, episode 17—*Smile*) that shows how Dr. Shaun Murphy interjects his views in a meeting with a patient to obtain informed consent prior to elective surgery to restore facial expression. Dr. Murphy, with his usual style of asking directly without knowing some social codes, wants to make sure that the patient is aware of the risks and benefits of this surgery. The information he provides is correct in professional terms, but his communication style could be considered inappropriate. We see, however, that it is not only Dr. Murphy who has obvious communication problems, and it soon becomes apparent that the team as a whole is not speaking clearly with the patient and her family. We specifically worked on interprofessional communication and communication with patients and families, linking elements related to complexity from the clinical field, context, and health system with the decision-making process.

Conclusions

All these experiences attest to the usefulness of cinemeducation methodology in teaching undergraduates, residents, and specialists complex and interactive aspects that are difficult to convey with other approaches. The audiovisual language of medical series offers an excellent opportunity to learn from complex scenes. Cinemeducation requires few resources; easily accessible TV series or movies can be used to achieve specific teaching objectives. Moreover, this approach can also be used in online teaching, making it invaluable during the COVID-19 pandemic.

Cinemeducation is a way to integrate perspectives from the humanities in education for the health sciences. It fosters emotional engagement, as students identify with the characters in the story, seeing situations from the viewpoints of different professionals, patients, and relatives. Cinema and TV series are rich in situations related to health sciences and adept at recreating the complexity of social environments, making it relatively easy to identify fragments that can be applied to specific objectives of training programs for health sciences students and professionals.

We approach working with these audiovisual resources (especially medical dramas) as a scientific investigation in which we test basic hypotheses (e.g. about the pedagogical efficacy of different activities with different material for a particular health sciences subject) during class. This approach requires us to design a rigorous protocol for the entire sequence of the activity, from the choice of the audiovisual resource to the evaluation of the activity's effectiveness. Only in this way can we compare the usefulness of this approach against other educational methodologies.

In summary, cinemeducation methodology can be adapted to actual teaching needs: it allows teaching to be approached in a way that can be multimodal (i.e. hybrid learning, face-to-face, immersive, asynchronous, and/or synchronous), multidisciplinary, multi-experiential, multidimensional, multicultural,

multiorganisational, multistage, and multi-institutional. Importantly, cinemeducation can help students develop not only in the intellectual dimension, but also in the emotional, occupational, physical, and social dimension. To face the challenge of addressing complexity in a changing world, teaching requires us to innovate with agile, dynamic, flexible methodologies.

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Chapter 4
The Usefulness of the Humanities in Teaching Pharmacology

Josep E Baños, Irene Cambra-Badii, and Elena Guardiola

Introduction

In his classic book *The two cultures and the scientific revolution* [1], Charles Percy Snow (1905–1980) called attention to the chasm that had opened between the sciences and the humanities, which had grown to the point where the two paths seemed to hold each other in mutual scorn. In the more than six decades since the book's publication, efforts to recognise science as culture and humanities as an indispensable element for understanding and contextualising scientific advances and beliefs have started to close the breach between these two approaches to understanding the world.

In recent decades, there has been a growing recognition of the potential importance of the humanities in medical education. This recognition comes after a long period in which the aim of the practice of medicine was seen as to repair dysfunctional organisms, a vision grounded in a technocratic orientation originating in the mechanistic physics of the eighteenth century that was consecrated in the advances in diagnosis and treatments in the following centuries. At least in some fields, this orientation has started to change as the profession comes to accept that incorporating knowledge from history, philosophy, literature, or the visual arts can

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substantially improve our understanding of disease and especially of people inflicted with disease. Early in the twentieth century, William Osler (1849–1919) affirmed '*In no profession does culture count for so much as in medicine, and no man needs it more than the general practitioner*' [2]. This affirmation holds true for the future professionals being educated in our medical schools today.

Putting Osler's vision into practice has not been a simple proposition. Perhaps the critical point came at the end of the 1950s, when the appearance of the first efficacious haemodialysis machines made it necessary to establish priorities for access to this limited resource among the numerous patients who stood to benefit from this treatment. This situation led to the creation of hospital committees to enable rational prioritisation. These committees were based on ethical principles derived from moral philosophy, and the application of these principles in medical science and practice later came to be known as bioethics. Thus, for the first time, it was generally accepted that a discipline from the humanities could help in clinical decision-making [3].

In biomedical research, however, the need to apply ethical principles had actually been recognised a few years earlier with the discovery of experimentation on prisoners in concentration camps during World War II [4]. Although the experiments carried out by Nazi Germany are better known, the Japanese army had also done similar experiments in a centre in Manchuria [5]. The discovery of these atrocities led to the first worldwide agreement about ethics in medical research, the Nuremberg Code, in 1947 [4].

As we enter the third decade of the twenty-first century, the need for the humanities seems indisputable. Nevertheless, apart from bioethics, the traditional presence of humanistic disciplines in medical-school curricula has declined considerably [6]. The battle among professors of scientific and medical disciplines to prioritise their own subject matters in allocating class time and credits in medical-school curricula has severely limited the inclusion of new disciplines [3].

Given the difficulties of introducing humanistic disciplines *de novo*, an alternative approach is to facilitate the integration of contents from the humanities into subjects that already form part of the curriculum. This approach makes it possible to present humanistic elements in context and to avoid conflicts about the number of credits that should be assigned to coursework in disciplines outside the realm of medical science. This approach also helps students to understand medical situations from the viewpoints of their patients and of society. A detailed description of the historical pathway to the recognition of the importance of the humanities in medicine and strategies for incorporating these disciplines in medical education is available elsewhere [7].

The current chapter aims to propose ways that the humanities can be exploited in teaching pharmacology to provide essential context for students who are learning about a field that has improved the prognosis of many diseases in the last century, a field that must not be taught simply as a succession of pharmacological groups. As Metzl [8] stated, '*In pharmacology courses, students are responsible for digesting massive amounts of information concerning every aspect of a medication's profile, ranging from its half-life to its mechanism of action and to its clinical indications.*

[…] *Little attention, if any, is paid to the complexities that can arise when these treatments are considered as symbols rather than hard-and-fast facts'*. Pharmacology is a field that encompasses both the basic sciences (e.g. physiology, chemistry, and biology) and the clinical sciences, providing essential elements for medical treatment. Since pharmacology serves as a bridge between these two areas of knowledge, it is even more important to situate this discipline within the context of society through the incorporation of the humanities.

Linguistics and Pharmacology

Within the field of linguistics, the most pertinent area in the study of pharmacology is etymology. Knowing the origin of words enables us to use them more precisely and helps us understand the content of their messages better. Therefore, we are considering the contribution of the study of etymology in pharmacology, which could be called *pharmaco-etymology*. The origins of the word *pharmacology* itself could be an interesting place to start.

The term is a combination of the Greek words *pharmakon* (φάρμακον) and *logos* (−*logia*) (λόγος; −λόγια). Whereas the element *logos* denotes knowledge or treatise, the element *pharmakon* denotes both medication and poison. This double meaning is of special interest for pharmacologists because it recognises the duality of the active principles of drugs, whose therapeutic effects are inseparable from their toxicity. When prescribing drugs, physicians need to remember this dual nature, weighing the possible therapeutic effects against the risk of toxic effects in each case. Benefit-risk analysis is an essential part of treatment in general and of pharmacology in particular. Explaining this dual etymology to medical students can help them bear in mind that administering drugs always involves the risk of harm to the patient.

Many other lessons can be found in the names of drugs, especially of those that were extracted from natural principles. For instance, the origin of the word *morphine* in the Greek god Morpheus illustrates its ability to induce somnolence, and the words that make up the term *salicylic acid* reveal that plant from which this substance was extracted, the white willow (*Salix alba*). Thus, etymology can help students appreciate the circumstances in which different drugs have been obtained and used.

History and Pharmacology

Students can benefit from knowing how the most important drugs used in the past and present have been discovered. They need to learn how intelligent observation, whether applying the scientific method or not, has made it possible to improve the prognosis for different diseases. The term *historio-pharmaco-etymology* would be a

useful neologism for an approach that helps students learn from explanations of the context in which drugs such as heparin [9], atropine [10], scopolamine [11], morphine [12], or artemisinin [13] were discovered.

Another way historical events can be used in teaching pharmacology is by incorporating historical elements in texts prepared for problem-based learning [14]. One example is the use of James Black's (1924–2010) work and his contributions to the discovery of propranolol and cimetidine, drugs that were based on the theory of the chemical modification of neurotransmitters to convert them from agonists to antagonists [15]. Another example is George Hitchings's (1905–1998) and Gertrude Belle Elion's (1918–1999) discoveries about the inhibition of nucleic acids that paved the way for the development of the first rational anticancer drugs and the first antiviral agents [16].

Literature and Pharmacology

Literature is one of the disciplines of the humanities that is most used in medical education [17]. Here we consider its use for the specific purpose of teaching pharmacology.

Physicians have written many literary works. Here we mention only two that are especially interesting for teaching pharmacology. Both *Morphine* (Morfi) by Mikhail Bulgákov (1891–1940) [18] and *The lost art of healing* by Bernard Lown (1921–2021) [19] are autobiographical works. *Morphine* relates Bulgákov's own experience of addiction to opioids, which arose from treatment for pain from severe wounds during World War I. Lown's work includes fragments of his professional life that are remarkably useful for teaching. One of these anecdotes, a case of digoxin poisoning, inspired a text for problem-based learning that we used in teaching pharmacology for several years [20].

One especially rich genre for pharmacology is crime fiction, where drugs are often used as poisons. Among writers in this vein, Agatha Christie (1890–1976) and Anne Hocking (1889–1966) are especially noteworthy. A detailed analysis of the plausibility of Christie's texts from a pharmacological point of view found that they were quite realistic, probably thanks in part to her experience in hospital pharmacies [21]. Her novel *Sad cypress* (1940) is especially interesting. The plot revolves around the murder of a woman by a nurse, who adds morphine to her tea. The nurse also drinks the tea, but injects herself with apomorphine immediately afterward to induce vomiting and thus prevent the absorption of the drug. In teaching pharmacology, the novel allows us to discuss the oral absorption of morphine, the consequences of overdosing, and ways of counteracting the drug, with special attention to the use of emetics in the absence of specific antagonists.

More recently, Donna Leon (1942), an American writer, got her start in crime fiction with the novel *Death at La Fenice* [22]. In this work's twisted plot, the victim is a German opera conductor, a despicable scoundrel who kills himself by cyanide poisoning and attempts to frame his wife for murdering him. Readers discover that

his wife was indeed indirectly responsible for her husband's death because she had surreptitiously administered him the antibiotic netilmicin, causing hearing loss and pushing him to the brink of suicide.

Although studies about the connections between pharmacology and literature are not common, we have published an analysis of the usefulness of different works for teaching this discipline that can be a good starting point for those who are interested in this approach [23].

Music and Pharmacology

Although few studies have addressed the use of music for teaching medicine, music can be used to help create a context for some subjects in pharmacology. MacDonald and Saarti [24] showed that a set of 12 blues songs about subjects ranging from pharmacological definitions to the effects of prolonged treatment with glucocorticoids helped improve medical students' performance in a pharmacology course. Similarly, Hermanns et al. [25] successfully used two original songs to teach psychopharmacological concepts to nursing students.

Our group used content analysis to determine to the possible usefulness of songs by The Beautiful Brains, a group initially made up of psychiatrists at Zamudio Hospital (Bizkaia, Spain), for teaching health sciences students [26]. We found that several songs in their albums *Creo en Emil Kraepelin* and *Toma la medicación* could be useful for teaching pharmacology and psychiatry. Finally, our analysis of Gaetano Donizetti's (1797–1848) opera *L'elisir d'amore* (1832) shows that it can be used for teaching students about the possible effects of administering a placebo [27].

Painting and Pharmacology

The use of the visual arts in medical teaching is becoming more common. Paintings are often used to help students learn to observe and to sharpen diagnostic competencies (see Heyn [28] for a review of this topic). Through detailed observation, students learn the importance of visually examining patients in the diagnostic process.

To our knowledge, no reports of the use of paintings in teaching pharmacology have been published. Nevertheless, some works of art could be used for this purpose. For instance, Santiago Rusiñol's (1861–1931) paintings *Before the morphine* (1894) and *Morphine* (1894) show the effects of this drug by depicting a young woman before and after taking it, offering an opening to the analysis of its abuse and the connection with the invention of the hypodermic needle. Another work that could be used to the same end is Eugène-Samuel Grasset's (1845–1917) lithograph *The morphine addict* (1897), which shows a woman injecting morphine into her thigh. Marià Fortuny's (1838–1874) two paintings entitled *The opium smoker* (1867

and 1869) show a man inhaling from a pipe. These works could help students understand the changes in addiction to opioids related to changes in the route of administration. Another work that might be useful is Hermen Anglada-Camarasa's (1871–1959) *The drug* (1901), which shows a woman under the effects of an unspecified substance that students could try to ascertain through observation, reflection, and debate.

Cinema and Pharmacology

The usefulness of commercial cinema in medical education is widely recognised, and some articles instruct how to use this tool optimally [29]. This teaching approach has been dubbed *cinemeducation* [30]. Although cinemeducation has long been used in many different areas of biomedicine, this approach is relatively new in pharmacology education; our group started using it about 25 years ago with two films, *Awakenings* (1990) and *Lorenzo's oil* (1992) [31]. Farré et al. [32] used these films together with *The Tuskegee experiment* (1997) in a teaching activity.

Another experience, *Biocinema*, used cinema to present transversal aspects of research through the films *Mary Shelley's Frankenstein* (1994), *The Andromeda strain* (1971), and *The boys from Brazil* (1978), among others [33]. To help students better understand the principles of bioethics applied to clinical research on drugs, we compared the film *Extreme measures* (1996) [34] with *Miss Ever's boys*. A randomised parallel study found that both these films were useful for this purpose [35]. Another film that proved useful for teaching undergraduate pharmacy students and graduate students was *The constant gardener* (2005), based on John le Carré's (1931–2020) novel of the same name, which was inspired by the true story of some pharmaceutical companies' unethical practices in Nigeria [36].

Even older films can be used to aid learning about topics of current interest. For instance, the film *Murder, my sweet* (1944), which shows the use of scopolamine, the active principle in burundanga, is useful for increasing awareness of the relatively common use of drugs to render victims helpless in robberies or sexual aggressions [37]. Another film, *The third man* (1949), based on Graham Greene's (1904–1991) novel, tells the story of the black market for penicillin in post-World War II Vienna, where the drug was often adulterated. This film can be very useful for introducing the topic of fake drugs, an important public health problem, especially in some third-world countries [38].

We recently studied the usefulness of the French film *La fille de Brest* (*150 Milligrams*, 2016), based on Irène Frachon's (1963) true story [39], for helping students in undergraduate programs in medicine, biomedicine, and human biology learn about adverse effects and the principles of pharmacovigilance [40]. We found that the using clips from the film improved students' knowledge about these topics [41].

Medical Series and Pharmacology

The development of new platforms for delivering audiovisual content, especially after the advent of widespread access to the internet, has changed the way people consume movies and series, resulting in substantial changes to viewing habits.

The most famous medical series in the last 20 years is *House M.D.* A content analysis of the first season found diverse episodes and scenes that could be used for teaching clinical pharmacology [42], and an empirical study showed that watching and discussing the series improved students' learning significantly [43].

A more recent study analysed the presence of COVID-19 in the most popular medical television series [44]. Content analysis identified elements that could be used in teaching students of the health sciences about the complexity of medical care early in the pandemic.

Epilogue

This chapter provides some examples of how the humanities can contribute to the teaching of pharmacology, showing that it is not necessary to teach these subjects in isolation from the elements that traditionally make up the curriculum or to replace the contents of pharmacology courses. Rather we propose that the humanistic disciplines impregnate the teaching methods used regularly to enrich theoretical classes, seminars, or laboratory experiments and to help students achieve their learning objectives. It is crucial to remember that professors do not merely train physicians, rather we educate critical, responsible professionals who need to know the traditions and culture of their profession.

University education must involve more than transmitting knowledge found in books and on the internet. Multiple resources from the humanities constitute a useful set of tools for presenting pharmacologic concepts in context. By taking advantage of these tools, professions can help students appreciate the importance of pharmacology in medicine and inspire students to delve deeper into the medical and social roles of pharmaceuticals, beyond their chemical structure. The emotional engagement engendered by these techniques is key to learning.

NOTE: This chapter is based on Josep E Baños' speech delivered on his appointment as a Fellow to the Royal Academy of Medicine of Catalonia on April 24, 2022 (https://ramc.cat/wp-content/uploads/2022/04/Josep_Eladi_Baños_i_Díez.pdf).

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Chapter 5
Employing Greek Laments for the Dead (*'Moirologia'*) to Facilitate Medical Students in Their Encounters with Patient Death

Theodora Tseligka

Introduction

Traditionally, the medical profession has focused on alleviating patients' pain, curing illnesses and sustaining human life. In this demanding professional journey, doctors' encounters with patients' (un)expected deaths constitute an unavoidable reality since dying is an inescapable part of living, despite the apparent oxymoron. Notably, offering quality palliative and end-of-life care is recognised as an essential competence for all medical doctors entailing a profound expertise in a variety of skills [1]. Also, some consider that the prevailing medical culture still views patient loss as a failure in the healthcare setting where death fails the 'life-saviour' doctor [2], while others [3] suggest it is a dissipating trend. The matter of the fact remains that an extensive scientific literature is a testimony to the overwhelming emotions and challenging responses that patients' deaths evoke to all healthcare professionals, and even more so to medical students, who do not yet possess an extensive experience of the exigencies of the clinical medical setting.

Medical Students and Patient Death

In a recent systematic scoping review, 54 studies were analysed, recording the impact of patient loss on medical students' personal and professional development [4]. Overall, it seems that medical students often have to face 'unresolved' dilemmas and conflicts between the personal and envisioned professional duty of a doctor to prolong human life and the frustrating obligation to let some patients die, and in

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parallel to offer sympathy and comfort to their families, while being professionally detached at the same time [4, 5]. Feelings of guilt, anger, frustration, despair, grief, sadness, shock, confusion, denial and helplessness have been reportedly experienced by many medical undergraduates when witnessing patients' deaths during the hospital departments rotations [2–4, 6]. Students are also challenged to confront their own death anxiety and mortality in the event of their patients' demise [6], while other studies testify to reactions of denial, self-isolation and bewilderment by medical students in such circumstances [4, 6]. Obviously, reactions vary depending on the patients' age, cause and manner of death, students' previous experiences, faculty support and former educational training, [3, 5, 7]. For instance, even though deaths in inpatient settings appear to evoke primarily feelings of sadness and grief, the suddenness and sometimes distressing imagery of traumas and patient losses in the Emergency Departments seem to be more shocking for students and call for different interventions in the medical educational setting [7].

Most fundamentally, literature has shown that many students are often unprepared to address the unexpected emotional toll following a patient loss as well as the burden of bereavement care. Despite recorded curricular changes in medical schools including mostly theoretical sessions and small-group tutorials on end-of-life care and, to a lesser extent, clinical electives with direct exposure to dying patients [4], medical students often reveal that their education on such topics is rather inadequate or superficial [2, 4, 8, 9]. Typical is the case in the aforementioned study by Batley et al. [7] where 16 medical students interviewed in the wake of a patient loss reported that no formal debriefing followed with attending physicians. Hence, even though first-hand experience with dying patients in clinical years is promoted as an optimal way of training and honing medical students' empathetic skills, this might not be as beneficial as expected if it is not supplemented by proper guidance from senior faculty [10]. Studies affirm that physicians themselves feel uncomfortable and thus may not be able to explore candidly these sentiments either by themselves or with their students [10].

All the above appear to hamper medical students' (and doctors') interaction with patients and future professional development, often leading to increased emotional detachment and suppression of feelings as a coping mechanism as well as a perceived sense of incompetence, insecurity and fear of failure [6]. The implications of such emerging stances are not to be underestimated since they can undermine medical students' future mental well-being, their professional practice and, ultimately, the quality of patient care. Evidence by the work setting, i.e. by junior doctors' experiences, concords with these arguments, as the latter acknowledge '*feel[ing] unprepared and out of their depth when caring for patients approaching and at the end of their lives*', pressingly demanding for further training [1].

Furthermore, the unprecedented upsurge of the COVID-19 pandemic which has led to more than 6 million deaths worldwide in the last two years [11] seems to have exacerbated the emotional fatigue for all healthcare professionals. Amidst this global health crisis with the high mortality, many health doctors have displayed heightened levels of anxiety and stress in the face of their patients' death, along with feelings of burnout and emotional exhaustion [12]. Unsurprisingly, many studies

have underlined the increased anxiety levels, psychological distress and worsened mental health of medical students too [13, 14], including Greek medical undergraduates [15], due to the ramifications of the pandemic. Furthermore, although Chinese medical interns (and particularly those with strong religious beliefs) appeared to be only moderately stressed due to COVID-19 patient death, most probably owing to a rationalisation of increased death events during the pandemic, the authors note that the scores for fear of death and death avoidance remain relatively high and call for a medical student support system [16]. Similarly, Peruvian medical students displayed lower fear of death compared to other studies despite the COVID-19 emergency; however, the highest fear was noted in the scale of fear for death of others, partly associated with the strong prioritisation of the significance of another person's death over one's own in the Western societies [17].

In view of the above, it is argued that medical students' education on patient death needs to start before they embark on their clinical training. We wholeheartedly concur with Pessagno et al. [3] that '*at that pivotal moment of reckoning as a human life slips away before them, [medical students] will almost always desperately require a humane, supportive atmosphere'*. However, contrary to their suggestion that pre-clinical instruction is not particularly conducive to these issues (ibid.), we purport that engaging undergraduates in critical readings of various forms of literary texts and subsequent reflective practices from the narrative medicine lens at the pre-clinical stage can armour students with the resilience, skills and knowledge required for these emotionally charged events. Particularly when it comes to preparing students for their first confrontation with patients' deaths, advanced training is necessitated even from the first years of study to allow undergraduates to cope with the loss of life, a potentially transformative experience for most of them [5].

Literature and Medicine

The study of literary works is not new to medical education. Long ago the integration of humanities resources in a strictly science-oriented and laboratory-based curriculum like the medical one has been recognised as significantly beneficial for prospective doctors [18, 19]. As aptly noted by Charon [20], literature and medicine share strong intrinsic links and deep similarities in terms of their basic tenets, objectives and methods. In her view, both literary and medical texts warrant a deep understanding and interpretative analysis of the language means employed since latent, contradictory meanings and implicit stances are detected both in poems, novels, autobiographies, fairy tales as well as in medical interviews, medical history records and case presentations. According to Shapiro [21], '*to respond adequately to a poem or to a patient requires careful, empathic attention, and the capacity to be moved by what is being conveyed'* as both instances are loaded with inexpressible meanings, heightened emotion and significance within a short time/space. Such attention to detail compounded with comparative interpretative activities enables medical students to recognise more complex dimensions of medical settings, learn

to negotiate meaning and language nuances, and address moral quandaries, effectively practicing medicine in a more empathetic way with the patient and their family [19, 22].

Fundamentally, both disciplines address the same eternal questions about the origins and destinies of human being, striving to provide tentative responses about the quintessence of life and death, whether this is affected through symbolic myths and short stories, from Sophocles to Hemingway, or by self-reflective practices upon incidents of patient loss [20]. All in all, it is foregrounded that engaging with literary works offers ample space and time to the medical student to adopt self-awareness practices, to uncover their interpersonal conflicts about profound existential issues, and accept the uncertainty of living with speculative, subjective answers (unlike the definitive, objective results from scientific experiments), in as much the same way that a reader of a fictional piece of work has to tolerate the ambiguous meanings of a literary work [20, 22]. Henceforth, reviewing on an innovative course that called for a cross-disciplinary synthesis between medical students' clinical visits and assigned literary readings, Shapiro et al. [23] argue that such innovative intersections provide medical students with a deeper understanding not only of the patients' illness adventures, but also of the families' and doctors' intricate reasoning.

The integration of literature in medical education resonates with the basic principles of narrative medicine often employed to precipitate essential medical learning. Embedded within the broader field of medical humanities, narrative medicine is far more than a theoretical perspective; it rather constitutes a more holistic approach to medical practice where emphasis is placed upon analysing the 'narratives', the 'told' and 'untold' stories recounted by the patients, families, doctors and all healthcare professionals in the wake of an illness, with the aim of shedding light on the complex workings of a pathology and whatever this entails [24]. The ultimate aim of narrative medicine is to contribute to the formation of a sustainable and more humane healthcare ecosystem [24]. Thus, attention is brought to the transformative power of narrative discourse, the linguistic expression of anguish, despair and grief about human health, which requires an advanced competence in order to be approached.

Against this backdrop, Skelton [25] reviews a range of literary texts on the topic of death and dying, and exemplifies how exposure to great poems, theatrical plays and novels can help medical professionals, whether young and inexperienced or older and overburdened with the emotional turmoil from heavy workload, articulate their deepest emotions and concerns; immersed in the predicaments of the tragic heroes and the uneasy circumstances portrayed, they can ultimately discover new insights into the essence of human nature. Concurrently, Welch [20] concludes that a group of medical students, following a literature and medicine course, managed for the first time in their six years medical training to feel '*comfortable enough to talk about or deal with issues such as death or suffering and come to terms with their own experiences with these issues*'. Reflective discussions and essays usually ensuing these literature readings appear to bring to the fore the fears, conflicts, empathetic problems, communicative deficiencies, religious and spirituality concerns shared by undergraduate medical students, while their open reading and analysis broadens students' comprehension of doctoring and its emotional demands [26, 27].

Simultaneously, such initiatives promote a dialogic and supportive process among medical students, by sharing (un)familiar situations and frustrating experiences, which could act in a liberating way and reinvigorate their interest in the core professional values of empathy, care and compassion towards their fellow human beings. Particularly within a medical culture which does not generally endorse the articulation of feelings of distress, suffering and exhaustion in professional settings, literary encounters '*offer an opportunity for physician readers to "find themselves" in the writings of colleagues in ways that they may not experience in the casual exchanges in hospital corridors or cafeterias*' [21]. Crucially, literature provides an access and invites an openness to the 'otherness', to different world perspectives, ideologies, cultural beliefs and value systems, all of which are important for a doctor to embrace in a modern multicultural professional setting [28, 29], considering that death and dying are conceptualised much differently across multifarious cultural settings. For instance, in the Greek culture '*thanatophobia*' (fear of death) is so salient that any discussion about (one's own) death is generally avoided as it is considered an omen of an imminent evil [30].

In view of the above, a distinct form of literary art, Greek lament songs for the dead *('moirologia')*, is explored below as an educative tool to support medical students in their encounters with patient death.

Greek Laments for the Dead ('*Moirologia*') in Medical Education

In many cultures, lamentation has traditionally constituted an inherent part of the funeral ritual of the family, and the wider community, to express their mourning and grief to the dead. In the Greek setting, laments for the dead represent a literary genre which has been continuously recorded from antiquity and Byzantine up to modern times, ranging from *threnos, goos* and *kommos* in classical tragedies and epic Byzantine poems to modern folk songs of *moirologia* [31]. Etymologically, *moirologia* is associated with *Moira* (=Fate), which in the folk tradition plays an instrumental role in a person's life and death (ibid). Several forms and types are documented across regions of Greece, sung for different occasions, including marriage, death and emigration, yet, our discussion here is centred upon traditional folk songs on the theme of death, with a prime focus on their textual content. These were composed and performed primarily by women in rural settings in the context of a burial or memorial service and exhumation, accompanied usually with intense weeping and woes. In fact, Greek folk laments, for all their amateur conception, are viewed as oral narratives [32], attributed a remarkable poetic quality [31] and are '*recognised as an art demanding musical and verbal skills in combination with an ability to transform one's own or another's pain into a work of art*' [33]. Nowadays, their performance seems to be rather scarce in the urban western world due to a dominant medicalisation and deritualisation of death [33]; nevertheless, their study appears more than ever pertinent from the narrative medicine lens, mainly owing to their authentic, candid and original engagement with death.

Usually, laments allow the bereaved to release their inner, passionate feelings of grief, suffering and physical pain because of the loss of a beloved family member. In essence, '*laments do not chat about despair. They confront death with open eyes*', as poignantly stated by Holst-Warhaft [33]. Typical is the following moirologi:

Ἄρχοντες μικροί μεγάλοι και λοιπή φτωχολογιά	*Young, old lords, and the rest poor people,*
Χάρος μας απαντυχαίνει νέους, γέρους και παιδιά.	*Death falls upon us all, young, old and children.*
Βλέπετε μην πλανευτήτε της προσωρινής ζωής	*You see, do not be deceived by the transient life*
Γης εγίνη το κορμί μου και η γη θελεί βαθύ	*Soil became my body, and the earth wishes it deep*
Και τα νόστιμά μας κάλλη μαύρη γης θα τα γευτή [34]	*And black earth will savour our flavoursome beauty*[a]

[a]Author's translation

In our view, this lament is comparable to what Alexiou et al. [31] call 'gnomic laments', which '*express with the utmost conciseness some consolatory and proverbial wisdom about life and death*'. The representation of human beings as food devoured by the earth is a commonly used metaphor in moirologia, depicting not only the gradual decomposition of the dead body in the tomb, but also the nourishment it offers to mother earth so that new life can emerge, thus, providing a more optimistic view of the circle of life [32].

In such, death evokes a vivid emotional response, which is perceived as therapeutic and calming for the mourner despite the apparent juxtaposition with a more rational and disengaged reaction to a loss of life, not uncommon in the modern western world [33]. The structured and controlled channelling of sorrow, desolation and misery in lament practice through the traditional meters, expressive motifs, the melodic formulae and the antiphonal performance attest to a deeply sentimental and, at the same time, thoughtful exploration of death [33].

Παιδάκι μου, τον πόνο σου πού να τον απιθώσω,	*My child, where can I lay your pain?*
που κι' αν τον ρίξω τρίστρατα, τον παίρνουν οι διαβάτες,	*if I throw it on the crossroad, passers-by will take it,*
κι' αν τον αφήσω στα κλαριά, τον παίρνουν τα πουλάκια.	*if I let it upon the branches, the birds will take it.*
Πού να βαλθούν τα δάκρυα μου για τον ξεχωρισμό σου;	*Where should my tears fall for your departure?*
Αν πέσουνε στη μαύρη γης, χορτάρι δεν φυτρώνει,	*If they fall on the black earth, no grass grows,*
αν πέσουνε στον ποταμό, ο ποταμός θα στύψη,	*if they fall into the river, the river will shrink,*
αν πέσουνε στη θάλασσα, πνίγονται τα καράβια,	*if they fall into the sea, the ships drown,*
κι αν τα σφαλίσω στην καρδία, γρήγορα σ' ανταμώνω. [35].	*and if I secure them in my heart, I will meet you straight away*[a].

[a]Author's translation

It is exactly this feature of laments which could motivate Greek medical students to inspect their own attitudes and feelings about death, giving vent to unexplored fears and inarticulate emotions in the face of human mortality. In the above excerpt, the infliction of pain due to a child loss appear to be unbearable for the mourning mother, who is striving to find ways to cope with it. The affliction is so heavy that the whole nature (*grass, river, sea*) seems not to endure it either. Yet, the mother does not wish to let go of the pain (lines 1–5) since this might be a way to hold on to the memory of her child, as if this torture was a desirable situation to help her come closer to her long-missed child ('*and if I secure them in my heart, I will meet you straight away*'). Alternatively, the last line might be interpreted from a different point of view; the more the mother does not disclose her deepest feelings, the more depressed she might feel, leading her possibly to a self-destructive behaviour and even death, as implied by the expression: '*meeting* [her son] *straight away*'.

In accord with the above, another Greek lament from the region of Mani (Greece) reflects the relieving effect of mourning songs for the lamenter.

Καλά που είναι τα κλαήματα, γλυκά τα μοιρολόγια, *κάλλιο 'χω να μοιρολογώ,* *παρά να φάω και να πιω.* [31]	*How good are tears, how sweet are dirges,* *I would rather sing dirges* *than eat or drink*[a].

[a]Alexiou's translation

If we accept that '*emotions are biological imperatives*' [33], then funeral laments can be a stimulus for our future doctors to acknowledge both their own and their patients' and families' outward emotional reactions to death as beneficial and effective towards a more empathetic, holistic and humane healthcare practice.

Another prominent feature of Greek funeral laments is the metaphorical, symbolic and allegoric language used to mediate the antithesis between life and death, by associating the latter with features from the former, such as with marriage, emigration abroad (*xenitia*), natural elements (i.e. plants, birds) as well as with food and water [32]. Characteristic is the resemblance of funeral laments with wedding songs in terms of their structure, format and even wording. Interestingly, the following moirologi is sung both at funerals and weddings, and is addressed from mother to daughter:

Πουλάκι νείχα στο κλουβί και το είχα ημερομένο,	*I had a little bird in a cage and I had it tamed,*
Το τάιζα τη ζάχαρη, το πότιζα το μόσχο,	*I fed it sugar, and I watered it with musk,*
Κι από το μόσχο τον περσό κι από τη μυρουδιά του	*And from the too much musk and fragrance*
Μου σκανταλίστει το κλουβί, και μου φυγε ταηδόνι.	*The cage was scandalised, and the bird left*
Πήρα τα όρη σκούζοντα και τα βουνά ρωτώντα	*I fled to the mountains crying and asking around:*
«Βουνά μου και λαγκάδια μου και κάμποι με τα ρόδα,	*"Dear mountains and valleys and meadows,*
Μην είδατε ταηδόνι μου και πέρασε πετώντας;	*Have you seen my little bird flying around?*
- Εχτές προχτές επέρασε και πάει στον Κάτου κόσμο.	*- It passed by a few days ago and it went to the Underworld,*
Τη νύχτα κλαίει για βυζί και την αυγή για μάννα,	*At night it cries seeking for breast and in the morning for manna,*
Και μεσ'τα ξημερώματα ποιος να το ξετυλίξη.»	*And at dawn, who can unwrap it"*[a]
[36].	

[a]Author's translation

According to Saunier [37], an implicit reference to 'hybris' is noted here; the mother's excessive tenderness and affection towards her child ('*too much musk*') induces the punishment, i.e. the child's departure and death. On the one hand, possible feelings of guilt and self-reproach are not uncommon among bereaved parents for the death of their children [38], a situation that many medical students will unavoidably encounter in their clinical settings. On the other hand, Saunier [37] emphasises that the child's death in folk laments like the one above is still perceived as unfair, cruel and unacceptable, a result of supernatural powers ('*The cage was scandalised*'), beyond any human control. Furthermore, such an apparent contradiction, where similar songs are sung in one of the most sorrowful and happiest time in someone's life respectively, uncovers the crucial metaphor of asserting death as marriage. Danforth [32] explicitly argues that this paradoxical relationship is indicative of an effort to approach the unbearable death in a more familiar manner and associate it with marriage, i.e. an experience from the living, since they both entail the ideas of departure (from home) and separation (from the family), albeit to a different extent. Arguably, the opposition between life and death can never be ultimately resolved, yet, the affinity of the funeral to the wedding ceremony attempts to portray death as a journey from one place to another, mitigating the idea of finality inherent in death (ibid.). Hence, by uncovering the metaphoric relationships between seemingly incongruous abstract notions, medical students can enrich their world views with more concrete and comprehensive depictions of grief and distress [32] and augment their interpretative skills by immersing into the linguistic complexities of textual content within a specific sociocultural setting. Hopefully, such skills can be transferred to their future clinical encounters with terminal patients and their families, where they will be required to 'decipher' emotionally loaded interactions

and provide comforting and healing words in the case of an impending or actual patient death.

Most notably, laments are typified by improvisations, as the mourner often adjusts the content to the specific death circumstances or personal attributes of the dead [31, 33]. Personalisation of the mourning displays a genuine respect for the dead, whose individual qualities are praised accordingly. For example, Alexiou et al. [31] refer to a case of a lamenter who complained about the inappropriate laments sung by some of her fellow female mourners, who did not integrate the correct distinctions. In effect, laments for the dead do not constitute an individual emotional response to a beloved's death but rather represent the communal feeling and society's relationship to death and life [33]. Laments embody a public language to convey the expression of sorrow about the deceased [32]. In doing so, it becomes evident that the study of such folk songs may assist medical students to make emotional sense of distressing events framed as a public, supportive process—on a par with the lamenters' grieving group—whereby they can overtly practice important aspects of professionalism, including empathy and respect. Finally, of relevance is also the fact that women have been typically the main representatives of performing laments and expressing grief across different cultures, often associated with the widely held conception that women are by nature more emotionally expressive than men [39]. Such perceptions can intrigue an informed debate among medical undergraduates about the pre-established notions of gender stereotyping of emotions.

Conclusion

The present discussion so far has argued in favour of the incorporation of a distinct literary form of art, Greek *moirologia*, at the pre-clinical stage of medical education in order to assist students to achieve a deeper awareness and more effective management of their own and others' emotions at the pivotal moment of human death. The study of selected funeral laments, followed by critical, reflective in-class discussions, essay writings and guided feedback, could foster future doctors' reflective skills, meaning negotiations and critical understandings in a novel pedagogic modality, different from the one they have been used to. It is aspired that medical students will integrate later on in their professional life these unveiled considerations about the essence of human life and death, while maintaining their well-being and professional ethos. With the wounds of the pandemic still sore, whereby dying has been seriously dehumanised as a lonely process both for healthcare professionals and their patients, we consider of utmost importance to bring medical students into contact with forms of art that communicate universal experiences of suffering and loss.

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Chapter 6
Theatre as a Tool for an Inquiry-Based Physics Teaching

Marina Carpineti

Introduction

Whenever students recognise the importance of physics in their lives, they usually think of technological applications, while they do not appreciate the influence it has (and has always had) on culture, way of thinking, and even on humankind's perception of itself. We tend to consider the emotional and rational spheres as separate, referring the first to the humanities and the second to the scientific disciplines. On the contrary, the two are strongly intertwined, as evidenced by the close link between scientific discoveries and the progress of art and literature [1, 2], and science should be able to touch the emotional chords and not just rationality [3].

Besides the lack of motivation and the scarce curiosity for physics, students have also objective difficulties towards it [4]. Traditional ways of teaching, based on solving textbook-style exercises more than prioritising creative thinking and stimulating students' observation of the world around them, have demonstrated to be inadequate to manage these issues and ineffective in creating students able to examine complex problems, propose explanations, test them, and evaluate alternative solutions by looking for connections and links [5–8].

The research in education has shown that an "inquiry-driven" approach can help to change the image of physics and to give a more realistic perception of how physics proceeds [4, 9–12]. When questions come from them, students do want to find answers and they can personally experience the scientific method that leads to a validated interpretation of results. To reach this goal, it is important to engage and surprise students, showing unexpected phenomena that naturally drive curiosity and questions, while touching emotional chords.

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Theatre owns most of the ingredients that are needed to mix reasoning, wonder and surprise, and to foster the desire to learn more. Sitting in the dark during a performance, people are open-minded, and naturally available to be involved, a situation very difficult to obtain with students in a classroom. These are only some of the reasons explaining the success that the marriage of scientific theatre and education has had in recent years and continues to have [7, 13, 14].

In this chapter, I first illustrate some of the main difficulties encountered by students and some methods proposed by research in physics education to address them. I will then describe the scientific theatre project "The Show of Physics" started in 2004 at the Physics Department "Aldo Pontremoli" of the University of Milan with two colleagues and friends of mine, Marco Giliberti and Nicola Ludwig [15]. The project, now composed by eight different shows, has now (Jun. 2022) reached more than 150,000 people in more than 420 replicas. I discuss the objectives of the project, its goals and results, and how this approach has proved to be a useful support to physics teaching and can give important help to both students and teachers.

Students' Difficulties to Learn Physics

There is a significant literature about the difficulties encountered by students in learning physics and about the gaps in their understanding of specific and basilar topics [4, 16–19]. I cite some of them, to give the reader an idea of the richness and complexity of the theme, and to give the framework in which our scientific theatre may be inserted.

At variance to what is often said to students, physics is far from being intuitive. One of the most studied problems is that of cognitive conflicts induced by the discrepancy between our ingrained ideas and evidence coming from the environment [20, 21]. Each of us, in our first years of life, develop a number of convictions about the world that we use to interpret and catalogue the facts (i.e. living objects move; liquids flow; solids are heavy …). Educational researchers have demonstrated that prior knowledge which contradicts scientific knowledge can be incredibly resistant and interfere with learning of new concepts [20]. These ideas are often very simple and naive, but they are the first ideas that come to our mind when we face a new phenomenon: even if we know Archimedes' law, our prior knowledge tells us that a large and heavy object cannot float if a lighter one sinks, therefore, without being aware of that, we have to perform a mental "translation" of our preconception in a new idea based on the complex information we have collected in our studies. School not always succeeds in managing the frustration coming from this discrepancy and to teach students how to learn the new description of the world and become more and more rapid in this "translation".

Another well-known problem for students is that physics proposes a description of the world based on words that they already know and properly use in their lives, such as time, work, energy, force, velocity, or pressure. In everyday language, however, many of these words can be used in a figurative way (i.e. "don't

put pressure on me"; "how fast time passes") or can be considered synonyms and interchangeable, as in the case of strength, force, and energy. In physics, on the contrary, any of these words describe well-defined quantities, and each of them is expressed with precise units. Students need to understand that they have to switch to a different language mode when facing a physical phenomenon and that they need a long time to re-understand the meaning of words they already know. This problem is incredibly amplified in the case of quantum physics and relativity where our tangible world is even an obstacle to our imagination: the world is no longer the one we know, but a place where things are no longer "objects" and distance and time intervals depend on who measures them. Any attempt to describe this world can generate a misunderstanding because any word we may use, necessarily carries with it an image coming from our direct but fallacious experience. Without a qualitative leap, any effort from teachers to drive students towards a robust understanding will be vain.

Learning physics should be an exciting experience able to change the way students look at things around them and not only the learning of a new set of concepts. Indeed, far from sharing the passion that physicists have for finding explanations, most students perceive physics as a science that gives answers to questions that normal individuals would not ever ask themselves [22, 23]. And these prejudices against physics are often so strong that they influence students even before they tackle it in secondary school, reaching them through jokes and comments from former students such as parents, friends, relatives, and even cultural personalities. Therefore, the teaching of physics must be able to win a strenuous struggle that begins with the need to overcome the wall of indifference and mistrust towards a science dealing with "*useless problems of no interest*".[1]

Many different approaches have been proposed to change the way physics is taught, by promoting active learning, a way to learn that conveys not only laws and formulas, but also the processes that physicists use to develop ideas and formal laws [4, 16, 18]. The importance of an Inquiry-Based Science Education (IBSE) approach [9–12], that leads students to follow the scientific process step by step starting from questions they ask themselves, has been recognised. In IBSE teaching, laboratories and direct experience must have a central role [19, 24, 25] as students have to learn personally and need the chance to make decisions on their own, using the necessary amount of time. However, the common indication coming from the vast majority of the research is the necessity to engage students, as the first step [18, 26–29], to win their initial resistance against physics and to catch their attention. Engagement should come from the way teachers pose the problems, but we now also understand the importance of those actions, collateral to formal learning, aimed at making physics known for what it is, at inserting it into the cultural landscape, showing its links with other areas of knowledge, and able to make it appreciated. The importance of science communication alongside teaching is now considered as a valuable tool to reduce the prejudices against

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[1] Personal quote inspired by some interviews with high school students.

physics in citizens and in students. If physics can reach students also through other channels than school, it has a chance to become a familiar topic and no longer a disturbing but avoidable challenge.

The Show of Physics

In the first years of the new millennium, it became evident that in Europe there was a diffuse fall in interest for science by young people [30]. Governments, conscious of the importance of scientific culture for a society able to compete with the modern challenges, started to take the first actions. In 2004, in Italy, the Ministry of Education developed a plan to fund those university projects aimed at increasing the appeal of "hard" sciences among high school students, and, after a first experimental phase, the plan moved to the implementation of system activities that are still lasting.

In this context, Marco Giliberti, Nicola Ludwig and I, Marina Carpineti, had the idea to use theatre to communicate the beauty of physics. Theatre has many of the ingredients that we consider as necessary for effective communication: it is a perfect place where wonder and reason can meet, and where emotions can emerge. It occurs in an atmosphere different from anyone currently experienced by people, it is on stage, in the dark, and the attention is necessarily focused. For students, it is a place completely different from a classroom and they can abandon themselves and open their minds without any need to take notes, forgetting about their teachers and their classmates. Moreover, a show is not necessarily for schools, but it can be addressed to both students and general public, therefore allowing, with a single action, to reach multiple purposes/audiences.

The Birth of an Idea

Since the beginning, we wanted to disseminate the scientific culture; to communicate the *charme* of physics with a new language; to propose an extra-curricular activity both recreational and scientific; to offer a support to schools for a renewal of teaching methods of scientific subjects. We did not want to propose a show based either on the personal history of a scientist or on the moral implications of science. Not only is there already an extensive literature on these topics, but we also wanted physics to be the main character of our show. We wanted to engage, to create fascination, and to raise a good feeling towards physics and physicists; what we did not want was to propose a lesson of any kind. We had it clear in our minds that we could not expect to teach anything with a one-hour show. Moreover, we wanted to show physics as it is, without simplifying it or making it more "digestible". When

complex topics are popularised, it often happens that they are described, para-phrased, rethought in many ways, but the result is that the real essence of the topic is distorted: what is shown is a bi-dimensional image but the depth is lost. Finally, we wanted to use humour and fun. We wanted our audience to leave the theatre being happy and fascinated, curious to learn more and amused by physics and phys-icists. These beliefs remained our guidelines also for the subsequent shows, but some more ideas were added, based on the target audience.

We decided to direct our initial efforts to children, in order to offer them a posi-tive image of physics before their first contact with it at school, in the hope to pre-vent the influence of the widespread prejudices they are destined to face as they grow up. The idea that university people could work for elementary students was completely new in Italy, nevertheless we obtained the support of our Department at the University of Milan. We put together several ideas based on our different research experiences (i.e. we are a theoretical, an experimental, and an applied physicist), but also on how science is taught. The show we had in mind had to stimu-late the natural curiosity of children by pushing them to use their critical sense including towards traditional school teaching, which tends to be dogmatic. We, therefore, selected several experiments that were fun but counter-intuitive to under-mine their certainties: the *leit motiv* of the show had to be *"you can't be too rigid in the classifications"*.[2]

The following step was to turn to theatre professionals as we needed theatrical skills to be able to make a show and not a simple lesson with spectacular demonstra-tions. So, we presented our project to two professionals from children's theatre and showed them the experiments, explaining what we wanted to demonstrate with each of them. We explained the gaseous state by exploding a balloon—*the gas does not maintain either the shape or the volume it occupies*, the liquid state by piercing a balloon full of water which, splashing us all, filled a bowl—*a liquid takes the form of a container but the volume is preserved,* and then the solid state with a balloon of frozen water from the freezer, which once punctured maintained its shape and vol-ume unchanged. We then presented the phase transitions using liquid nitrogen to show its spectacular evaporation at room temperature, to solidify water, and to apparently deflate a balloon filled with air that liquified at the very cold temperature (Fig. 6.1).

Once these well-known concepts were clear enough, states much more difficult to classify, but which we constantly meet in our lives made their appearance: foams (i.e. shaving foam sprinkled between two clapping hands and splashed everywhere); gels (i.e. delicious puddings); and a non-Newtonian fluid (i.e. the wonderful Silly Putty®). What are these states? How can we classify them? The world is definitely richer than we expect … We then move to the topic of light, with laser rays in air and water, scattered, reflected, and refracted, with coloured lamps whose summed

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[2] Sentence repeated during the show "Let's throw light on the matter" [13].

Fig. 6.1 We explained states of matter using balloons and phase transitions using the extraordinary liquid nitrogen. From left to right in the pictures are Nicola Ludwig, Marco Giliberti, and Marina Carpineti. Photos by Giovanni Hänninen

lights produce white light, with polarisers and with the infrared, to show also the light that we do not see. Eventually, enthusiastic about the marvel of physics, the professionals of theatre found the project interesting and innovative and decided to help us. Provided, however, that we play the show. Its strength, according to them, laid in our credibility. Therefore, against our original will, we found ourselves not only being the authors of the script, but also the actors, and this double role was maintained over the years with rare exceptions when the request of shows was too difficult to manage for us. From the merge of different professionalisms, our first show *Let's throw light on the matter*[3] [13] was born. We decided to impersonate some funny stereotypes of the scientists among children [22, 23, 31–33], wearing white lab coats and putting on stage a blackboard with formulas written on it, recognisable scientific elements such as beakers, electronic instruments, and warning signs. We made these choices to let children feel comfortable with us. Nevertheless, we also decided to contrast some negative prejudices about scientists that research has documented over the years [22, 23, 33]. Students often think that scientists are males and work alone [31, 32], while we were two men and one woman, happy to work together with reciprocal respect.

When we presented our project to elementary teachers, they were extremely interested but scared by the possible questions that children could ask them once back in their classrooms; they felt uncomfortable as they were not confident enough about science, also due to the complex phenomena we were presenting. We then added a Question and Answer (Q&A) session at the end of the show, with lights on, during which the children could ask for explanations and see their favourite experiments again. The Q&A session is an integral part of this show, usually it lasts approximately the same time as the "real show" and is also present in most of our other plays.

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[3] Here and in the following, the titles of the shows are translated in English. Apart from a case discussed later, the project is national, so the shows and titles are in Italian.

Shows for Different Audiences

Since 2004 we have realised 6 other shows addressed to various audience and, in 2020, during the COVID-19 pandemic we projected and performed a 7th one specifically for YouTube [15]. All the shows respected the guidelines we had given ourselves when projecting the first one, and all dealt with topics related to our research or teaching activity, but they were very different from each other. Moreover, for each one we had made precise choices about the language and the message we wanted to convey, depending on the audience we were targeting.

Traces (2007) is a dreamlike and poetic show, targeting an audience of people with some knowledge of physics already, typically students at their last year in high school or undergraduate students [7]. It shows physics from different perspectives, highlights the way physicists approach problems, and brings out the creative aspects and the deep links with philosophical and artistic thought. The subtext of this show is inspired by a famous sentence of the cosmologist Rocky Kolbe *"The eye cannot see what the mind is not prepared to accept"* [34] to underline that physics is not intuitive, but an educated eye is necessary to see extraordinary phenomena and be surprised by them.

Light from the stars (2009) is a more animated show for all audiences, but is particularly suited to high school students. It deals with the observation of the cosmos at various wavelengths and, while showing that there are now much more powerful ways to study the universe than direct observation with visible light, it tries to bring back to the personal experience of the viewers in terms of the properties of the various waves. The show is organised as a fake conference in which a prestigious speaker, a famous populariser, never arrives and leaves his assistants the task of improvising a speech that surprisingly advances between gags and stumbles. The theme that pervades the whole show is that of the dangers of scientific popularisation that, at the end of the show, the public can personally appreciate. A twist, in fact, shows clearly to them that popularisation can intrigue us and push us to go in more depth of problems, but can also be tricky and cannot substitute study and learning.

In 2010 and in 2012, thanks to a collaboration we had with the Piccolo Teatro di Milano, one of the most prestigious theatres in the city, two shows were born, *Alice in Scienceland* and *Alice in Energyland*, a sort of scientific re-interpretation of the famous novel by Carroll, where the audience has the role of Alice falling into a world that she does not understand. In a crescendo of surprises, gags, and games with people who are brought on stage, the public passes from the initial dismay to the appreciation of physics and the trust in the scientific approach to problems (i.e. even the most dramatic ones related to energy and climate change).

The year 2015, the international year of light, was particularly fruitful as two new shows were born. The first one, *Under another light*, is a new show for children. Inspired by *Let's throw light on the matter* for the scientific part, it has a different script which takes into account the different age of the actors and the changes in children language and habits, after 11 years from the first version.

The second one is *Light Mystery,* one of the deliverables of the EU funded project TEMI (Teaching Enquiry with Mysteries Incorporated) aimed at fostering inquiry-based teaching across Europe [35]. *Light Mystery* (the original title is in English) is the first international show of our group. It proposes a reflection about physics teaching, trying to put an accent on the power of emotional engagement, both for learning science and for being a scientist. The three physicists on stage play three characters: a teacher, a university lecturer, and a physicist pretending to come from the future who tries to understand our scholar system and reveals completely unconventional ideas: *"So… You do not answer students' questions, you interrogate students about things you already know, and you give answers to questions nobody asked you? How strange ..."* After a number of gags and misunderstandings with the continuous involvement of the public on stage to perform experiments and solve problems, a new possible teaching approach is tracked.

Finally, we realised $E = mc^2$—*the great show of physics* [36] that was the opening event of the 2021 national congress of the Italian Physical Society, performed online due to the COVID-19 pandemic. The show proposes an innovative format in which the rigorous language of physics is confronted with the shouted and sensationalistic one of "bad science". Three physicists invited to a TV show about physics, find themselves in a nightmare. There is a *democratic tele quiz* where scientific results are put to a vote and there is an interview with a Nobel laureate who exposes theories of great scientific interest but which, in a riot of linguistic misunderstandings, ends with the embarrassing arrival of the sponsor. The TV show is expected to talk about relativity but the approach is completely antiscientific, until the three physicists start to talk about physics with each other, with shared reasoning and interesting reflections, and realise that the public is fond of real physics, much more than of junk TV science. As the previous ones, the show tries to give a glimpse on unusual aspects of physics, from simple experiments such as the bounces of an elastic ball, to the energy efficiency of nuclear fusion processes in stars, ending to the theory of relativity, its implication in science and in our lives. The show ends with the notes of a song on relativity specifically written and composed for the physics show, in the hope to hit the public imagination and have people starting to sing a song about physics during their lives.

How can Scientific Theatre Help Us Teach Physics?

Children are especially responsive, and their surprise exclamations, laughs, and hands clapping have always accompanied any replica of our shows. Adults and grown-up students are more measured, but all the same, we can evaluate their reactions in many ways. In most of our shows, we involve the public in various actions. People have to move from their seats to come on stage for surreal hands-on examinations of physics (i.e. they have to mount on a bike and pedal to turn a light on, they have to perform experiments write on a blackboard, jump, run), and they always do whatever they are asked to with much enthusiasm. This is a first thermometer of

their appreciation, but at the end there are the applauses that transmit their real and deep engagement. Additionally, we conducted research on the effects of the first two shows based on interviews and anonymous questionnaires [7, 13] and these demonstrated that children remember a lot of details of the show even after two years, a surprising result given their young age. Moreover, the shows help to change students' perception of physics, stimulating new ideas about it and an interest in further exploring the topics discussed there. In general, these results were much more than we could ever have expected and convinced us of the efficacy of theatre, not only as a way to communicate science but also to touch the emotional chords and create engagement.

In our shows we deal with many different topics, ranging from classical physics to relativity and quantum mechanics. We put a great effort in the choice of the language that must be correct and not simplified, but all shows are maintained as light, funny and always with a note of humour. We choose the message to transmit on the basis of the results of research in physics education, in order to intervene where difficulties and misconceptions are evident. We also take an eye on the public debate about science to insert themes that are of interest for students and the general public in our storytelling.

The research in physics education indicates that the goal of good teaching should be that students learn to start thinking as physicists, but that the first step is to engage them somehow [9–12, 28]. The cognitive conflicts can be a way to create interest for a problem and be a propellent towards researching an answer [20] but can also produce the opposite result as the discrepancy between the experimental result and the prior knowledge could demotivate students and block them [20]. The possibility to observe surprising real experiments in a theatre, a context definitely different from school, can help to solve the problems associated with the frustration due to cognitive conflicts. Students start to accept a reality in contrast with their unconscious ideas in a situation where they are not expected to answer questions or make predictions. Another interesting point that emerges in our shows is that asking questions is typical of scientists and therefore should not be felt as a sign of weakness. The debates that follow our shows usually need to be interrupted at a given time because the number of questions we receive is countless, a clear sign of students' interest but also of a relaxed atmosphere that is possible in a neutral environment far from school. The help for physics teaching that can come from our theatre is then to create familiarity with physics and to get students used to its language and to its way of proceeding, thus meeting some of the needs discussed in the second paragraph of this chapter.

Another aspect that deserves to be considered is the help that physics theatre can give to teachers who decide to use it as a tool. As we have directly experienced, the effort to talk about a physics topic through theatre changes the gaze we have on it, moving back to that of someone who still does not know the answers, and going in depth in aspects that we usually take for granted. A further help in this direction comes from working with theatre professionals, as they are experts in communication who do not know the subject and can guide the authors to find the proper way to present the topics. All these elements can help teachers to gain further confidence

with the subjects, but also with students' difficulties. Communication is bidirectional and cannot work if the public is not properly considered. Being on stage and performing a theatre show makes this aspect particularly evident as an actor perceives the audience reactions, their appreciation or their disappointment. Teachers can learn that also the success of a lesson can improve if they manage to capture students' attention and appreciation. They also can acquire showmanship and learn the importance of details that are often neglected either in lessons or in a laboratory demonstration. In theatre, any object is on stage for a precise reason, also lights are cleverly focused on what is most relevant in order to guide the viewers' gaze on what is important, a way to proceed that can be exported in teaching.

The "Show of Physics" project was also a seed that generated many other initiatives with more direct teaching purposes, tailored on students and teachers. Besides the already mentioned project TEMI [35] that proposed teachers training activities where theatre had a fundamental role, other projects have been carried out in these past years. Since 2006 we proposed to high school students a scientific theatre laboratory where they prepared a short sketch on a physics topic. Thanks to the involvement of theatre experts, students learnt about theatrical techniques and the project gave them the chance to look at physics with a different and renewed interest and to explore aspects that are neglected in school. We also created various *augmented lectures* where we conjugate our experience with theatre and live experiments with the rigor of a conference. These lectures engage people as they blend physics with arts, mime and acting, and haute cuisine [37–39]. In particular, the pairing of physics and cooking has demonstrated to be extremely fruitful and is much requested either in school with students or in public contexts with general audience such as scientific festivals or general conferences [39, 40]. We have also created a formal didactic path for high school students to teach the physics of electromagnetic waves with an inquiry-based approach, where laboratory and direct demonstrations are inspired and strictly related to the informal aspects presented in our show *Light from the star*, whose attendance is an integral part of the course [41, 42].

Finally, we have recently been involved in the exciting project of a MOOC (Massive Online Open Course) on fundamental physics, aimed at high school students, where we have created mini-lessons/sketches on the various physics topics addressed in the course, on the basis of our experience with scientific theatre [43].

Conclusions

Physics is an intellectually demanding but fascinating discipline that describes the world around us and creates links among different areas of knowledge. For a physicist, each simple phenomenon seen during the day can offer the opportunity to reflect and investigate, try to understand, make models, and find a way to describe the observations with appropriate language. Students should be helped to appreciate physics and to broaden their views on it, without confining physics to the limited definition of a technical topic. Theatre can help in this action and can be a valuable

tool for schools. Our project, which has lasted for eighteen years and still responds to the school's changing demands, is a possible way to engage students, make fun, and touch emotional chords with physics.

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Chapter 7
Alive Together—Interdisciplinary Practice in Human/Non-Human Relationships

Louise Mackenzie and Anna Olsson

Introduction

Perhaps never more than now, in a time of ecological and pandemic crisis, '*animals are entering our lives*' [1]. The way humans relate with non-humans is changing as humanity begins to understand the fullness of our impact upon the environment and other species within it. Interdisciplinary approaches bring unique opportunities to explore these relations through new forms of engagement, yet at times, this engagement can in practice mean little more than the negotiation or contracting of skills and resources. Here, we present an educational approach to working with human/animal relationships that moves beyond an exchange of services to develop deep collaborative practices.

The scholarly study of human–animal relationships is inherently interdisciplinary, involving disciplines situated within the arts, humanities, the social sciences and the life sciences. This includes, for example, work within the fine and applied arts, philosophy and ethics, critical animal studies, anthrozoology, human–animal interactions, applied ethology and animal welfare science.

Interdisciplinarity can offer many possibilities. Bringing differing perspectives together can lead to the development of new working practices, relationships and associated challenges [2, 3]. Contemporary European examples that embrace these interdisciplinary challenges include research groups such as the Cultural Negotiation of Science [4] as well as project-based networks such as the international Hybrid Lab Network [5] and Animal Research Nexus [6].

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Non-Transactional Interdisciplinary Approaches

Interdisciplinary approaches bring new ways to engage with human/animal relationships, yet many initiatives are in practice transactional, limited to one actor providing something the other needs. Drawing from our experiences working in the Cultural Negotiation of Science research group in the United Kingdom (UK) [4] and the European Hybrid Lab Network [5], we propose that the greatest benefits from interdisciplinary working require a level of risk-taking and trust that moves beyond transactional arrangements to the development of deeply collaborative interdisciplinary practices that can be transformational.

Coming from distinct examples of interdisciplinary backgrounds, we (artist, Louise Mackenzie and ethologist, Anna Olsson) first met during an iteration of the Hybrid Lab Network, an interdisciplinary teaching and learning workshop led by i3S, University of Porto, in collaboration with University of Aalto in Finland, Waag Society in the Netherlands and Alma Mater Europaea in Slovenia. It was during this experience that we formed the seeds of the short course, *Alive Together* [7] that we later ran with the support of the Hybrid Lab Network [5].

Artist Louise Mackenzie's work focuses on human interaction in and with the environment and in particular our relationships with other species. She explores this through working with other disciplines who also relate to the environment and non-humans in their practices. Mackenzie completed her PhD with the Cultural Negotiation of Science research group in the UK. This group is based within the Department of Arts at Northumbria University but has a strong interdisciplinary focus, with researchers meeting to share their cross-disciplinary practices and develop skills in interdisciplinary working methods. Within this research group, Mackenzie has developed previous interdisciplinary modules, including *Ways of Working* [8] and *Working Together*, focused on exploring and expanding methodologies at the intersection of arts, humanities and sciences. Louise continues to develop interdisciplinary working practices at Newcastle University as a researcher in the Hub for Biotechnology in the Built Environment.

Ethologist Anna Olsson is an animal welfare scientist with a farm animal background, now working in the biomedical research institute i3S at the University of Porto. Her own research is focused on behaviour of laboratory rodents and companion animals, and on ethical issues in the use of animals in research and biotechnology. She is also involved in strategic initiatives to Replace, Reduce and Refine research with animals. She leads a research group and organises training to prepare scientists for a responsible use of animals in experiments. Prior to *Alive Together*, she developed interdisciplinary teaching initiatives in science, ethics and society for PhD students in basic and applied biology. *Science Takes Time* [9] was her first art-science project.

Together we developed the short course, *Alive Together*, born from a shared understanding that interdisciplinary projects are at their most successful when participants come together through a mutual interest in the subject matter and have the opportunity to explore and build skills together, rather than co-opting one another

on a transactional basis. We therefore share our experience of *Alive Together* as an example of interdisciplinary practice that encourages individuals to move to the edge of their respective practices in order to meet and in doing so, has the potential to be transformational for both course participants and for human/animal relationships. Through describing the methodology, course content and outcomes, we will demonstrate how *Alive Together* challenges disciplinary approaches to understanding human/animal relationships through the provision of deep engagement with new skills, time for relationships to be nurtured and grow, and space for developing collaborative projects that are generated through trust, respect and understanding, rather than transactional needs. Such approaches actively critique existing ways of working and lead to processes, practices and outcomes that transcend disciplinary boundaries.

Context

First, we will set the context for the broad scope of cross-disciplinary relationships by introducing the terms STEM and STEAM (explained further in the next paragraph) and why we suggest that although well intentioned, the situating of these terms within the sciences can be problematic. We then go on to introduce interdisciplinary case studies, including examples from our own practice, where practitioners move towards the edge of their discipline to explore other fields in ways that are non-transactional. Then we introduce the project, *Alive Together*, as a template for risk-taking and innovation in developing interdisciplinary working practices.

The terms STEM and STEAM have done much to highlight the potential of interdisciplinary working. These terms should be familiar to most in an educational context as a pedagogical approach in many countries that begins with school-age children to bring different disciplinary skills to bear on real-world problems. STEM is an acronym for Science, Technology, Engineering and Mathematics, first introduced in 2001 by the U.S. National Science Foundation [10] and the acronym STEAM was later founded by Georgette Yakman, originally denoted as, '*Science and Technology, interpreted through Engineering and the Arts, all based in elements of Mathematics*' [11]. Today, STEAM is often more widely—and problematically—interpreted as adding the arts to STEM. There is a tension therefore between STEM, STEAM and the arts. Not only is the entirety of the arts—not to mention the humanities— encapsulated within a single letter, but this letter was literally slotted in as an afterthought to the perceived value of science, engineering and mathematics. Thus, by virtue of the initiative arising through the sciences, the arts and humanities are not afforded an equal footing. This scenario is systemic beyond school education as funding streams tend to focus on either the arts or the sciences, with arts funding increasingly marginalised in times of economic crisis. Thus, the potential for both the arts and sciences to work together on an equal footing is limited, with artists receiving at best a supporting role in scientific funding

bids and occasionally, scientists receiving the same role in (generally smaller) arts funding bids.

This pedagogical and economic framework sustains a cultural divide between the sciences and arts which serves to perpetuate a transactional model of working. Whilst interdisciplinary research groups are now common, most initiatives are still based within one discipline and engage another discipline for the provision of a specific service. Art, for example, is often employed as a tool to illustrate objects as perceived or processes as described.

Looking beyond STEM and STEAM to contemporary interdisciplinary approaches, we suggest that the starting point for interdisciplinary projects should be, '*How can this (non-STEM) question be addressed through collaborative and critical engagement?*'.

For interdisciplinary projects to move beyond transactional models, we suggest that they must embrace the full skill sets of artists, which extend beyond the purely practical arts. Whilst the use of art in service to science can be invaluable in an explanatory capacity, often the situated perspective of the observer is lost. Art in the service of science foregoes the capacity of art as critical tool. Artists are trained to look at problems from different angles and to generate questions in the mind of the audience. Artists can use their craft to challenge the status quo, to look beyond depiction and use their imaginative capacities to consider perspectives less readily seen or understood. Furthermore, as highlighted by the research of the arts-led Cultural Negotiation of Science research group in the UK, it is the very meeting point of the arts, humanities and other disciplines that brings into focus questions that had not previously been identified. By moving towards the edge of one's disciplinary knowledge and embracing a level of uncertainty, there exists the capacity to tolerate ambiguity and therein lies the potential for transformation [12].

'We were travelling towards different vocational destinations; neither of us was, as yet, located in our respective disciplinary silos. Consequently, we could tolerate the differences that lay ahead of us, especially those associated with the different values that art and science place on ambiguity'. Dorsett in [12].

Case Studies

As part of the Cultural Negotiation of Science research group, Louise Mackenzie developed two linked interdisciplinary projects: *Ways of Working* and *Working Together*. *Ways of Working* [8] a collaboration with the Biochemical Society in the UK brought together artists, scientists, ethicists and humanities scholars to explore working methodologies in a day-long workshop format. The workshop presented an opportunity to address questions that are common to the arts, sciences and humanities around ways of seeing, methods of working and approaches towards developing interdisciplinary practice. Acknowledging that all practices are creative, the workshop focused on 'ways to practice' that allow for time, space, error and specifically,

what we can learn from questioning existing methods of working. Over the course of the day, participants formed into groups and developed fledgling project ideas as a means to test hybrid working practices together. The event led to significant interest in developing ongoing project-based activities and ultimately generated the project *Working Together* [13] as a collaboration between the Cultural Negotiation of Science art research group and the Department of Applied Sciences at Northumbria University. *Working Together* was devised as a means to develop interdisciplinary methodology through exploring the collaborative potential of the use of human cells in both artistic and scientific research. Over a period of 6 months during the restrictions imposed by the COVID-19 pandemic, *Working Together* used remote exercises and discussions through Zoom to develop imaginative approaches that generate novel insights into the processes, ethics and regulations around working with human cell lines. Esoteric laboratory diaries were used to draw attention to overlooked aspects of human cell care, whilst speculative exercises enabled a reimagining of the liveliness of human cells, leading to discussions around ancestry, identity and the necessity of detachment. The project led to the creation of a field-based interdisciplinary workshop and a short film reflecting upon the process of working together.

As part of the high-profile biology PhD program GABBA at the University of Porto, Anna Olsson designed and co-taught an interdisciplinary one-week course in Ethics, Science and Society, together with science communicator Júlio Borlido Santos. The fortunate combination of highly engaged and talented students who had been handpicked for this program, and total freedom for Anna and Júlio as course coordinators to develop content and format, allowed this course to become a workshop in the true sense of the word. This is true not only for the students but also for the teachers. During over 10 years, different approaches were tested to guide students with a science background in using a variety of channels and formats to communicate pertinent topics in biology with non-scientists. The basic approach was always a combination of theory with project-based hands-on work, with the two running in parallel throughout the week, culminating with the student groups presenting their project. The theory component included regular lectures covering relevant disciplines such as science communication, bioart, philosophy of science and bioethics with occasional more specific guest presentations (i.e. video games as science communication or utopian thinking as a research tool). For the project component, the model is based on a predefined portfolio of key aspects of presentations (e.g. type, audience and duration) that are combined with topics coming from papers published the previous month in the high-profile generalist journals Science [14], Nature [15] and PNAS [16]. Through a draw, each group gets their own unique combination to work with, which could be a 20-min slideshow presenting a mathematical modelling paper at a congress for anaesthesiologists or a 5-minute theatre presentation for a retirement activity centre on the capacity of domestic chicks to process numbers! The complete surprise element and the fact that the students are not previously familiar with the topics add an important element of challenge and capacity building, where the students often initially think they have been given an impossible task, but typically deliver clear and inspired projects in the end.

The authors of this chapter met during a teaching and learning course as part of the Hybrid Lab Network, where we shared ideas on ways in which different disciplines approached the negotiation and development of human/animal relationships. We were both aware of the work of UK-based interdisciplinary group, Animal Research Nexus, a six-year project which works to increase the understanding of social relations in the various contexts of animal research. Animal Research Nexus [6] has delivered a number of projects that function at the intersection of the social sciences and science, often engaging public and scientific audiences through creative methodologies. Projects include: *The Mouse Exchange*, which engages public audiences in conversations about the life of laboratory mice through the creation of felt mice complete with travel passports; *Vector*, a sophisticated interactive role play where participants act out the role of an Animal Welfare review body; and *Labelling Animal Research*, which uses a seemingly simple task—creating a medicine label that declares a product has been tested on animals—as a means to draw out the ethical issues around laboratory testing. These projects struck a chord with both of us as means by which to engage the public in the subject of animal welfare and we identified an opportunity to engage a wider research audience. Whilst it is of course important to engage the public in the wider questions around animal research, it is also vital that animal researchers and scientists who connect with animals in some way through their research have the opportunity to debate and explore these same questions if we are to move beyond 'informing' the public to truly 'engaging' with them. By extending who is involved in interdisciplinary project creation and decision-making, we can begin to build a necessarily multi-layered picture of the field of human/animal relationships.

Alive Together

Alive Together is a global community of interdisciplinary researchers with a shared passion for the study of human/animal relationships, formed with the support of the Hybrid Lab Network, a European project to advance training in Higher Education across Art, Science, Technology and Humanities. The rationale behind *Alive Together* was to develop a methodology and toolkit for interdisciplinary working that focused on human/animal relationships. Our firm belief was that the translation of science into art should not be our goal, but rather the mutual understanding of the field of human–animal relationships through the different lenses presented by the arts, sciences and humanities.

Over a two-week period in November and December of 2020, 17 international participants, including artists, ethologists, anthrozoologists and humanities scholars came together online for the short course *Alive Together I: Human/Animal Relationships in Crisis?* Our aim was to invite participation through questions that intersect disciplines when exploring human, animal and multispecies relationships. Questions such as: what does it mean for humans to be alive together with animals when our ecological future is precarious? What are the core skills humans must

develop to sustain good working relationships across disciplinary and species boundaries? and How can interdisciplinary approaches inform the ways in which humans and animals co-exist together?

Although online, the course was structured to encourage the maximum contribution from all participants through a series of lectures, exercises and case-study discussions, all building towards the development of self-selected interdisciplinary project groups. Spreading the course across two weeks allowed participants to gradually get to know one another through exercises in pairs, in small groups and in discussions following each activity or lecture (Fig. 7.1). Core subject lectures in the first week provided the framework for interdisciplinarity. From the arts, Louise Mackenzie discussed examples of approaches to the exploration of human/animal relationships from her own research and through contemporary art history. From the sciences, ethologist Anna Olsson shared and demonstrated methodologies for observing animal behaviour. Guest speakers were also invited, including award winning interdisciplinary artist Maja Smrekar, who shared her long-term research on the human–dog bond and novelist Daisy Hildyard, who led participants through a series of exercises that consider the non-human perspective through literature.

From this initial structure, participants were encouraged to move towards the edge of their respective practices and to explore methodologies from other disciplines during activities including exercises and case studies. Although participants self-selected for the course and therefore the desire to work in an interdisciplinary environment was anticipated to be high, we were aware that working with other disciplines may still be new territory for some. It was therefore important for us to create an environment that would foster collaborative working. This meant establishing opportunities for participants to get to know one another and understand each other's specific interests in the field of human/animal relations.
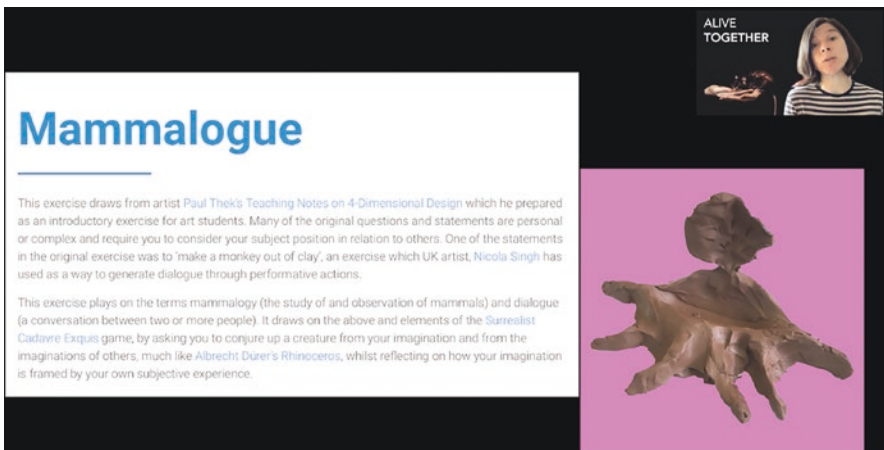

Fig. 7.1 Louise Mackenzie introduces *Mammalogue*. This exercise encourages dialogue between scholars from different backgrounds to find practical ways to bring their differing perspectives together. Screenshot from the Alive Together course

We adopt what we describe as a 'ground up' approach to interdisciplinary project-building. This is a strategy that Mackenzie has employed on previous interdisciplinary project-building activities, *Ways of Working* [8] and *Working Together* [13] as part of her research with the Cultural Negotiation of Science group at Northumbria University. Working from the ground up is a deliberate strategy to avoid transactional modes of interdisciplinary working. It involves two core components: providing the opportunity for participants to bond around a common theme and enabling a slow and gradual understanding of the interests and working styles of each participant. In this way, given time and course content that facilitates group dialogue, it is possible for individuals to identify a goal for working together through self-selected groups. This strategy can run the risk of no groups forming, or some members not finding compatible interests with others in the group. In interdisciplinary projects, it is sometimes difficult to avoid an amount of incompatibility as individuals struggle to see how their distinct experience can contribute to a shared goal. One way in which we mitigated this risk was through asking course applicants to provide a paragraph that described their research interests and ideas that they were willing to explore, allowing for a basic pre-screening on the basis of potential compatibility across broad research themes and interests. The second mitigating factor was the design of the course content, which provided both structured and unstructured opportunities for dialogue among participants. Lastly, a listening-centred facilitation of participants, as they began to develop ideas and potential relationships, helped to ensure that the interests and needs of each participant were heard and accommodated within the project groups that were beginning to form.

Course Content

Three structured lectures provided the core subject content, from which participants could expand and explore their own learning, through case studies and exercises. The lecture on arts and human/animal relationships was given by artist Louise Mackenzie, who reflected upon how she relates to the non-human in her own practice, tracing the concept of the found object in early twentieth century art sculpture through to contemporary forms of engagement with living biological materials. The lecture also gave an overview of contemporary artists whose practices are concerned with human/animal relationships, highlighting differing methodologies and approaches, from performance and participation to sculpture and installation. The lecture on applied ethology (Anna Olsson) introduced ethology as a research discipline in which behaviour is studied using observation and considering behaviour as an evolutionarily adaptive trait. Within the wider discipline, applied ethology focuses on animals that are in some way under human influence, and since an important subset of this research is focused on animal welfare, the lecture addressed
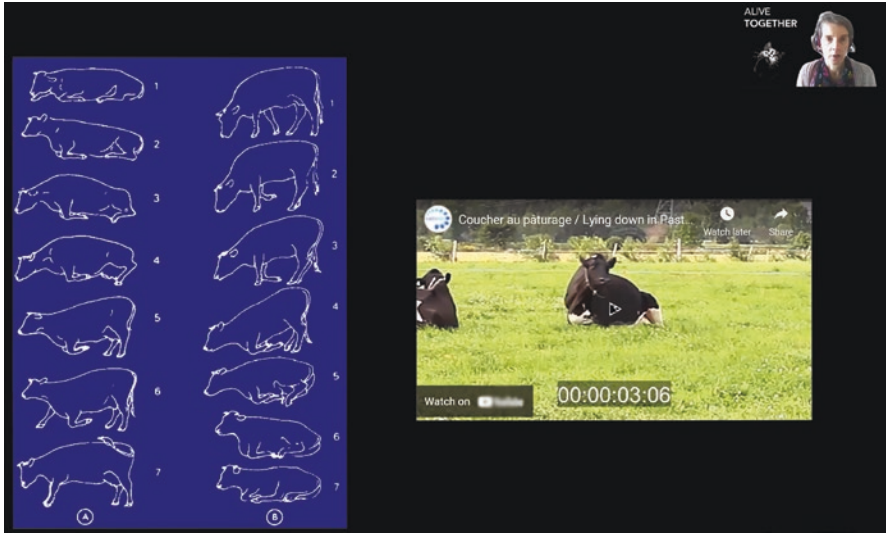
Fig. 7.2 Anna Olsson delivers the ethology lecture. This introduces participants to different aspects of behaviour, such as the importance of movement patterns as illustrated here. Screenshot from the Alive Together course

the role of behaviour in the study of animal welfare. Finally, methods to observe behaviour in ethology were introduced, including studying patterns of how animals move their body and methods to quantify behaviour (Fig. 7.2). The humanities lecture, by guest lecturer, novelist Daisy Hildyard, focused on techniques for thinking and writing with non-human animals. A second guest lecture by artist Maya Smrekar focused on contemporary artistic practices where the human/animal bond is an approach to exploring wider socio-political questions.

Interspersed between lectures were a structured series of exercises, designed to encourage the testing of new practices whilst simultaneously allowing for the building of relationships among participants. Referencing Roy Ascott's Groundcourse [17] and Paul Thek's Teaching Notes [18], participants were given a series of activities that formed as both ice-breakers and a means to begin to open dialogue on human/animal relationships. Two exercises drawing from collage and bricolage art methodologies aimed to encourage scholars from humanities, arts and sciences to find practical ways to bring their differing perspectives together. The third, durational exercise in *Alive Together*, *Spend time with an animal*, aimed primarily to give participants the experience of observing behaviour systematically. It gave them the opportunity to practice observation of animal behaviour and to consider the variety of means of observation (audible/visible/etc.), and—equally important—it also confronted participants with practical challenges of observation (Fig. 7.3). Case studies drew from projects which exemplify the *Alive Together* methodology. Using strategies such as

Fig. 7.3 The exercise *Spend time with an animal* gives participants the experience of observing animal behaviour systematically. Examples from participants of the Alive Together course

empathy and anthropomorphism to reveal that the human as much as the animal is a species within what Donna Haraway has described as 'natureculture' [19] and that it is not culture that divides us from the animal, but that we are one culture among many species' cultures, in co-existence.

The exercises guided participants in working together so that, over the two-week duration of the course, participants were able to form self-selected groups based on shared interests. Three such groups formed after the structured section of the course was completed at the end of week one, and met to develop their nascent project ideas during the second week of the course. These groups resulted in three potential interdisciplinary projects: an audio-visual experience of the human/whale relationship through whale song; a toolkit for practicing languages of love and vulnerability in human/animal relationships; and an interactive performance on the many faces of the rat/human relationship (Fig. 7.4). Each project drew on the specific skills of practitioners to present a novel approach to understanding human/animal relationships and participants found the experience transformative for their practices, with all three groups expressing an interest in developing the projects beyond the course itself.

Fig. 7.4 Artist Mari Keski-Korsu as the Plague Rat, a character in the interactive project *RatHum* created by one of the groups in the first edition of *Alive Together*. Screenshot from the Alive Together course

Discussion

The first edition of *Alive Together* was fully online. This was an adaptation forced upon us by the COVID-19 pandemic, as the original plan was for an in-person one-week workshop. Nevertheless, the online format worked well and was helpful in gathering an international and diverse audience, with participants as far apart as California, India and Finland. It required some creative solutions, in particular for the *Spend time with an animal* exercise, as many participants were in lockdown and participating from their homes. Among the students who did not have a companion animal at home, one chose to observe feral coypu in a nearby park, and another used an online camera stream of free-living rose-ringed parakeets.

To work in participant driven interdisciplinary projects requires participants to have developed a certain level of maturity in order for them to be safe in their own practice. It is a format that works particularly well for people who have at least completed the first level of professional training (if academic, a first degree, however the approach may not be restricted to academics), but may be less suitable to undergraduate students, at least not until their final year of study.

It is interesting to reflect on what the output of the workshop is. In some cases, there have been opportunities for further dissemination of the research developed and work produced by participants [20]. Maybe the greatest value is in the intangible experience of working together in a truly interdisciplinary way. But the workshop also generates projects, which have value in themselves and merit being presented to a greater public than that of fellow participants and teachers. Herein lies a big challenge for *Alive Together* and similar initiatives. The limited duration

means groups are able to produce a prototype but rarely if ever have time to develop into a complete, standalone project. At the end of the workshop, they are highly motivated to continue working together, but no longer being in the workshop context means that other priorities take over and the initial intent is rarely realised. The development of the *Alive Together* course is, in fact, one of the rare exceptions, where a project developed into fruition after the end of the workshop during which it was conceived. This was possible through the support and infrastructure provided by the Hybrid Lab Network. When planning for interdisciplinary workshops which aim to generate projects, it is relevant to consider how to support fledgling projects after the end of the workshop. Highly competent professionals generate projects with great potential even in a short workshop, and maximising the possibility that these projects reach a bigger audience is a relevant secondary aim.

Conclusion

The context in which *Alive Together* was generated allowed for a truly interdisciplinary approach, with collaborators meeting for the first time around themes that interested each of them both individually and collectively. Despite a wealth of examples of interdisciplinary projects across academic settings, our view is that *Alive Together* is still a rare example of something that reaches comprehensively across arts, sciences, humanities and social sciences and provides a nurturing environment to develop the requisite skills for working together. The project had two key points of focus: one on developing good interdisciplinary working practices and the latter on allowing individuals to find a common interest (in order to aid the former). It is our belief that both are essential ingredients to good interdisciplinary working relationships but even this is not enough to sustain interdisciplinary projects. Support beyond project inception is crucial to maintain the good will, trust and energy generated in project-building environments.

Alive Together presents disciplinary approaches to understanding human/animal relationships that could not develop simply through the interaction of one or two disciplines. Rather the methods developed during the course and subsequently by each of the self-selected project groups comes from giving space and time for different disciplines to understand each other's languages and find ways in which to bridge the gaps between them. Through the provision of deep engagement with new skills, time for relationships to be nurtured and grow, and space for developing collaborative projects, trust in each other can be developed, allowing for participants to move beyond the edge of their own discipline into uncomfortable territory, but to do this in a way that feels safe and supported. This gives rise to forms of co-working that are not based on the trading of skills but on the development of approaches that share interests and in doing so, bring about transformational ideas and processes. Such approaches actively critique existing ways of working and lead to processes, practices and outcomes that transcend disciplinary boundaries.

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Part II
Research and Innovation

Chapter 8
The Art of Serious Storytelling: Using Novel Visual Methods to Engage Veterinary Practitioners in Reducing Infection Risk During Surgical Preparation

Alastair S. Macdonald, Matthieu Poyade, Orla McCorry, Christopher Trace, and Mark Chambers

Design for Serious Storytelling

Antimicrobial-resistant bacteria are a growing global healthcare issue [1, 2]. One counter-strategy is to reduce microbial contamination in the healthcare environment through effective infection prevention and control (IPC) measures, leading to reduced antibiotic usage, and ultimately contributing to reducing the risk of antimicrobial resistance (AMR) developing. Uptake of appropriate IPC measures is heavily influenced by human risk perception, consequent behaviour and the ways humans and animals interact within the environment [3–6]. Effective IPC communication and teaching tools are therefore necessary to ensure that individuals' understanding and behaviours are in line with scientific recommendations. This chapter describes the development, over two phases, of a novel IPC training tool by an interdisciplinary team from the Glasgow School of Art (GSA) and the University of Surrey (UoS), using serious storytelling, dynamic interactive three-dimensional (3D) visualisation and collaborative design methods. Across the two phases, team expertise included: co-design; antimicrobial resistance, microbial sciences and pathobiology; simulation, software coding and 3D programming; environmental psychology; veterinary practise; and e-learning and pedagogic development.

The team's intention was to improve veterinary practitioners' perception of risk of infection during surgical preparation and procedures, thereby promoting '*risk literacy*' to raise their awareness and inform decision-making [7].

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'*Well-designed visual aids can often dramatically improve risk communication, comprehension, and skilled decision making among diverse users*' [8, 9]. Macdonald et al. discuss contemporary approaches to developing animal-related IPC training materials [10], such as mathematical modelling [11], bio-security procedures [12], and risk identification from video footage [13]. However, there has been much recent and useful work in the area of serious games for health (SGH) worth acknowledging. Abt, quoted in Hill et al., defines serious games as '*games with a carefully thought-out educational purpose, but not lacking entertainment value*' [14, 15]. In their systematic review, Wang et al. state serious games are '*created for the purpose of imparting knowledge or skills, and which incorporate an element of scoring as well as challenging goals and engaging design*' [16]. Maheu-Cadotte et al. review the efficacy of SGH to professionals' education [17], and Maheu-Cadotte et al. found that few studies in their systematic review reported end-user involvement in the SGH development process [18]. Within the frame of SGH, the work described here is design for '*serious storytelling*', i.e. '*storytelling outside the context of entertainment, where the narration progresses as a sequence of patterns impressive in quality, relates to a serious context, and is a matter of thoughtful process*' [19]. This storytelling took the form of a narrative co-constructed through a collaborative design approach with substantial end-user involvement throughout.

Development Summary

Phase 1 Study: AMRSim

Responding to the global AMR challenge [1, 20], the Phase 1 study, AMRSim[1], took a novel interdisciplinary and multi-method approach to achieve proof-of-concept for an IPC training tool to demonstrate visually how bacterial contamination can be spread during preparation for veterinary surgical procedures. The underlying hypothesis tested in this phase was that as practitioners interacted with the 3D tool, they would gain a greater appreciation for: (1) the impact IPC measures can have on infection control; (2) where weaknesses lie in current practise; and (3) how effective mitigations, through IPC, can disrupt the *status quo*, leading to a reduced risk of bacterial contamination and infection, and ultimately reduced reliance on antibiotics.

The AMRSim study's approach used interactive digital animation and visualisation, collaborative design and workshop methods deployed over a 24-month iterative 5-stage process with the involvement of end-user representative groups throughout. The study modelled the interactions between human and animal avatars

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[1]AMRSim: A Microbial Reality Simulator for Veterinary Training and Practice. Arts and Humanities Research Council, AMR Theme 3b Grant Ref. AH/R002088/1.

and the practice setting, derived from actual video footage of risky procedures and behaviours to provide accurate and believable, evidence-based scenarios. 'Marley', the canine avatar being prepared for surgery, was central to the narrative. The Phase 1 prototype was delivered face-to-face, at each iteration, by an instructor (one of the research team), via laptop and large display screen to a small group of veterinary participants. Feedback indicated the tool enhanced the delivery of training content by making difficult and abstract contamination concepts easy to understand. At evaluation, 92% of 51 participants agreed that they would change their behaviour and stated an intention to implement infection control measures that aligned with training objectives. The development, evaluation and detailed findings from Phase 1 are described in Macdonald et al. [10].

Phase 2 Study: VIPVis

Phase 1 participant feedback identified the desire for a self-standing, self-paced training tool available in both WebGL and Android app platforms, able to be deployed via phone, tablet, virtual learning environment (VLE) and Massive Open Online Courses (MOOC) as content for veterinary student curricula and for professional veterinary practitioner training. The objective of the Phase 2 study, VIPVis[2], was to develop and deliver these platforms and to further enhance the tool. Phase 2 development time was compressed, requiring the beta-version software to be ready-to-deploy within a 9-month timeframe. Unexpected restrictions due to COVID-19 required the switch from planned face-to-face (as used in Phase 1) to online participant workshops. Although this necessitated additional organisation and an adjustment to the planned process, it worked to the team's advantage in that successive iterations of the prototype were made available online or as a download for participants to work through, after which participants completed an online questionnaire in advance of workshops. This allowed the team to pre-identify issues and potential enhancement opportunities as topics for discussion during the workshops.

The 9-month timescale allowed for three stages of development and evaluation, using the following process: (1) recruitment and consenting of participants (students, nurses and professional surgeons [vets]) for each stage; (2) preparation of the latest version of the prototype tool; (3) making this version available to participants for evaluation and their anonymous feedback via an online questionnaire, requesting both Likert scale and free text responses; (4) collating responses from the participant feedback to determine a topic guide for the online workshop; (5) using the topic guide to explore issues during the workshop, introducing additional features for discussion, and recording feedback using a proprietary video conferencing tool and (6) using both questionnaire and workshop feedback to guide the preparation of

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[2] VIPVis: Veterinary Infection Prevention through Visualisation, Arts and Humanities Research Council Follow-on Grant Ref. AH/V001795/1.

the next version of the tool. The workshop discussions were recorded and the audio transcripts from these used a coded identifier to preserve anonymity, while indicating their role as student (s), nurse (n) or vet (v).

Phase 2 User Involvement

The team endeavoured to ensure the development of the tool took account of the potentially different sensibilities and training needs of the main constituent veterinary groups—students, nurses and professional surgeons (vets). Ethics permission for the study was obtained via both GSA's and UoS's standard ethical protocols. Student participants were recruited via the UoS VLE, year-group leads and advertisements during relevant lectures, and nurses and vets recruited via all-colleague emails within the Vet School. All were provided with an information sheet, and consents gained. Table 8.1 details participant numbers for each stage.

Developmental Framework

Macdonald et al. describe the developmental framework and iterative process used in Phase 1, summarised here in seven key stages, with stages 3 to 7 continuing into Phase 2 [10].

1. *Ethnography*: record and understand stages and detailed procedures in the patient pathway and the interactions between humans, animals and the environment through video ethnography.
2. *Risk assessment*: identify distinctive characteristics of contact and interactions in procedures and behaviours, selecting those which present greatest risk of infection and cross-contamination.
3. *Scenarios development*: select and develop scenarios from 1 and 2 which embody these risks, and present the best opportunities to reveal direct and indirect sources

Table 8.1 Participant numbers at each stage of the Phase 2 study also showing the stage versions of the training tool evaluated

	Stage 1		Stage 2		Stage 3	
Format	PowerPoint		WebGL		Android app	
Participant	Q'aire	Workshop	Q'aire	Workshop	Q'aire	Workshop
Student	3	2	1	0	6	5
Nurse	4	4	4	4	3	3
Vet	3	3	3	3	3	3
Total	**10**	**9**	**8**	**7**	**12**	**11**

of infection and their effective mitigation through IPC measures, guided by the evidence from literature and practise experience.

4. _Serious story development_: develop an educational narrative around these scenarios with training objectives which poses questions and calls for reflection.
5. _Creation of dynamic visuals_: develop a series of accurate dynamic visuals of these scenarios to 'make the invisible visible', embodying the points to be conveyed, and showing mitigation through IPC measures through monochrome and coloured layers.
6. _Interaction_: develop opportunities for engagement, interaction, navigation and 'reveal' through gamification.
7. _Co-construction of the visual and text-based narrative through iterative prototyping and testing stages_: engage participant groups in stages 4, 5 and 6, and evolve these synchronously through an iterative build, test and evaluation process, capturing the discussions.

This approach bears a similarity to Verschueren et al.'s framework, also used by Suppan et al. for a pandemic-related SGH to promote safe behaviours amongst health care workers and which proposed stakeholder input throughout [21, 22].

Co-constructing the Narrative

The chapter now focusses on the process commenced in Phase 1 and continued throughout Phase 2, i.e. the careful co-construction of the narrative around Marley and of the potential threats to his welfare through infection risks during his preparation for surgery, and how these risks might be mitigated through appropriate IPC measures. The principle question driving the narrative was '_What can be done to get Marley into theatre with as little contamination as possible, both on him and left behind in the prep room?_'

Developed initially in Phase 1, the set of 3D digitally animated sequences, originated from recorded video footage and incorporated observed risky behaviours (indicated in italics), were as follows: (1) opening scene showing the three human avatars (vet, nurse and auxiliary) and Marley; (2) nurse bringing Marley into the preparation area; (3) vet administering intravenous drugs to induce anaesthesia, with Marley being held by a nurse and assisted by an auxiliary on the floor (_Marley is lying directly on the preparation room floor while receiving treatment)_: (4) Marley being lifted onto the table (_Marley is in contact with the nurse's and auxiliary's clothing)_; (5) nurse holding Marley's head up and mouth open so that the vet can intubate (_Marley is held against the nurse's body during treatment, with the nurse touching hair and watch)_; (6) nurse attaching Marley to the anaesthetic machine for the maintenance of anaesthesia; (7) auxiliary shaving Marley's limb to remove hair, and cleaning and sterilising the site for surgery (_using the hair clippers but with no effort to contain the hair)_ and (8) auxiliary and nurse wheeling the prepared Marley on a trolley into theatre.

Training Content

Making the Invisible Visible and Readable

Schoffelen et al. refer to readability issues of texts and visualisations as discussed in Nilsson et al.'s psychological and educational studies: '*for the comprehension of text, readability is subclassified into the legibility, the reading ease, the interest value and the comprehension ease of a particular text*' [23, 24]. Houts et al. review addresses the accessibility issue, finding that '*adding pictures to written and spoken language can increase patient attention, comprehension, recall and adherence*' and that they '*can help low literacy people understand relationships*' [25]. Houts et al. also provide a number of implications for practice including: '*simplify language used with pictures*'; '*guide how pictures are perceived and interpreted by the viewer*'; '*be sensitive to the culture of the intended audience in creating or selecting pictures for use in health education materials*' and that '*health professionals should be actively involved in creating the pictures*' [25]. These were all points considered by the team working with participants in developing this intervention. On-screen text and video sequencing were continually modified as a result of participant feedback. The following example is from a stage 1 workshop discussion regarding a general point about the appropriate sequencing of text (in this case, questions) and animations.

> P3 (nurse): … *I'm not that great at reading. So, having just the sort of short, sharp kind of text and stuff, is much better for someone like me to learn, and take in a lot easier… Put too much writing and it kind of just goes into a big blur. So, I thought it was quite a good level of text on there….*
>
> Researcher: *And it was, I guess, around, yeah, the way that we use video, and the benefits, and potential challenges of having questions before a video, or after the video.*
>
> P3 (nurse): *I think if I'd had questions before, sort of, I tend to just look for those answers. I don't tend to then take in anything else that's said. So, you just sort of think, oh that's the answer, I can switch off to everything else. Whereas, I think if you have the questions after it makes you think back about what you just heard, or what you've just read.*

Technical Development

As mentioned previously, in Phase 1 the narrative was presented face-to-face to a group of participants by one of the team, using animation sequences operated manually from a laptop, and interaction took place in 'live' tutor and group-participant mode. Therefore, the development of the Phase 2 stand-alone versions (app and WebGL) presented a number of technical challenges. Starting with the original Phase 1 'script' and the associated files that defined the specific interactions required, the early Phase 2 (stage 1) prototype was initially devised, for speed, as a sequence of Microsoft PowerPoint slides, into which were embedded the appropriate animation sequences, an optional voice-over (VO), and simple navigation and video-play functions. Further developmental iterations—developed in Unity—led to a WebGL version (accessed via a shared folder link) (stage 2) and an Android app (accessed via a bookable tablet) (stage 3). Stage 4 was used for technical refinement

to ensure the tool worked on both WebGL and Android platforms. The coding, interface, and animations for these were developed with the assistance of a variety of freely available Unity graphical assets, i.e. furniture, dog model, and reworked and rigged humanoids.

The advantages of developing this in 3D software as distinct from, e.g. Millman et al.'s video approach were several, including: the ability to model and remodel the digital environment, the interactions between vet staff, the animal patient and the environment; the ability to introduce interactivity and gamification features such as 'contamination hotspots'; being able to recreate a digitally rendered environment as a representative yet not a photo-realistic version, as a 3D monochrome 'canvas' devoid of extraneous visual clutter, into which the colour-coded indicators of contamination sources and spread, and mitigating IPC measures could be introduced [13].

Narrative Content

Narrative content comprised visual and text narrative components (the latter with an optional voice-over function). Visual content comprised the set of successive animation sequences described above, generated in a monochrome 3D model (Fig. 8.1).
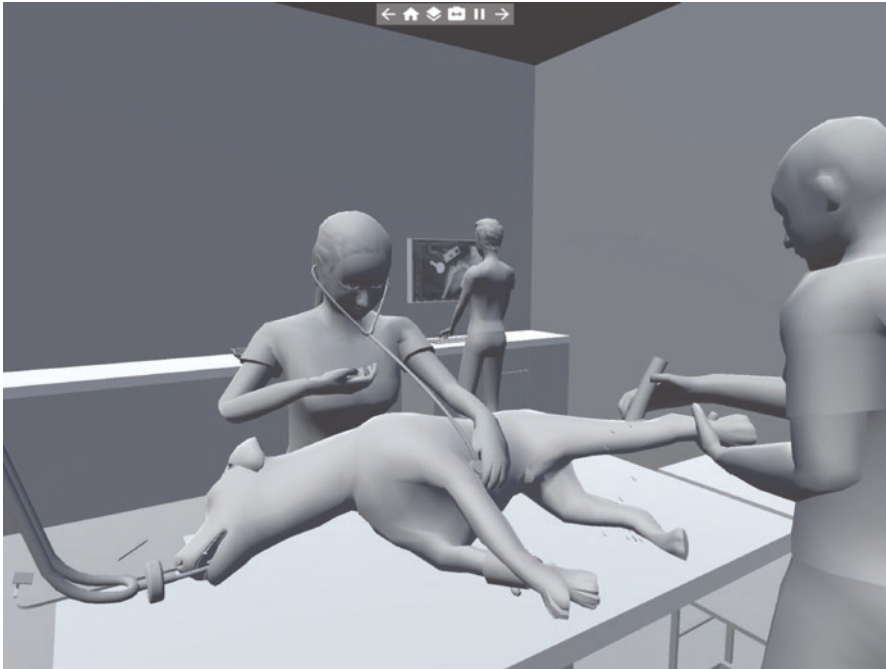
Fig. 8.1 Identifying potential infection risks from the animated sequences through the monochrome layer
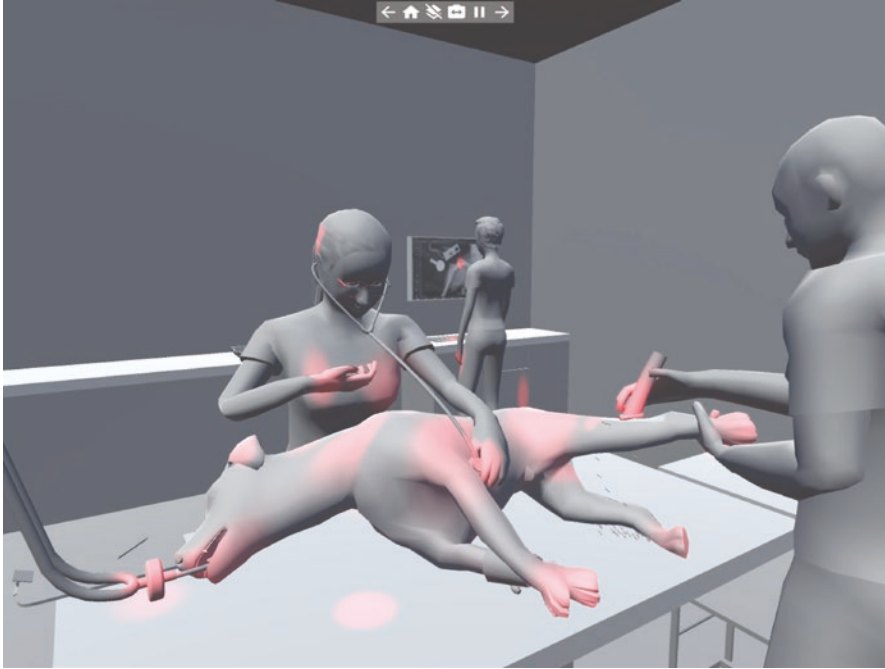
Fig. 8.2 Revealing potential direct and indirect contamination sources through the 'red' layer

In broad terms, participants were asked to identify risks during procedures, potential contamination sources and their spread which were then revealed via a second, red-coloured layer (Fig. 8.2) and which finally, after being asked how best to mitigate these through IPC measures, were then revealed via a third, green-coloured layer (Fig. 8.3).

Feedback from the Phase 2 pre-workshop questionnaires and during the online workshop sessions proved very useful in suggesting how proposed features might work effectively as well as additional features including: changing camera view (e.g. from front to aerial view); asking participants to identify a number of 'contamination hotspots'; using the tool's 'show and reveal' sequences; and then subsequently asking whether these were direct or indirect sources of infection. Feedback indicated these 'gamification' elements enhanced interaction and engagement.

The visually animated content was interspersed with on-screen text for which there was an optional VO feature. This text was adapted from the Phase 1 verbally delivered 'script', and updated as new visual features were introduced and the narrative developed. For clarity and to allow for an easily readable screen font size, text was kept to an effective minimum. Two distinctly separate voices, a female and a male, were used in the VO, to maintain interest and to give audible clues that different types of information were being given: the first providing the ongoing narrative, the second with instructions or posing questions, e.g. asking the user to reflect on aspects of what they had just viewed.
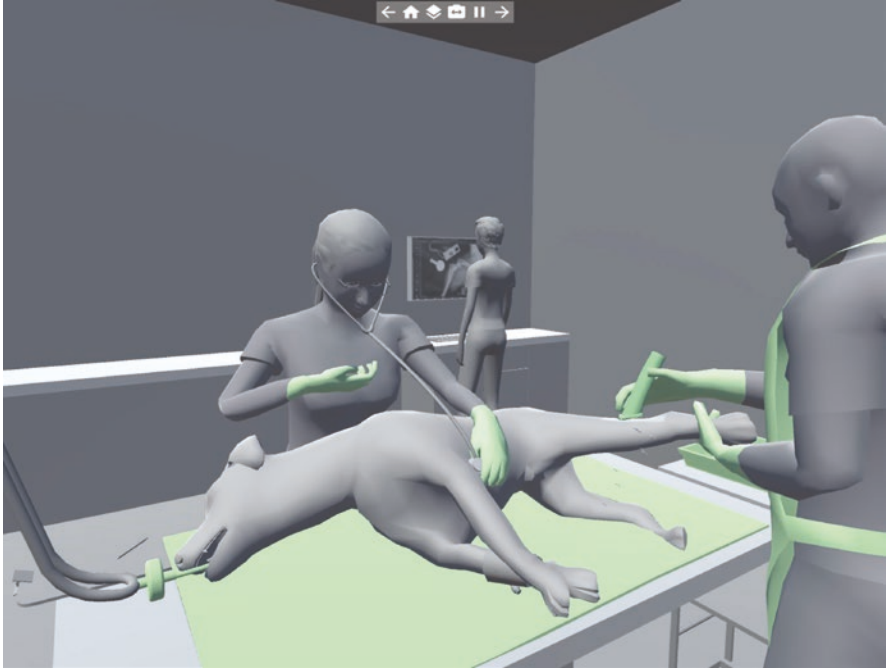
Fig. 8.3 Showing the positive mitigating effects of infection prevention and control measures through the green layer

Introducing Additional Features

During Phase 2, additional features introduced into the training tool were discussed with—or suggested by—participants both in terms of how these might add to the educational objectives of understanding infection risks, sources and their spread, and also technically, i.e. how best to make these features work practically and provide a good user experience. The following extracts relate to how one of the new Phase 2 interactive features was explored and developed, i.e. to identify a number of 'contamination hotspots' (Fig. 8.4) by touching/clicking locations on the scene where participants suspected these were likely to be present.

The feature was first introduced in the stage 2 workshop as a demonstration 'mock-up' and then, with development guided by participants' feedback, embedded in the stage 3 prototype tablet-based app made available for evaluation pre-workshop 3. Participants, therefore, had the opportunity to guide the team on detailed aspects of the features, to see their suggestions become manifest in the next iteration of the tool, and to offer further critique of these via the online questionnaire and workshop discussions. The following extracts, from the stage 2 workshop transcript, illustrate the nature of the ongoing participant critique fostered by the team throughout the
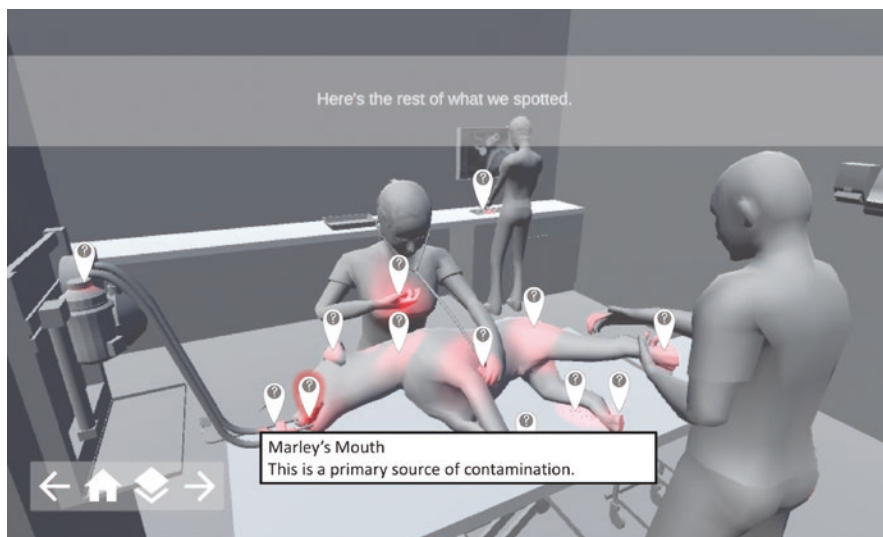
Fig. 8.4 An early screen mock-up of the 'contamination hotspots' exercise; clicking on correct sources shaded these red, and clicking further indicated whether this was a primary or secondary source of contamination (later renamed as direct or indirect)

development process and which were prompted by the presentation of the demonstration mock-up of the 'contamination hotspots'.

> P6 (Vet): …*I think that's exactly what I would have wanted from this, is because I find the whole reflecting on your own quite difficult because I struggle motivating myself in that situation. Whilst if it's, like, a thing that's interactive, it's much easier to do and so I think that everything you've said sounds really, really great and it could also be a really interesting thing…way to…like, if you'd then be able to analyse where people click more commonly to then use that as potentially a way to almost do research in to which bits people miss more, which I'm sure you've already thought of.*
>
> P5 (Nurse): *I really…I like the idea of doing this. I guess the only thing I'd say is I'd prefer a number rather than a time, only because sometimes when you are doing this, depending on where you're doing it, it's quite easy to, you know, get distracted or an email pings up or somebody walks through the door or things like that. And I'd worry that if it's time based, you know, there's a chance you end up missing the whole thing because something's happened. So, I think probably having a number to choose rather than the time base thing would work better from my perspective.*
>
> P1 (Nurse): *…agree, it's really good. I would definitely say I like the idea of being able to differentiate between the ones that you've picked and then the extra ones. I think that would…I definitely prefer being able to see…clearly see which ones I've missed, if that makes sense.*

At the next stage of the process, the following responses (shown collectively per cohort group also with Likert scores) were given to the online stage 3 questionnaire (Question 17) after participants had interacted with the stage 3 'Contamination

Hotspots' feature in the on-tablet app. The team were trying to establish whether it was more useful if participants could themselves identify a number of 'hotspots', what number of these, and how, before all were revealed.

> Q17, '*The 'Contamination Hotspots' exercise was helpful.*
>
> (Students: 2/5 agree; 3/5 strongly agree): *"Easy to click on and great to show other hotspots after your selection." "It allowed you to really think about where contamination could be introduced." "Yes, it was helpful to verify our understanding of the possible contamination areas. However, it might have been more beneficial to allow the partici-pants to identify more than 5 'hotspots' to further affirm our learning." "Many hotspots were very useful to know as in a clinical environment you generally don't think of them as contaminations." "It helped to recruit the knowledge learnt previously and apply it."*
>
> (Nurses: 3/3 strongly agree) *"I think this worked really well. I would have liked the option to just 'undo' one spot I had clicked on rather than resetting the whole thing. I liked the 'info' points that were added on at the end but felt the content in them could have included more information. I also think an explanation of what is meant by a primary and secondary contamination source would be a good addition (sorry if this was somewhere and I missed it!)." "Allowed me to check that I was thinking along the right lines and to check on my understanding of the exercise." "Really liked this feature. Really good to have the option to stop at 5 and be shown the rest or to find them yourself. Only thing I found was when you select 'close' to find all 13 yourself, once you have, then the continue button doesn't work. You either have to use the forward arrow at the bottom, or reset the finder, find 5, then select 'continue' instead of 'close'."*
>
> (Vets: 1/3 agree; 2/3 strongly agree): *"It was useful to stop and think about the points of contamination." "helped interact." "I love games and these pull you in well. Also, you could opt out so that if you hadn't found everything it wasn't frustrating. I feel like the mini-mum amount could have been slightly higher though."*

Findings

This ongoing critique from participants, their suggestions for avenues for develop-ment, enhancement and engagement, and critique of prototype features and general usability were fundamental to the study's collaborative design approach, to the innovation process and to the careful co-construction and honing of the central nar-rative. Each prototype iteration together with the online questionnaires and work-shop topic guides provided practical means of engagement and triggered valuable dialogue between the participants and the interdisciplinary research team. While aspects of the questionnaires and workshop discussions were pre-occupied with technical details, such as camera view, orientation and navigation, analysis of the qualitative data from the online questionnaires and from the workshop transcripts highlighted the value of three particular aspects of the team's visual narrative approach: 'seeing' the risk; the potential to influence behaviour through changed perception; and potential for applying lessons learned from one particular procedure to others.

'Seeing' the Risk

As reported above, from their Phase 1 findings, the team understood that their approach to visualisation was able to positively change the perception of risky behaviours and an understanding of how to mitigate infection risk. In the Phase 2 study, the team were keen to understand, in further depth, how well their visual approach helped participants 'see' the contamination risks. Representative comments below were taken from responses to the stage 3 online questionnaire, also indicating their Likert response to each question.

Q7: The training app helps me better understand the risk of microbial contamination.
   R2 (student): Strongly agree: Clear diagrams showing the ease of spreading microbes. Consequences and risks outlined at the start.
   R7 (nurse): Agree: This is something that I found to be widely covered in training etc but having a visual moving image to demonstrate it was helpful, especially for clarity.
   R11 (vet): Strongly agree: I think the visual representation is really useful to actually appreciate where the contamination occurs and how it spreads. Also thinking about where the contamination occurs before seeing it and also imagining the changes before implementing them is really useful. Thinking about the consequences also puts it into perspective.

Q11: The visual animations were helpful in 'seeing' the contamination risks.
   R2 (student) Agree: Extremely helpful with the patches of contamination highlighted and the difference between protection and no protection.
   R3 (nurse): Strongly agree: Adds to clarity being able to see the areas that are contaminated and where this happens in the process.
   R6 (vet): Agree: It was good seeing the animation before contamination was revealed and after. It showed areas where contamination exists which may not have been obvious.
   R11 (vet): Strongly agree: Just thinking about a theoretical contamination is not as easy as seeing it.

Potential to Influence Behaviour Through Changed Perception

The team were interested in how better 'seeing' the contamination risk could potentially change perception and influence behaviour. The comments below were taken from responses to the stage 3 online questionnaire correlating, to an extent, with the findings from the Phase 1 evaluation.

Q19: How has this training app made you think differently about the role you can play in reducing infections and ultimately the need for antibiotics?
   R5 (student): The training app has taught me to consider the possible preventative measures to take, before handling an animal in a clinical setting, in order to reduce infection and the use of antibiotics (for this purpose).
   R8 (nurse): For me, the app reiterates the requirement of PPE[3], cleanliness, reducing contamination etc, and will remind me not to become complacent when infections are not always seen.

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[3] Personal Protection Equipment

R6 (vet): *It has made me think about using PPE to avoid contamination.*

R9 (vet): *As a veterinary surgeon and educator it has helped* [me] *realise the need for more specific observance of these activities.*

Applying the Principles to Other Procedures

Scenarios modelled in the animations were derived originally from Phase 1 video data documenting the preparation stage for TPLO,[4] a specialist orthopaedic operation used to treat ligament rupture in the knee joints of dogs. These particular video data were collected from a large referral practice, a partner in the Phase 1 study. As many smaller veterinary practices do not have the facilities or expertise to conduct such orthopaedic procedures, the team were interested in the extent to which the learning outcomes from viewing this specific procedure could be applied to other more commonly practiced procedures, such as bitch spaying.[5] The following extended extracts are taken from the transcript of a dialogue in the stage 3 workshop to give a sense of the discussion about the transferability of educational principles, learnt through the approach taken in this training tool, to other procedures.

> Researcher 1: *How well do you think this one example of the TPLO procedure will make you think differently about other procedures?*
>
> P7 (vet): *Yes, I think it will, I think it'll make you think about all sorts of surgical procedures, about these areas of contamination that you don't really consider, so I think it has got a lot of, you know, reference to other procedures as well… I did a lot of surgery in my previous practice, and I think it would be very relevant to all procedures. It's just this whole concept of thinking about contamination from sources that you wouldn't consider.*
>
> Researcher 1: *If we were to do this again with a different procedure, to pick up your point, what might be a useful procedure to subject to the same kind of treatment… that people could learn generically from in the same way that P7 has said, you know, you could transfer this to other procedures?*
>
> P5 (nurse) *A bitch spay … so pretty much every practice is going to do them, they're quite a regular surgery, quite a common surgery, but they do carry risks and things associated with them, they're often underestimated just how much of a big procedure it is …*
>
> P7 (vet): *… the example I was going to use … abdominal surgery, they're slightly more forgiving in terms of infection than orthopaedic procedures when it's a healthy animal with no problems to start with, and it gets a serious infection like peritonitis, yes … it's absolutely devastating when that happen.*
>
> Researcher 2: *I just find it quite interesting that you don't necessarily have to have the tool that shows the scenario that you're familiar with or working with, you can use this and then from a teaching perspective, you could then have a very useful workshop session, like a flip classroom type arrangement where you actually say, okay, what principles can we draw across to this scenario or that scenario.*
>
> P10 (vet): *I've taught nearly 400 undergraduate students with this tool in its former version, AMRSim[6]… so when we did the first round of teaching, we realised the students weren't thinking outside small animal practice altogether, so … we asked the questions, can*

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[4] Tibial Plateau Levelling Osteotomy

[5] Ovariohysterectomy

[6] While the Phase 2 study was underway, the Phase 1 tool was being evaluated in the teaching of undergraduate veterinary students in the University of Surrey's School of Veterinary Medicine.

you think of other veterinary situations that you may not be in a controlled environment, but you still need to use your knowledge of IPC … We talked about standing castrations, supine, farm animal practice and surgeries on site, in the field, and then we also talked about daily life, visiting farms, cleaning your kitchen after cutting up a chicken with Salmonella *or* E. coli *on it, so we used the tool and we sort of started the discussion using the same tool without having any other measures. And the students just, you know, caught fire, they started talking just like you did, I was listening, I was waiting to see what you guys would say.*

Conclusion

Is there an art to serious storytelling? In 1920, Klee stated '*art does not reproduce the visible, but makes visible'* [26]. Not only is this work about making the invisible (hypothetical) pathogens visible that might make Marley seriously ill or worse, but it is about making clear sense of the potentially 'messy' environment of multifarious actors, causes and consequences within this setting—what Schoffelen et al. describe as a '*complex entanglement'*—transparent, accessible and readable [23].

This issue of preventing infection through effective IPC measures was of serious concern to the interdisciplinary research team, veterinary staff and students alike. Their individual and collective endeavour was '*how to get Marley into theatre with as little contamination as possible, both on him and left behind in the prep room'*. All knew that if the prevalence of AMR rises through poor IPC and hence an over-reliance on the use of antibiotics, then future options for patient procedures and treatments would be seriously compromised.

Key to the study's approach were the means and materials to bring together the interdisciplinary team and the participants in common pursuit of the study's objective; the collaborative framework which enabled this; and the way this narrative was co-constructed, and made readable and accessible to end users. Stakeholder participation was essential from the outset: representatives of end-user groups were involved from early in Phase 1 and throughout the whole Phase 2 development process, a factor vital to achieving the results in the Phase 1 evaluation and Phase 2 findings reported above. The mock-ups and working prototypes provided a point of common discussion between the team members themselves and between the team and participants. Table 8.1 indicates the extent of data collected via questionnaires and workshop transcripts (57 sets of written and verbal response).

Together, the research team and participants were '*individuals bound by a common cause'* [27], '*a dynamic organization of individuals and groups formed by the desire to address an issue'* [27] and to achieve the desired outcome. All had a vital role to play in contributing to the construction of and engagement with this serious storytelling endeavour.

Limitations

The colour-coding of bacterial contamination and IPC mitigation in the animation software uses the cultural convention of red (danger) and green (safe) as discussed in 3.1.3 above. However, this may prove problematic for certain types of colour vision defects (CVD). Following Phase 2 stage 4, the team did further work on developing recommendations for the use of appropriate colour-coding for those with CVD, which will be reported separately.

The TPLO procedure modelled would only be available to larger veterinary practices with the appropriate resources and facilities. However, as discussed in the Phase 2 findings above, the principles, understanding and insights gained from the modelled TPLO procedure show the potential for these to be applied to other procedures; other procedures common to all practices, such as abdominal surgery, could be modelled using the same approach and principles. A Phase 3 doctoral study[7] using the resulting application and WebGL from Phase 2 as a beta-version will allow not only an evaluation of any change in perception of risk in veterinary practitioners, but also any change in practitioners' behaviours, the rate of post-surgical infections, environmental contamination, and antibiotic prescribing compared to other forms of training. This is where the true and lasting impact will be felt.

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[7] https://www.surrey.ac.uk/fees-and-funding/studentships/innovative-solutions-improve-antibiotic-stewardship-and-reduced-amr-veterinary-practices

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Chapter 9
Using Poetry to Actively Target the Incubation Period

Sam Illingworth

Introduction

Poetry has previously been shown to be an effective way of both communicating research and engaging various publics [1]. From disseminating information [2], through to encouraging dialogue [3] and enriching science education [4], poetry provides a unique medium through which to help reconsider the way in which researchers interact with their discipline. Another role that poetry can play in helping to develop teaching, research, innovation, and public engagement is in actively targeting the incubation period.

In creativity research, the incubation period is defined as the process whereby initial conscious thought is followed by a period of the sustained suppression of task-related conscious thought [5]. Or to put it more simply, it relates to that period in which you step away from the task that you are working on and turn your mind to something else instead. This period of incubation has been shown to help facilitate creativity [6], which in turn can lead to unique solutions for tasks that need completing or problems that need solving.

However, this approach is somewhat passive and relies upon the would-be-problem-solver to have both the patience and presence of mind to step away from their laptop/lab bench/field site, safe in the knowledge that the answers they seek will leap into their heads when they go for a walk/cook their dinner/jump in the shower. Instead of this passive approach to engaging the incubation period for creativity, might we actively try to target it instead?

Previous studies have shown how this might be done either through the completion of adjacent tasks [7], through the utilisation of technology [8], or via engagement with an artistic process [9]. Poetry has also been suggested as a unique way of

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actively targeting the incubation period [10], and the purpose of this chapter is to develop strategies that will aid the reader to become more familiar with poetry. In doing so I will also outline a framework for how you might go about using poetry to target the incubation period for creative solutions to your own tasks and problems.

Embracing Poetry

The first step in using poetry to try and actively target the incubation period is to become more familiar with poetry. One of the best ways to do this is to read poetry, but in order to do this you first need to find some poetry that you might enjoy.

There are many different poetry journals that you could engage with, and which exist either in print, online, or both. The trick is in finding a journal that has a selection of poems (and an underlying ethos) that appeals to you, in terms of writing style and topic. I do not want to explicitly recommend any one journal over another, as the ones that I enjoy reading might be very different from the ones that appeal to you. However, The National Poetry Library (UK) has a fairly comprehensive list of poetry journals, including a brief summary of each one, that is a great place for you to get started [11].

Exercise 2.1 **Find some poetry journals. Visit the list of poetry journals provided by The National Poetry Library [11] and pick two or three journals that you would like to find out more about. Read about their topics of interest, their editorial boards, their inclusivity statements, etc. until you are satisfied that this is a journal whose poetry is likely to appeal to you.**

In reading and engaging with poetry, it is of course perfectly fine for you to not like some of the poems that you read. However, if there is a poem that you do not like, then ask yourself what it is about the poem that does not appeal to you. Do you dislike the style? The content? The imagery that the poet has utilised? Similarly, for those poems that you do like, what is it about them that grabs your attention? Is it the way in which the poet has given voice to the subject? A particular turn of phrase? The fact that it reminds you of a pleasant memory or experience?

When you read a poem, you bring all of your personal lived experiences to the reading. That is why a single poem can captivate one person whilst simultaneously repulsing another. When the poet wrote their poem, they could not possibly have had in mind the experiences that you would be bringing to your reading of it. This is why everyone's reading of a poem is valid, and why (in my opinion at least) there is no 'correct' way of interpreting a poem.

However, whenever you have a strong reaction to a poem (positive or otherwise), you should take the time to consider what it is about this poem that elicits such a response. Doing so will help you to become more comfortable in selecting and engaging with poetry. It will also help you to better understand the styles and attitudes that you might adopt when writing your own poetry, as we will be doing later in this chapter.

For now though, read the following poem, which was written by me; inspired by research which has found that almost all children have tobacco smoke toxicants on their hands, even in non-smoking homes [12]. As you read this poem, take note of anything that you enjoy or dislike, and try to contextualise why this might be the case. Is it because the poem is aesthetically unappealing, or is it because of some other reason that is related to your accompanying experiences when you engage with the poem as an individual?

<u>Lingering Smoke</u>
Stubborn stains
swirl across the room,
as yellowed rugs
and mottled drapes
swish callously
in stifling drafts
of vice.
Surfaces soaked
forever in the
selfish wisps of
memories long
since lost.
Children crawl
through our exhaust,
faultless little fingers
casting filthy shadows
in the sticky remnants
of abandoned haze;
smoke on their hands
to match the blood
on ours.

I have purposefully chosen my own poems for you to engage with in this chapter, as I am thick-skinned enough for you to dislike them. Indeed, I actively encourage readers to pull apart my poems, as in doing so you can become more confident and familiar in identifying what type of poetry does and does not work for you, and how this might hone your own writing in the process.

With that in mind, what do you think about the following poem? This poem was inspired by research, which has found that head lice can help researchers to analyse the remains of our ancestors [13]. As you read the poem, think again about what it is that you enjoy (or not) about the poem, and why this might be the case.

<u>Scratched into the Past</u>
Greying apparitions
scurry silently
down hirsute paths,
nestled amongst
the cloying warmth
of flaking skin.

Their crude cement
seeps
across the contours
of our ancient scalps,
fixing oval shells
between seams
of folded flesh
and swaying stalks.
In search of lives
once lived
we comb through
fraying manes,
our past preserved
in bonds more fierce
than bone
or tooth
or claw.
Tenderly we run
fingers through hair,
tracing histories
to the withered stem
of every root.

Exercise 2.2 **Read some poems. Select one of the poetry journals that you iden-tified in Exercise 2.1 and pick two poems from each to read. Either pick them at random or because they have a title that appeals to you. As you read them, make a note of what it is that you like and dislike about these poems. In doing so, do you get a better idea of the kind of poems that you might like to read or even write?**

Reading poetry regularly is a little like engaging with the latest peer-reviewed research. Doing so helps you to become more familiar with the various topics, forms, and voices that are on offer. It also helps you to develop your own unique voice and writing style, which we will now go on to explore further.

Writing Poetry

Writing a poem can be quite a daunting experience, especially if it is not something with which you have a lot of experience. In fact, asking someone to 'write a poem' is a little bit like asking them to 'do some science' or 'provide some healthcare', i.e. it is perhaps too broad an instruction as to be useful.

There are, however, a number of strategies that we can employ in order to help make this task more manageable. Picking a specific topic, writing for a particular audience, or even copying the style of a poet that we enjoy are all ways to help focus

the poetic creative process. Another tactic that can be adopted, and which we will now employ, is to use a poetic form to help guide our writing.

As I have argued elsewhere [1], poetry does *not* have stick to any specific form any more than it has to rhyme. However, in many instances such forms can really aid a poet, providing the scaffolding on which to build their creativity. Furthermore, understanding these forms and how they (do and do not) work can help to develop your own innate sense of rhythm, and with it the confidence that is needed to write poetry more freely and more frequently.

I am now going to introduce you to two forms of poetry that you might want to use in your own writing journeys, providing examples to demonstrate what these look (and sound) like in practice. To begin with, the 'heroic rispetto'.

The heroic rispetto is an Italian form of poetry made up of two quatrains, i.e. two verses, each of which is four lines long. The rhyming scheme of the poem follows a pattern of abab ccdd, i.e. the last syllable of the first- and third-lines rhyme, whilst those of the second- and fourth-, fifth- and sixth-, and seventh- and eighth- lines also provide rhyming pairs. The metre (or basic rhythmic structure) of a heroic rispetto is iambic pentameter, which means that each line consists of five pairs of first unstressed and second stressed syllables. Here 'iambic' means that each pair of syllables has an unstressed/stressed pattern, while 'pentameter' means that there are five of these pairs in each line, for a total of ten syllables per line.

To illustrate this form, consider the following poem, which was written about research into bombing raids by Allied forces during the Second World War, and how they produced shockwaves that were strong enough to weaken the Earth's upper atmosphere [14]:

A Blemish in Our Atmosphere
Between the curves where space and sky entwine,
The air is stripped by violent, solar flow;
A savagery inherently benign,
When matched with what arises from below.
The shockwaves of our past can still be felt,
Revealing every blow as it was dealt;
As ripples found in time unveil each scar,
The atmosphere cannot hide what we are.

Exercise 3.1 **Write a heroic rispetto. Using the structure that is outlined above write a heroic rispetto for a topic of your choice. This might be in relation to something that you are currently researching or inspired by a recent article that you have read. Pay attention to the metre and be cognisant of the final syllable in each line.**

Another poetic form that you might consider is the 'terza rima'. This is another form of poetry that originated in Italy (terza rima translates into English as 'third rhyme', for reasons that will become apparent), invented in the early fourteenth century by the Italian poet Dante Alighieri to structure his three-part epic poem, *The Divine Comedy*. This type of poem has four verses and the following rhyming scheme, with each line consisting of exactly eleven syllables: aba bcb cdc dd. Again,

to illustrate this in practice, consider the following poem, inspired by research which found that allowing sunlight in through windows can kill bacteria that live in dust [15].

A Dusty Eviction
Within the grimy creases of our home,
Lurk microbes poised and floating in the dust;
A sullied sign that we are not alone.
We treat these scrounging tenants with disgust,
Yet most of them just want to co-exist;
To which our incensed manners seem unjust.
By letting sunlight stream into their midst,
We banish tiny lodgers from our sight;
And wash away all traces they exist.
Like stranded vampires in the dying night,
Our unseen guests cannot survive the light.

Exercise 3.2 **Write a terza rima. Using the same topic that you wrote your heroic rispetto about in Exercise 3.1, write a new poem but this time using the poetic form of the terza rima. How do the two poems differ in both structure and meaning? Which of them do you prefer? Which did you find the easiest to write?**

There are many different forms of poetry that you can use to help structure your creativity. The website 'Shadow Poetry' [16] provides a comprehensive list of many different forms, including worked examples. If you are writing in a language other than English, then there are potentially even more forms available to you, many of which also have anglicised versions for you to try. As you experiment with these different forms, you might decide that you want to bend some of the rules, or else break them completely and develop your own poetic form. Whatever approach you decide to adopt, try out several different forms until you find a couple that you enjoy, as we will now be using these in our framework for targeting the incubation period.

Developing a Framework

Having engaged with reading and writing poetry, it is now time to introduce a framework to actively target the incubation period for problem solving. This framework is presented in Fig. 9.1, followed by a description for each of these steps.

Fig. 9.1 A framework to help actively target the incubation period using poetry

Identify the Problem

Begin by identifying the problem or task that you wish to address. Try to make this as specific as possible. For example, 'why are there discrepancies between the amount of carbon monoxide emitted from fires, when I compare my satellite data to a well-known emission inventory' would be preferable to 'why does my stupid computer keep returning unintelligible results' and is likely to result in a more manageable and actionable solution as a result. Incidentally, this is an actual problem that emerged from my PhD thesis [17].

Create a List Poem

List poems are poems in which you list everything that you associate with a particular topic. They can be physical objects, but also sights, sounds, ideas, memories, or anything else that pops into your head when you think about that topic. When you are writing your list poem, set yourself a time limit of 60 s, and list all the things that you associate with the problem that you have addressed in Identify the Problem section. For example, taking the problem identified above, I wrote the following 60-s list poem:

Satellites, pixels, fires, observations, sense of unease, lack of scope, scale, direction, colours, maps, imagery, dots, ambiguity, temporal management, distance, errors, understanding, databases, code.

As well as serving as a warm-up exercise to get your creative juices flowing, this list poem will also provide you with a word / ideas bank to help you in the next stage of the framework.

Write a Poem

The next stage in the framework is to write a poem about the problem that you are trying to solve. Rather than trying to recreate the problem didactically, instead think about how you might use the medium to re-frame or reconsider the issue. Pick a form that you enjoy working with, perhaps taking inspiration from one of the poems that feature in this chapter. The list poem that you have created in Create a List Poem section can act as both a source of inspiration and also a potential word bank; for example, when you are searching for a particular rhyme or syllable count to match the metre of your selected poetic form.

Continuing with my example, I have decided to write a nonet. This is a nine-line poem, in which each line (n) consists of (10-n) syllables.

Viewed from above you blister with rage,
pixels protruding from the screen

in rainbow colours of doubt.
Looking up you smoulder,
like beacons of heat
that dissipate
over time
I can't
see.

Read Your Poem

Having written your poem, try reading it out loud. Think about the cadence, the rhythm, the flow. Whilst the aesthetics of the poem are not the most essential part of this framework, is there anything that you might change to better explore or represent the problem that you are trying to address? Reading, editing, and re-reading your poem in this manner affords you the opportunity to continue to actively target the creativity incubation period.

In my nonet I was trying to convey the following concept: that using satellites to observe the amount of carbon monoxide emitted by fires in sub-Saharan Africa, produced a value that was much higher than the amount that was recorded in an emissions inventory. The line 'in rainbow colours of doubt' does not really get at the problem that I am trying to address, nor does it read particularly well, or indeed make any kind of sense. As such I reworked the nonet to read as follows, the 'unease' in the new line reflecting the inherent uncertainty in the satellite observations:

Viewed from above you blister with rage,
pixels protruding from the screen
in colours laced with unease.
Looking up you smoulder,
like beacons of heat
that dissipate
over time
I can't
see.

Revisit the Problem

Having written, edited, and read your poem, revisit your problem. Has the process revealed any new potential solutions, highlighted a new route for investigation, or exposed a mistake in your thinking? Approach the problem again, with your poem in hand, and see what you find. Even if you don't manage to directly solve the problem as a result of writing your poem, there are likely to be many additional learning opportunities that this process has presented, as will be discussed in the final stage of this framework (Consolidate Additional Learnings section).

As a commitment to the cause, I revisited my PhD thesis for the first time in over a decade to see if this nonet revealed any new potential solutions to the problem that I had posed. At the time of writing my thesis, I had observed that the discrepancies between the top-down (satellite) and bottom-up (emissions inventory) estimates of fire-emitted carbon monoxide were likely due to an underestimate by the emissions inventory. This was evidenced by comparing the observations to an in-situ fire map for an isolated fire event in Western South Africa on 6 February 2009. Doing so revealed that the emission inventory did indeed rely on data that dramatically underestimated the extent of the fire, but that further work was needed to confirm the reliability of my satellite observations. Unfortunately, in writing this nonet, I was unable to shed any new light on this issue, although as will be discussed in Consolidate Additional Learnings section, writing this poem presented me with several additional opportunities for learning.

Consolidate Additional Learnings

Even if your poem did not lead to a direct solution to the problem that you were trying to address, by actively targeting the creative incubation period you have opened up several additional learning opportunities for you to reflect on. For example, you might have identified an area for future research, drawn attention to a specific theory or concept that you need to brush up on, or corrected a misunderstanding that you had previously held. In writing your poem, you have also potentially created a medium through which to engage others with your work. At the very least, in writing, editing, and reading your poem you have continued to develop your poetic voice.

With regard to writing my own nonet, it enabled me to engage with a body of work that I have largely neglected; my own research interests having long since moved on from using satellites to observe the emissions of greenhouse gases. Doing so helped me to reflect on my own research journey over the past decade, which in turn prompted me to set aside time to plan what this might look like over the next 3–5 years. I also genuinely enjoyed revisiting my thesis, but that is perhaps because I was safe in the knowledge that it had long since been defended…

Exercise 4.1 **Follow the framework. Using** Fig. 9.1 **as a guide work your way through the framework and reflect on the extent to which this process helps to either solve a problem and/or lead to additional learning opportunities.**

Conclusions

This chapter has presented a framework for problem solving, exploring how poetry can be used to actively target the incubation period for creativity. In doing so it has also introduced several ways in which to engage with poetry, and why this might be

beneficial to you as both a researcher and a practitioner. I have also provided a set of exercises that will help you to put into practice what has been discussed, and I hope that these have helped to convince you that poetry is a powerful tool to develop teaching, research, innovation, and public engagement. Thank you for engaging with this work with an open and creative mind, and it is in this spirit that I would like to end with three requests:

1. **Read more poems.** Begin with the poems that you read in Exercise 2.2. Which of these did you really enjoy? Seek out more work by these poets and start your journey down the poetry rabbit hole—you won't look back.
2. **Share your work.** Having started to develop your poetic voice, why not share it with a wider audience? Start with the poetry journals that you identified in Exercise 2.1. If you like to read their poetry, then surely you might like to write for them too? You might also consider submitting your poetry to *Consilience* [18], a science poetry journal that I help to run and which offers free peer-review and support to all submitting poets.
3. **Get in touch.** If you have any questions or comments about this Chapter, or about the intersections of research and poetry more generally then please get in touch. My inbox and Twitter account (@samillingworth) are always open, and I welcome the opportunity to both collaborate and further develop my own knowledge and understanding.

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Chapter 10
Seeing Beyond Labels: Staff and Student Perspectives on the Importance of Building Community

Phil McAleer, Mathilde Sijtsma, Leonie Schorrlepp, Graham Reid, Liam Brady, and Heather Cleland Woods

Introduction

Much has been made as to what constitutes the student experience at university, particularly in recent times when the COVID-19 pandemic has meant an overhaul of approaches as to how students engage and interact with each other and staff [1]. The main two aspects of this experience are thought to be made up of a social and academic dimension, with a wealth of research suggesting that when one of these dimensions is not functioning as hoped, by the student, then the other will also suffer [2–4]. To facilitate a healthy link between the social and academic strands, universities and other higher education institutions invest significant resources into creating a brand that helps symbolise what it means to be part of the community within that university, with a view to staff and students engaging with that brand, leading to a greater sense of community, and ultimately better academic performance for their students [1, 3, 5–8]. Furthermore, community not only plays a role in student's academic achievements but also in the wider higher education market through the National Student Survey (NSS) in the United Kingdom (UK). The 'learning community' and environment is a factor within the survey with two questions dedicated to assessing how students feel a part of a community of staff and students and opportunities to work with peers. These scores then feed into university rankings such as the Complete, Guardian, and Times University Guides, highlighting the sector level impact that student's experience of community can have.

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At the heart of these communities is the sense of belonging and the sense of being part of something! Whilst the definition of 'belonging' varies, an often used standard, proposed by Goodenow and Grady [9], highlights the importance of students feeling that both their voices and their views are heard, that there is a strong and fair sense of inclusion, and that students feel supported pastorally, socially, and academically. In short, the same ideas and feelings that make us feel part of a family or social group, outside of our studies and work, apply when we look to form bonds with those around us in our class and study groups [1].

The feeling of belonging at university or college level however is not guaranteed and does not happen just by staff, students, and societies willing it. Rather it requires work both on the part of a community in creating opportunities and on the part of the person who hopes to belong to the group. Allen et al. [1] propose that for a sense of belonging to develop within a person they must first possess the ability to get on with others to some capacity, they must then be motivated to want to belong, there must be opportunities for interaction laid on by the community, and the person must come away with a good perception of the community from these events and interactions. When this does not happen—when there are no opportunities to socialise, an event goes wrong, or no desire to belong—a student ends up feeling isolated and lonely [1, 2, 8, 10, 11].

Whilst the drive to belong is potentially a universal human desire [12, 13], avoiding being lonely may ultimately be at the root of this need. Loneliness in its basic term means feeling by oneself regardless of the number of people around us or within our local environment; we are sure many can relate to feeling alone in a lecture hall whilst being surrounded by three or four hundred people. Indeed the sheer volume of people on a university course may inadvertently lead people to feel more lonely as the perception becomes that everyone else has friends except you, despite what the reality may be [14]. If this perception of being alone continues, then this can have a knock on to mental health and academic achievement, with research suggesting that those that rate themselves as lonely, rate themselves as higher in stress, higher in anxiety, higher in depression, achieving lower grades than they hoped for, and more likely to not complete their course [1, 3, 5, 10, 11, 15, 16]. As such, fostering an inclusive and supportive environment to prevent people from feeling lonely and developing that sense of belonging is an area of great importance to all levels of a university: module/course, school, college, campus.

Taking the above together, one might imagine that an easy solution is to just provide endless opportunities for people to meet and bond. However, whilst this may prove popular for a good number of students, consideration must be given to the type of event and the expectation of what will happen at the event. For example, whilst there is much clamour for the return to in person teaching at the end of the COVID-19 pandemic, after two years of largely online tuition, the expectation of the social opportunities that this is thought to create may not match up in reality and as such students may feel more lonely than they did off campus if universities do not work to mitigate this; an effect already witnessed to some degree in social media use and expectations outside of education [14, 17, 18]. On a smaller scale, one must also consider cultural norms at events, such as the availability of alcohol and acceptable

levels of drinking, or the reliance of conversation to foster bonds at an event, which for second language speakers will be very difficult [19]. In short, whilst a group may look to foster bonding through extracurricular activities, if done without consideration for the breadth of the student body, they could inadvertently cause more harm than good. That of course does not mean that social events should not be used, but that schools and societies must consider alternative means, in addition to standard social events, to create a sense of community.

To that end, we have adopted three principles and/or approaches that we believe help our students develop a sense of connection both socially and academically, within our school, and that work both online and in person. The three approaches are effective communication, open door policies, and seeing beyond labels. We will briefly outline what these three concepts mean to us before introducing a series of student perspectives on these areas.

Effective Communication[1]

Mann [20, 21] proposes that a key issue in the failure of a community is ineffective communication. When starting a degree programme, a new student must navigate a barrage of information [17]. If we take an example from a Scottish University student who may take three subjects in their first year, that said student will receive information from all three programme leads of the subjects, information from individual topic leads within those subjects, information from lecturers and tutors, information from the university in general, information from societies and clubs trying to vie for their interest, as well as the general chitter chatter of their friends and social media channels. This can ultimately lead to an effect best summarised by the Nilsson hit song, '*Everybody's talking at me, but I can't hear a word they're saying*' [22]. The cognitive overload of information, much as Mann suggests, can potentially lead to a student withdrawing from active engagement in their topics, and whilst the lecturer may perceive it as the student no longer engaging (how many times have lecturers said 'Why won't students just read the information?') in reality the issue is that there is too much information, in too many different forms, and the student can't see the trees for the wood! As lecturers, we find it too easy to see the world from our perspective but it is vital that we step back and try to view the world from the student perspective as well [19]—in short, as educators we must learn to live in both worlds. In order to address this cascade of information, one approach we have adopted within the School of Psychology and Neuroscience, at the University of Glasgow, is what we call *The Friday Message*.

Born out of an idea by one teacher working late one evening and needing to get a handle on everything that was going on that week, the *Friday Message* is akin to a

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[1] This section first appeared, in part, as a blog by the authors entitled 'The Friday Message' and can be found at https://uofgsotl.blog/2021/12/17/day-12-title-2/.

newsletter targeted to a specific cohort or programme within a School. On every Friday of term, without fail, each programme lead sends a message on our virtual learning environment (e.g. Microsoft TEAMS (https://www.microsoft.com/) or Moodle (https://moodle.org/)), to all students on their programme summarising key information about upcoming teaching, important dates for assignments, and any administrative tasks the students need to complete in the coming days. The message also highlights any internal and external events such as seminars or workshops, online talks, or opportunities for skill development over-and-above the student's own programme. But beyond that, the *Friday Message* acts as a connection between the lead and the students of that programme—maybe we share a song or a book that has caught our attention that week, or perhaps we give just a reminder of the importance of looking after ourselves and remembering that there is nothing that can't wait an hour or a weekend. Each message, with its own distinct tone and personality, reflecting the writer, is a step towards breaking down barriers between staff and students; showing staff as humans while emphasising that everyone is on the same team and the same journey has been previously suggested to increase student engagement and achievement [10, 19]. In short, the *Friday Message* is a one-stop shop to keep the students up-to-speed with what is going on in their course as well as helping to develop the sense that the community is for students as much as staff.

Despite being a simple idea, the *Friday Message* can really help reduce that sense of being lost in the semester we know many students experience. Instead of having to siphon through several smaller sporadic messages arriving throughout the week, students know that they can go back to the *Friday Message* at any point that week and the information that they need is right there. It also means that the information is more likely to get read because there is no longer an overbearing number of notices; instead all the relevant points are there, in one place, on the same day each week, creating a sense of structure and regularity that is sometimes missing from the busy student lifestyle.

From our own perspective, as teachers, we have found that the *Friday Message* saves us both time and brain capacity. We no longer write numerous emails and announcements throughout the week, losing a countless stream of 'just a couple of minutes to write this', with the added stress of having to process the information ourselves there and then to make sure it is conveyed appropriately to students. Instead, we can save the information for that one post at the end of the week, dedicating just an hour to writing the message on a Friday, with the added benefit of allowing ourselves time to reflect on the information and think how best to put it across. A well-considered summary of ideas and information, in our experience, will always be better received and understood than a message written in haste.

The *Friday Message* has been a simple yet highly effective approach to developing a community within our school. Whilst we can all feel somewhat disconnected within our own silos—staff just as much as students—there is something quite connecting about hearing what is happening in other programmes. As messages from programme leads come through each Friday, we all get the chance to see what events and opportunities there are within our community and that we can get involved in if we so wish. Over the few years we have been using this approach, we

have greatly benefitted from it within our school and regularly see a mix of cohorts at events, from first year to masters, from undergraduate to postgraduate, all brought together by the *Friday Message*.

Open Door Policies and Seeing Past Labels

Whilst the streamlining of communication helps students navigate an ever-increasing influx of information, a school must also consider how we interact with students and the influence that may have on developing our community. Much like the *Friday Message*, these approaches do not have to be expensive, in time nor cost, and much previous research has suggested that even small details such as trying to learn a student's name can help increase a student's engagement and interest in a course [10, 19, 23–27]. This makes perfect sense as by simply feeling that you are valued enough for a lecturer to try to learn your name can make you feel as though you have gone from nobody to somebody, particularly if you are already feeling lonely or disconnected. What is interesting is that it is not so much about whether a lecturer knows your name or not, but just that they have made the attempt [19]—again, going back to the notion that the percept and the reality don't always match [14, 17, 18]. Furthermore, Sandstrom [26] suggests that even well intended greetings at the start of a class, and other small behavioural approaches that signal shared interests, can be as effective as remembering names; a simple gesture is more realistic and achievable in large cohorts. In short, as with any relationship, the social aspect of the interaction in teaching and learning is highly prized by students, and one that requires minimal changes to help foster.

Tanner [19], in a reflection of their teaching practice in a large +300 cohort, highlights a number of points towards instilling a sense of community, but an overarching aspect is that of being on the same team as students. Using the example of learning names, again, we are taught as children, when playing games, to learn the names of those we are playing with as that helps us form bonds and connections. If we know nothing else about a person, we know what to call them. Likewise with students, a staff member making the attempt to learn a student's name shows that the staff member values the student, values the student's opinion and perspectives, and that they, staff and student, are both part of the same team. Much like learning names or sending an email, how to go about forging links between staff and students does not have to be ground-breaking and, as we shall discuss below, can be as simple as how we, as staff, refer to ourselves, how students refer to us, and making sure to actively incorporate students into discussions about their learning.

From the staff perspective, in our school we have aimed to include student bodies in various meetings and groups so that the student voice is always heard. In these meetings, students are equal to us and just as we would refer to them with their preferred name, so they refer to us as well, without titles or labels. These meetings include our Learning and Teaching Committee, where we decide on strategic approaches to teaching in our school, and our Staff Student Liaison

Committee (SSLC), where we discuss programme and course-level specific directions, but also we include students on our recruitment panels for new members of staff, as any new hire to our learning and teaching team will impact students as much as staff and having that student perspective can be invaluable in these decisions. One important aspect of these meetings though is making sure that the approach is not just lip-service to inclusion, and care must be taken to make sure that students are given time to present information and opinions. In addition, we make sure that students are actively called on to give their views as previous research has found societal biases can lead to the opinions of minority groups being underrepresented and excluded, despite being in the same room [28, 29]. As such, it is the role of the chair in our meetings to ensure that the student voices are heard by directing questions specifically to the students and tabling a slot within the meeting agenda that students know is theirs alone. It is often the case, we have found, that students have many great opinions and ideas, we, as staff, just have to make sure we facilitate their voices.

A second aspect we have aimed to provide is the feeling that our doors are always open to our students. In our experience, there is a perception in the student body that lecturers cannot be approached, for a variety of reasons, and that the only contact with lecturers should be in the lab or lecture hall. Whether this is a viewpoint developed in school, a fear of asking for help, issues relating to the Hidden Curriculum [30, 31], or a combination of them all, it is a pervasive problem that may lead to feelings of loneliness and low academic achievement. To illustrate, every member of staff within our school holds weekly staff office hours where students can attend and receive one-to-one tuition on any academic question, or just have a chat about how they are doing, yet whilst personal tuition is what many would perceive to be the best teaching one can get, it is perhaps surprising that for a long time these sessions have been poorly attended. Though some have proposed giving course credit to improve the uptake of these sessions [19], our approach has been to consider it more from the perspective of the student and to think about the reasons behind the low attendance. As such, we have changed the names of these sessions to Student Office Hours or Student Drop-In Sessions, to emphasise that this session is for them. In addition, we actively highlight our Drop-In Session, and of relevant other team members, on our *Friday Message* and on posts on our Virtual Learning Environments (TEAMS channels and Moodle posts, etc.). We remind students what these sessions are for, and we make it clear as to how they will be conducted (i.e. online, in person, turn up, and wait or booking), in order to remove any uncertainty students might have and to make attendance more inclusive for all. Moreover, we make it clear that if a student can't attend the session or would rather have a meeting when there is less likelihood of other students waiting, then we can arrange that. Whilst we are also clear on our own personal boundaries (e.g. working to certain hours, not working weekends, and we hope to reply in three working days), we have found that reminding and demonstrating the usefulness of such sessions, and the availability of staff, have helped improve the uptake of these sessions and has helped students feel that, again, staff are working with them to the benefit of their education

and future development. Our resistance to using obligation on the part of students to attend our office hours also stems from our commitment to skill development with our students. Beyond graduation, students need to be equipped to reach out and approach people they are not familiar with so supporting our students to learn that using times people say they are free or drafting a message to book some time is a helpful way to grow confidence in connecting with people.

Student Perspectives

Much with the *Friday Message*, improvements that lead to a greater sense of community do not have to involve large expensive wholesale changes and can instead be simply about how you include and interact with students. Yet, whilst we as staff have maintained the above principles in our practice, one issue is always in conveying that to students and hoping that students, either explicitly or implicitly, understand what we are aiming to do and how they benefit. To that end, we wanted to include first-hand accounts of what it feels like to be a student within our school and whether the above approaches have helped students in feeling part of our community. As such, we asked four students to write a reflective paragraph on their experience within our school, directing them to focus on all three principles or just the ones that they felt they wanted to discuss. For clarity, students were given only the abstract of this chapter as a basis. We now present those perspectives unedited.

Leonie

Feeling like you are a part of a community is hard to pin down. It is more than the separate elements that I describe here, it is their interactions, and it is all the things that add to your experience without you ever realising. But to make an attempt at this, here I describe how I felt seen, heard, and welcome during my time in the School of Psychology (SoP).

Tone—Feeling Seen

Tone comes first but is hard to describe. Knowing each other on a first name basis, being able to joke with lecturers, and being told that our well-being was important. Being told that teaching staff was aware of our struggles, successes, and everyday lives. A general warm, informal tone is the base of almost everything I describe here because the way we were communicated with, set the scene for how we could communicate back. It all starts with a two-way street of communication between teaching staff and students.

Office Hours—Feeling Welcome

Office hours were always there. In all honesty, I rarely used them, but when I actually had a question, idea, or problem that I wanted to discuss with a lecturer in person, then I could. The importance of office hours was always stressed, and lecturers complained if no one came to visit them in this time. But this was by no means wasted effort because this was exactly what made me feel like they really wanted me there, and that they got something out of this time, too. Only after leaving the SoP, I realised how big the distance between students and lecturers can be if you do not know how to find each other. Having the opportunity for one-on-one contact with a lecturer so regularly, added to my belief that I was always welcome with any of my teachers, that I had a place in this school, that I belonged.

Feedback Processes—Being Heard

Naturally, those teaching and those being taught do not always agree on how to teach and be taught. But discussions always included student representation. They were constructive and if we ever had feedback that the staff did not want to hear, that was okay. We could insist, if we felt like something important was brushed over, and we could disagree with no other consequence than maybe even being praised for this. This came so naturally, I did not question it too much at the time. Of course, I could tell someone so far above me in the academic hierarchy that I did not even know all the steps you had to take to get there, that they were dismissing an important point. What is hierarchy when you can have a friendly chat after?

An overarching theme for me here is about meeting each other on eye-level and listening, learning, and improving together. The teaching staff led by example and if my teachers take time to listen and learn, then of course I can listen and learn. And if that does not work, then we were not excluded from the solutions. Instead of barricading us behind the demands we had of each other, we always sat on a table together, and in that environment, you can do more than learn a subject, you can grow beyond what the courses teach you.

Graham

In addition to the importance of developing academically in any degree programme, an indispensable part of studying successfully and happily at higher education is the sense of community and inclusion that staff and students experience and contribute to. In my own experience, I was particularly lucky to study psychology in an environment, which was friendly, supportive, and dynamic. Reflecting on my time I can think of several instances of community spirit that were particularly notable and made the experience enjoyable as I learned more about my discipline. Throughout my degree, for example the cohort leads would send us weekly emails, keeping us

in the loop with upcoming events, whilst summarising the week that had just past. I found this particularly conducive to community because the tone of the emails was always inclusive, congenial, and informal. For me, these emails created a sense of unity and involvement, ensuring we could all follow the momentum of the academic calendar. This sense of openness was not only felt virtually through emails but was also present in the general atmosphere of the psychology department. There was a tangible sense of there being an open door policy in the department which was engendered by the staff's warmth and approachable demeanour. At no point, did I feel or hear of others feeling excluded or needing to navigate an academic hierarchy in which they were not sure of the dynamic between them and the staff. Interestingly, I found that this open atmosphere instantiated itself within the learning environment as well, including our tutorials, lectures, and workshops. For example, most lecturers would create space at the beginning and end of lectures for students to engage with material, to ask questions, and to develop their critical thinking. In my own experience, some of these encounters on either side of the learning environment were incredibly engaging and affirming as I chatted with field experts on a personal level. As a home student, such moments were particularly conducive to creating a sense of community, considering that, at times, it may not have been possible for me to engage with the community at other times due to transport issues and other commitments at home.

Going beyond the lecture hall, I also found that the quantity of group work and collaborative learning in our course helped build community and encourage the flat hierarchy that was so evident in our department. To give an illustrative example, during our statistics workshops the members of staff would frequently wander around the room, speaking to groups of students as if we were colleagues, discussing ideas with us. Seeing staff engage with us by exploring the entirety of the physical space rather than lecturing from the front, not only developed a sense of being one community within a single space, but also helped us feel listened to and respected. Indeed, although we were working together in groups of around six, developing a community amongst ourselves, staff members' moving between groups then became the social thread that united us together as a larger cohort. In a similar vein, we had ample opportunity throughout our undergraduate studies to work on research projects with fellow students, developing ideas, challenging each other, and encouraging excellence. Although we did not have much opportunity to dictate the dynamic of these groups, we benefited hugely from having peers allocated to us in that it widened our social network, helped us to develop more flexible communication skills, and work with different members of staff. I found that this benefitted me and other students greatly in being confident to approach academics and researchers both within our university, as well as at other research centres. That is, the feeling of an open and friendly environment, coupled with our ever-developing skills in communication, helped us to network and gain research-relevant skills for our careers in psychology. In my case, I was able to join several lab groups across different institutions throughout my undergraduate, working closely alongside senior and more junior researchers. I am of the opinion that the flat hierarchy at my institution and the opportunity to learn and grow from staff and fellow students

instilled in me a confidence to approach others in the knowledge that I would be respected, included, and encouraged.

Together, it seems that the generosity of the community spirit at my institution helped me develop academically and socially, whilst enjoying the experience of learning about my discipline within an environment that was encouraging, challenging, and incredibly welcoming.

Mathilde

My experience of feeling part of a community during my undergraduate degree is the result of a combination of many more factors than I can explain here. While student-led events are a crucial factor, I would like to take the opportunity to focus on the impact of communication from staff to students on building a community.

To build communities in education, education must be seen as a place where we want to form a community. In my experience, this starts with the emphasis of messages sent to students. If we only receive communication in a strictly formal tone about practical course information, it is difficult to form the social and emotional bond needed to create a sense of community. Instead, I found it important that staff communicated to us about other topics that are essential to a successful educational experience such as taking care of our physical and mental health, to know where to go for support, but also about fun extracurricular activities. This then helps creating expectations ('the way we do things here') that generate a sense of togetherness.

Equally, if not more important, is how the message is communicated. For me, interacting with peers, staff, and lecturers is essential to feeling part of a community. Academia is very busy, and quite intimidating from the student perspective. It is easy to feel that you do not want to 'bother' researchers and/or teaching staff with your self-proclaimed 'basic' questions. The seemingly specific and simple event of weekly office hours were therefore essential for me during my undergraduate degree. Office hours significantly lower the threshold to ask questions, seek help, or just to interact and have a discussion. It also contributes to a culture where it is okay to do so, so even if you would never make use of the opportunity, you know the option is there and you know that is part of the way we interact with each other. Additionally, visiting the buildings where the offices are and being able to navigate and feel comfortable in that space makes me feel connected more to the department. Office hours therefore also reduce the boundary between 'the researchers' and 'the students' as separate groups.

Fundamental to the success of the office hours formula is that it happened weekly. In my opinion, consistency is key. It does not create a sense of community to sporadically tell students about an event happening every couple month, or to only tell us in an introductory talk that staff is here if we need help. Students likely already know about the events, and they know they can seek help if needed. The thing that

builds community is continuously reminding each other of these things, and has continuous and open lines of communication. For example, I found it very helpful to receive weekly, informal, and personal-feeling emails from both my school's director and course coordinator, with an overview of what happened that week, announcements, and achievements. Consistently receiving these emails made me feel connected to my year and broader department.

I hope to have demonstrated that it is not only what you communicate to students, but also what consistent opportunities for communication are provided that contributes to building communities within education.

Liam

Communication

The main thing that stands out for me in terms of communication to help build communities is the weekly emails we received from our course leads. They didn't necessarily have to contain a lot of information, a lot of the time it was saying something along the lines of 'this deadline is coming up' or 'office hours are this time this week'. But what this regular flow of communication did do was help build a familiarity with staff members and increased the feeling of community as a lot of the time there was a message saying 'hope you're all well' or 'how are you?'. It wasn't expected that we had to reply to these emails but knowing what's going on in the school, from our course coordinator, was a simple touch that really embedded that feeling of being in a community.

Accessibility (e.g. Being Able to Chat to Classmates, Members of Staff, etc.)

One thing I really struggled with in years 1 and 2 was that there were so many people it was almost impossible to feel part of a community; you were one of a group of hundreds. I barely knew anyone in psychology and almost found it quite anxiety inducing to go to lectures because there were so many people and I hadn't found 'my people' in psychology at that stage. The big turning point for me was year 3, which is junior honours for Glasgow, and the class size had dropped significantly. It was attending the reading party which was a residential trip to Aberfoyle with classmates and staff members. For me, this was really being thrown in the deep end and it sort of forced me into meeting more people in psychology and it was the best thing that could have happened to me. I met one of my best friends still today on that trip so I am a big advocate for community building outside of the lecture theatre as well as in it. From that point onwards, I was much more comfortable in lectures and tutorials because I had people I knew and it gave me the confidence boost to make conversation with people I didn't know.

I have always found the members of staff to be accessible and approachable. From year 1, staff made sure to include personal anecdotes in their teaching which really helped break down the barrier of us and them; that staff members are people too who have lives outside of the university and sat where we once sat as students. I was the first person in my family to go to university so having staff come across as normal people and not be held on this pedestal really broke down barriers of what was achievable. I was very lucky to have a fantastic advisor of studies throughout my time at university who always took the time to check in with me once a semester to see how I was getting on and give me words of encouragement. Whilst the advisor of studies role is typically more academic focussed, mine took the time to check in on my well-being and saw the role more holistically as is the student experience. I wasn't just spending time chatting about what subjects I was studying and how my grades were, but they took the time to ask about my social circle, if I joined any clubs or societies, and if I was just generally doing okay. Little things such as knowing me by my first name when I'm sure they had other advisees really helped with that staff/student community building.

One final aspect to staff accessibility was academic twitter. It was quite commonplace from staff to have their twitter handles on their lecture slides and from engaging with staff on here it again broke down that us-and-them barrier. I followed staff members who tweeted about their research, but also shared stories about their lives, their music taste, and even their running #psyrun. Seeing staff in this light most definitely made them more accessible and approachable.

Seeing Beyond Labels (i.e. Not Thinking About Students and Staff as Us-and-Them But All One Group and Community)

I think a lot of my previous points also work here, and this next point probably works for the other categories as well, but for 'seeing beyond labels' student representation really comes to mind. I was lucky enough to be elected as the School of Psychology Representative on our Student Representative Council (SRC) in my final year and it took me by surprise almost how much the school worked in partnership with the representatives. I attend SSLCs and Teaching Management Group as a rep and I most definitely was made to feel as an equal. For me, the School of Psychology went above and beyond simply giving reps a seat at the table, but encouraged their engagement across all aspects of the school and was constantly seeking feedback. This is, of course, not saying that the school got it right every time and as reps we did clash with staff members on different things, but that's a completely normal part of working in a large, diverse body with different opinions. It was how both staff and students came to a resolution on these issues that really highlights that we saw each other beyond labels. I was fortunate enough to continue working in the SRC for two more years as a Sabbatical Officer and every opportunity I had to cross paths with a member of staff from psychology reaffirmed everything I had learnt as a student; it is made up of staff who are approachable, see you as their equal, and who strive to improve the experience of students at the University of Glasgow.

Narrative

In writing this chapter, the two academic staff members (Cleland Woods and McAleer) created a first draft of the introduction completely separately from the student perspectives (Brady, Reid, Schorrlepp, and Sijtsma); neither group saw the work of the other until both parts were written. This was deliberate as it was important that the student perspective was not influenced by the staff perspective as we, as staff, wanted an honest account of the student perspective. Given that, it was incredibly pleasing to see how much of what we intended as staff, in our practice, comes across to students; ideas based on the research and put into practice by our staff such as community through continual communication, use of first names, students being represented on panels as equals regardless of rank. These were the areas we were hoping would come out and it is testament to our staff and students that they were recognised. It is also interesting though to see the additional points pulled out in student perspectives that we perhaps take for granted: ideas such as the importance of groupwork as both an academic and pastoral tool; the familiarity of the teaching environment; and the humanising of staff through personal relevant anecdotes and social media. But one area that we think speaks volumes, and that we may not have fully appreciated as staff, was the power of students and staff being able to disagree on approaches but ultimately reach a reasoned outcome. Common goals have been known within psychology to be a method of creating intergroup cohesion for a long time [32–36] and what the student perspective highlights are that when both parties feel heard and valued, regardless of outcome, having a clear and obvious common goal of academic achievement, and the development of knowledge, can really help foster community and belonging within a school.

Conclusion

The common goal between students and lecturers is to create an environment that allows students to feel welcome, part of, and included, and an environment that allows students to maximise their academic potential in their short time at university through developing skills and knowledge relevant to their destinations post-graduation. As we have discussed, these goals are inherently interlinked, with students feeling encouraged and supported to achieve through feeling they are valued members of the community. The principles and approaches we set out above are not difficult or expensive to incorporate, and there is nothing special about our school that means they could not be used elsewhere, but they can have a significant impact on both the skills and well-being of our students, as well as the reputation of our school. They do however require thought, and patience, and, for both staff and students, they may require people stepping out of their comfort zones to meet in the middle ground. It is too easy to revert to our corners, using the us-and-them approaches of the past, creating distance between staff and students, and ultimately leading to a lack of belonging despite being surrounded by potential. Communities

do take work and they require investment from everybody, but, in the long run, using the approaches above, we have found that a little goes along way, and it is to the benefit of the working and learning environment when we open ourselves up to each other, confidently acknowledging the human perspective of our journey together.

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Part III
Public Engagement

Chapter 11
The Hidden Curriculum of Public Engagement for Creative Methods of Instruction

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Introduction

Science communication and public engagement serve a multitude of purposes—from marketing, recruitment, widening access, to civic responsibility for the translation of knowledge from academic disciplines to the public domain [1]. There are a range of different public engagement methods, which can be adapted for various audiences. Creative approaches to teaching and learning translate well to outreach events due to their innovative nature and wide appeal, granting access to domains of knowledge or learning that are often restricted. Educators engaged in creative approaches to teaching may be asked to deliver outreach events. Though advice exists regarding the practical considerations of public engagement in the sciences, little guidance exists in reference to the sociocultural implications and considerations of outreach activities. For example, the lack of representation amongst outreach facilitators and their assistants, such as life models; the physical spaces in which events occur; who can access outreach events and how this relates to equity; and the tacit signposting regarding what you communicate, and how.

This chapter will consider the tacit messages of public engagement, focusing on how these manifest in creative approaches to scientific outreach. We will illustrate these tacit messages—which we frame as the *hidden curriculum* —in action by discussing case studies grounded in our practical experience of public engagement.

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Acknowledging the hidden curriculum of outreach represents a new paradigm for public engagement, as it is not a current focus in contemporary science/medical education public engagement literature. At the end of this chapter, we offer practice points for interested educators and practitioners that synthesise our main insights from engagement with the literature and our lived experience in this area.

What Do We Mean by Public Engagement and Outreach?

The terms outreach and public engagement are often used interchangeably. However, there are fundamental differences. Public engagement describes the many approaches in which the activity and benefits of higher education teaching and research activity can be shared with the public for mutual benefit. Examples might include roadshows, community engagement, public lectures, participatory arts, or science festivals. Public engagement can, in theory, happen anywhere. Working within the community is at the core.

Many universities advertise the benefits of public engagement to their employers. For example, the universities in the United Kingdom (UK) purport the benefits of public engagement to include the potential ability to educate, inform, and inspire members of the general public, school students, and potential students. Such events contribute to a vibrant, creative, and inclusive environment for university staff, students, and visitors. They enable universities to position themselves intellectually, encourage knowledge dissemination and exchange, inform, and facilitate interdisciplinary working, inform and educate the public about the work of universities, inspire the next generation of researchers, enhance teaching and learning, and increase and demonstrate the university's impact on society and the economy. What is also clear, is the advocacy of the personal benefits to staff if they chose to engage, namely opportunities to develop transferable and career-enhancing skills.

Further, public engagement is often posited as a mechanism by which universities can demonstrate accountability in the use and impact of public money used to deliver research. Institutions and individuals contributing to public engagement contribute to the educational, social, and cultural development of their locality too.

> *'Public engagement describes the myriad of ways in which the activity and benefits of higher education and research can be shared with the public. Engagement is by definition a two-way process, involving interaction and listening, with the goal of generating mutual benefit'.*—**National Co-ordinating Centre for Public Engagement** [2]**.**

Outreach might involve similar activities but it has a different social mission and purpose. Outreach activity typically targets prospective students from geographical areas who have lower progression rates into higher education and with a lower

socio-economic status. The format of the activities undertaken may be similar to those used for public engagement but the audience is more targeted. Such interventions aspire to offer students insights into programmes of study, professions, or other opportunities available to them [3]. Outreach is often part of university agendas to widen participation. Outreach is most often delivered in schools or on campus, with most activities typically delivered face-to-face.

It is important to appreciate that public engagement can serve as a form of outreach activity, however, the intention is not to increase the participation of underrepresented groups within higher education, as is the case with outreach. Outreach typically falls under the umbrella of admissions and social responsibility. It is not unusual for universities to have strategies for both outreach and public engagement.

> Outreach includes the many ways in which universities deliver activities as part of the access and participation plans to improve access for underrepresented groups to higher education.

The Hidden Curriculum: Definition and Challenging Common Misconceptions

The hidden curriculum (HC) is a concept which has rocketed in popularity within educational literature and, perhaps, then, predictably, healthcare and science teaching within the last few decades. In the 1970s, the HC was key to understanding the popular Marxist perspectives on education, which maintained that education teaches learners to obey authority and, in doing so, reproduces inequality [4]. Within this position, the HC acts as one vehicle by which learners are taught to obey authority, and by which social norms are taught and reinforced. Within healthcare education and, more specifically, within medical education, Professor Fred Hafferty is the veritable founding father of the HC, first writing on the term with co-author Professor Ronald Franks in 1994.[5] Hafferty defines the HC as:

> "...*the attitudes and values conveyed, most often in an implicit and tacit fashion, sometimes unintentionally, via the educational structures, practices, and culture of an educational institution.*" [6]

Simply put, the HC is the unwritten rules, values, and patterns of behaviour that students learn, and are expected to conform to whilst learning. Though powerful, the HC is not the only type of curricula that shapes student learning. The formal curriculum, which is also known as the explicit, written, or overt curriculum, also plays a large role. Though other fields distinguish between terms such as 'explicit', 'written', and 'overt' (and, indeed, utilise distinctions within the formal curriculum that we do not even use as terms, such as 'codified', and 'manifest'), in health professions and science education, the terms are used interchangeably [7]. Given this, we will not distinguish between them within this chapter. The formal curriculum is

that which is stated as required learning for students. It can refer to curriculum documents (such as syllabi or curriculum maps), textbooks, and a variety of teaching and learning materials produced for instruction (including multimedia formats). The formal curriculum is that which will be taught and so it represents the skills and knowledge that institutions expect students to acquire (and may test them on).

The HC exists in contrast to the formal curriculum, as an 'other-than-formal' type of curriculum (other types of other-than-formal curriculum include the null curriculum, and experienced curriculum). Other-than-formal types of curriculum are usually tacit—that is, implied or understood without being formally or explicitly stated. What unites the types of other-than-formal curriculum is the fact that they are not formally announced by institutions or educators, and they are unintentional lessons.

A full list of the various terms associated with the other-than-formal curriculum is given in Table 11.1. We focus in this chapter on one type of the other-than-formal curriculum, the hidden curriculum, but you might see additional relevance to the variety terms presented below.

Though discussed most frequently within the context of school or higher education (hardly surprising given the origin of the term, and use of the word 'curriculum'), we believe the concept of the HC has value beyond traditional conceptions of education. In this chapter, we explore how the HC can help us process and challenge some of the barriers we have experienced whilst engaging in outreach events or activities. In order to ensure we explore the relevance of this concept thoroughly, it

Table 11.1 Definitions of terms associated with the other-than-formal curriculum

Term	Definition
Hidden curriculum	The unwritten rules, values, and patterns of behaviour that students learn, and are expected to conform to whilst learning.
Informal curriculum	Understandings of how things are done, versus how things are supposed to be done in accordance with rules or policies.
Null curriculum	That which isn't taught, said, or done. Can send messages to students regarding the importance (or un-importance) of content.
Experienced curriculum	The learning actually experienced by students. What the learner absorbs through their engagement. Sometimes referred to as the learned curriculum.
Actual curriculum	The curriculum which is actually carried out. Might be identical to the formal curriculum (though this is rare), and might include the hidden curriculum.
Curriculum in action	Synonymous with the actual curriculum, the curriculum actually being provided.
Latent curriculum	Synonymous with the term hidden curriculum. Latent means hidden or concealed.
Peripheral curriculum	Sometimes known as the collateral curriculum. Designed intentionally to allow students opportunities to learn about concepts, ideas, and principles peripheral to the content being directly taught. Though learning outcomes are planned, they are not made available to students. A planned form of other-than-formal curriculum.
Unintended curriculum	An unplanned lesson or learning that happens during formal curriculum delivery. Not hidden as messages may be explicit, but unintended in that it deviates from the formal curriculum accidentally.

is necessary for us to briefly detail what might be counted as the hidden curriculum (i.e., what sort of attitudes and values might be implicitly conveyed by education), and consider some of the debates surrounding the use of the term, to clarify the way in which we have conceptualised and employed the HC within this chapter.

To illustrate what we mean when we say 'HC', we are going to discuss a piece of our own research which explored how the HC of medical school impacted medical students. We have chosen to discuss this research as it illuminates the multiple and varied ways the HC manifests within medical education, without focusing on outreach specifically. We will consider how the hidden curriculum manifests within outreach activity in a later section of this chapter. We hope that by first offering a broader example of how the hidden curriculum manifests within medical school environments, understanding of the concept will be enhanced. To investigate what factors beyond the formal curriculum influenced medical students' experiences of clinical and educational settings, we conducted focus groups with 39 medical students at one UK medical school [8]. We also interviewed 14 faculty members across medical schools to triangulate our data. We found that medical students focused largely on the influence of the hidden curriculum on professionalism and professional identity development. Within their accounts, the hidden curriculum influenced professionalism and identity in a variety of ways including through role modelling, organisational culture, stereotyping, and dress code. Though students largely considered the hidden curriculum negatively, and expressed concerns that it could be leveraged by institutions as a form of organisational control, some noted that experiences of the hidden curriculum (both positive and negative) could aid identity development by helping students become familiar with professional norms, and form opinions regarding the type of professional they wished to become [8].

There are three core messages relevant to this chapter that can be gleaned from our prior research in this area. (1) The hidden curriculum manifests in a multitude of ways; (2) The hidden curriculum is often negatively perceived as a vehicle for enforcing outdated or biased professional norms; and (3) Though perceptions of the hidden curriculum are often negative, it is ubiquitous and can add value, given appropriate interpretation of the norms and values students are presented with. These findings support the research we have previously discussed but go further to illuminate the ways in which unwritten rules, values, and behaviours are communicated to learners, and how the expectation to conform to these norms is perceived. This is a critical development to the hidden curriculum concept that we will draw on within the next section of our chapter, where we consider how the hidden curriculum manifests in outreach.

How the Hidden Curriculum Manifests in Outreach

As previously delineated, we know that the hidden curriculum within medical school manifests through role modelling, organisational culture, stereotyping, and dress code. As educational events, there is a hidden curriculum—unarticulated and
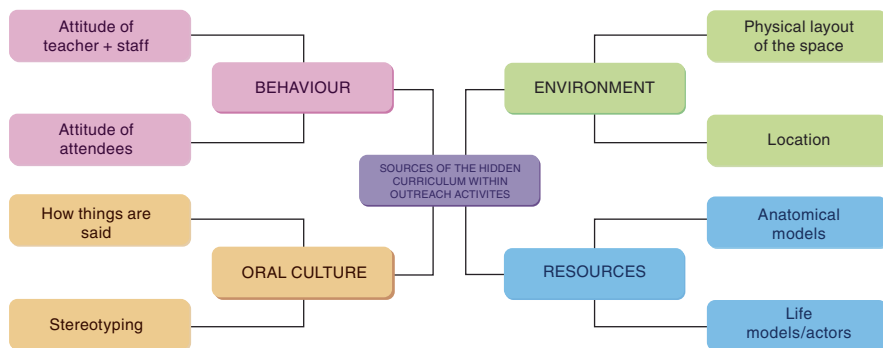
Fig. 11.1 Sources of the hidden curriculum within outreach activities

unacknowledged learning—associated with outreach activities. Yet, the context in which outreach occurs is different, and so how the hidden curriculum manifests is, in our experience, also changed. In Fig. 11.1, we offer insight as to the various sources of the hidden curriculum in outreach activities. This figure was created both through reflection on the literature in this area, and our own experiences as educators involved in outreach.

In our case studies later in this chapter, you will see these sources of the hidden curriculum in action. Here, we discuss the broad category of these sources to offer a foundation for these considerations. We have divided the sources of the hidden curriculum within outreach into behavioural sources, environmental sources, resources, and oral culture.

Behavioural sources of the hidden curriculum are what people say and do, how they act. Within outreach, the attitude (and the values and opinions this communicates) of the teacher or facilitator is critical, as are the attitudes of any associated or affiliated faculty and staff. The attitude of attendees also plays a role—though you hope that by attending an event, an attendee is interested and engaged with your outreach topic, experienced facilitators will know that attendees bring their own (often strong) thoughts and opinions on a topic that can influence other attendees and the overall delivery of a session.

By environment as a source of the hidden curriculum, we mean the physical environment (i.e. space, such as the room within a venue) and geographical location of an outreach event. How you choose to configure a room's layout tells attendees a lot about what you expect from them within a session (e.g. are the tables circular, fostering discussion amongst participants, or are they organised in rows, a style more typical of a lecture?). Further, walls talk, and it's important to consider what messages the venue your event is hosted in might send to your attendees. Within medical education, research shows that building imagery (e.g. pictures, portraits) can propagate stereotypes of how doctors should look (i.e. most imagery within medical schools has traditionally been of old, white men) [9]. Similar

considerations are important within private venues. Geographical location might also send messages about who is welcome to attend, given that some locations are less accessible than others.

Resources acting as a source of the hidden curriculum are evident within both of our case studies later in this chapter. Recent conversations regarding decolonising health sciences curricula have focused on the lack of diversity within anatomical models including cadavers, life models, diagrammatic representations, technological representations, and plastic anatomical models or simulators [10]. This lack of diversity sends tacit (but strong) messages regarding what is perceived as the norm within medicine and outreach and perpetuates underrepresentation.

Finally, we have identified oral culture as a prominent source of the hidden curriculum within outreach. Oral culture is a term most often applied to societies without a written tradition, '*in which intergenerational cultural transmission of values, attitudes, and beliefs is by word of mouth (including through myths)*' [11]. We use the term oral culture here to highlight how what a facilitator, staff, or participants say within an outreach setting can communicate values, attitudes, and beliefs. Stereotypes might be present within the examples or anecdotes provided within the session, which serve to propagate biased attitudes or beliefs.

What Are Creative Methods of Instruction?

Creative methods of instruction within outreach are particularly rich sites in which the hidden curriculum acts. Creative methods of instruction are engaging and typically offer attendees the opportunity to actively participate. Some examples of low fidelity methods utilised within science outreach include art-based approaches, for example anatomical body painting, life drawing, and low fidelity modelling of structures [12, 13]. Higher fidelity methods include sculpture, performance, simulation, or virtual reality. These instructional, or participatory methods, may involve interactions between facilitators and attendees, or between other attendees. Figure 11.2 exemplifies some of these low fidelity approaches such as clay and edible modelling, drawing, and painting.

Finn and colleagues [12, 14–23] have described numerous benefits to using creative types of instruction, such as the fun, interactive nature, the development of empathy, the educational benefits on memory when learning through the use of vivid colour, or the opportunity to diffuse the formal setting when discussing sensitive topics. However, caution must be taken not to use such creative approaches in an attempt to 'teach by stealth' [14], after all, the HC is hidden by its very definition.

Using children's reusable modelling dough, for example can afford a number of benefits—it is inexpensive, easily transported, easily cleaned up, only the clay and
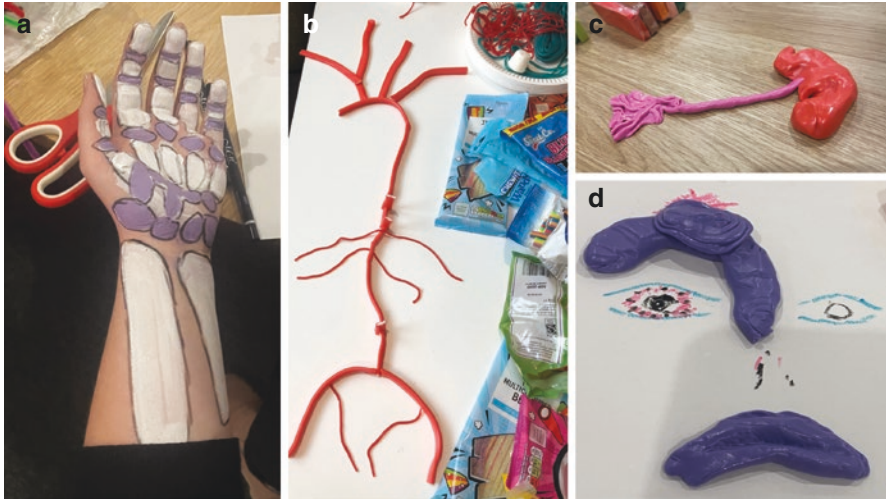
Fig. 11.2 Examples of creative approaches: (**a**) bones of upper limb painting, (**b**) edible arteries, (**c**) kidney modelling, (**d**) drawing/modelling of experiencing a migraine

Fig. 11.3 Examples of the use of children's reusable dough for creative approaches to instruction

instructions are required, the activity can be standalone too [16]. Further it can be adjusted for age and ability, and used with a range of other models or activities for scaffolding or more complex activities. Figure 11.3 depicts examples of the use of children's reusable dough.

Case Studies

We now offer two case studies in which we integrate our own experience as educators with relevant theory in this area to provide worked examples of hidden curriculum analyses. We hope that you will use these case studies to reflect on how the hidden curriculum might manifest within your outreach event, and how you might challenge any negative impact of this manifestation.

Case Study 1: Body Painting

> You are attending a public engagement event hosted by a science museum. You advertise to students to volunteer to assist, and ask for a model to have their thorax painted. The event is an interactive evening at the museum, with catering outlets open serving food and alcoholic beverages. You have paid a small fee to attend. Higher educational, health services, and industry partners have a range of activities and exhibit for you to browse at leisure. A team of medical students, graduate students, and anatomists are hosting an anatomical body painting station. You are able to participate in a hand painting activity. Paints and instruction sheets are available, as well as assistance from graduate (doctoral) and medical students. In addition, anatomists are doing a live demonstration where they are body painting thoracic anatomy on a model. While you are watching the painting, the male model is approached by other members of the audience who photograph him and touch his body without asking permission. When asked to refrain they remark, '*what does he expect, he's topless in public'*. This is in front of all participants. They continue taking their photos which later appear on social media. The event is well attended, and there is a subsequent buzz on social media when images of the activities appear.

Anatomy lends itself to science engagement events. The subject is compelling, after all—everyone has a body. Anatomy has long been considered taboo, in part due to its dark history with many anatomical discoveries being made through immorally obtained cadavers and outlawed practices. These include grave robbery, vivisection, slavery, or Nazi war crimes. It is, in part, due to this history, as well as sensitives including death, sex, and reproductive organs that are associated with anatomy, that delivery of events must be well considered and appropriately framed. There are examples where public activity, such as Gunther von Hagens, was being branded disrespectful and a 'showman' for what was perceived as an overly theatrical dissection demonstration on British television. There are a variety of potential tacit messages pertaining to respect for donors, death, and views on mortality that are inferred when relaying anatomical content—even when living anatomy is the focus.

Concerning our case study, there are many positives. Firstly, the interactive nature of the session has many benefits—it can diffuse the formal delivery of scientific content and any anxieties people might have regarding participating if they have little or no knowledge of anatomy. Secondly, the activities are fun and engaging. They spark interest and, when events go well, act as marketing tool for institutions. There are also opportunities to widen access, promote positive role modelling, and exchange knowledge.

With respect to the hidden curriculum, there are a number of potential implications. The messaging that someone might pick up with respect to consent, sharing and imagery, and touch is very important [24, 25]. In the case presented, behavioural correction is essential. Signposting the issue to the perpetrator(s), the students, and bystanders goes some way to ensure that positive behaviour is role modelled and that negative messaging does not perpetuate. The importance of respect and consent, for example, can be easily signposted in order to ensure that negative messaging does not persist. Teachable moments are possible, linking the importance of respect for models with the teachings in health professions education about respecting body donors, patient dignity, and of course the sharing of imagery. Alcohol also introduces another element, behaviours and attitudes can change for example. Team briefings detailing concerns and plans for any potential scenarios are key here. Having such plans in place helps from a practical escalation perspective, but also signposts for volunteers that their dignity and comfort are of paramount importance.

Implicit biases may be at play, these are the unconscious attitudes and stereotypes that any stakeholder in the event could be exhibiting. A male model was demonstrated upon, even though a volunteer and there may be a self-selection bias at play, outwardly there is potential for messaging that 'a male thorax is easier to deal with' and a host of other gender related implications is possible.

Case Study 2: Cardiopulmonary Resuscitation Events

You are a final year medical student taking part in a cardiopulmonary resuscitation (CPR) marathon, which will be hosted in your local supermarket, to raise money for a charity pioneering cardiac research. You are going to take part in the marathon with five other male final year medical students. You went to sign up with your female friend, but the medical student in charge of organising the event discouraged your friend from signing up, stating '*It's very physical, a CPR marathon, you need decent biceps, we don't want to fail*'. Your medical school has loaned you a Resusci Anne mannequin to use during your CPR marathon.

CPR marathons are commonly organised by medical students. Hopefully, if you have experience of these events, they are not as problematic as the case study we have outlined. Take a moment to pause and consider how the hidden curriculum relates to this case.

There are many ways in which the hidden curriculum is manifested even within the planning stage of this outreach event. Firstly, the attitude of the medical student in charge of organising the event discriminates against women—this is unacceptable, and propagates the biased view that only men are strong enough to sustain CPR efforts. This is a form of descriptive gender bias, where negative assumptions are made about women based on stereotypes [9]. During the marathon, members of the public will now only witness male medical students performing CPR, and so may also, unknowingly, adopt this view unconsciously.

Perhaps more subtle is the hidden curriculum in regard to the resources planned for use during this event. Resusci Anne is the most popular CPR doll available commercially within the UK. Two versions exist—a torso, and a full body version. If you have ever received any sort of adult life support training, you will likely be familiar with Resusci Anne. Astute readers who have experience performing CPR on this model might notice that the anatomical features of the model (which is male-presenting, given that the model does not have breasts) and the name of the mannequin (which suggests that the mannequin is a woman—indeed, the face of the mannequin was taken from the death mask of an unknown woman drowned in the river Seine, l'innconue de la Seine) are mismatched [26]. We offer an important proviso here that we are associating breasts, a biological feature, with gender, a social construct, and so would highlight that not all men will be without breasts, and not all women will have breasts [27]. We make this association as it is commonly a correct one at large within society and because of the fact that women are 27% less likely to receive CPR than men if they collapse in a public place [28]. A recent study by the American Heart Association explored possible reasons underlying this discrepancy and reported several influencing factors including the perception that breasts make CPR more challenging [29]. The use of Resusci Anne dolls which are labelled with a traditionally female-presenting name but provide only a traditionally male-presenting torso to rehearse CPR on propagates gender-based inequalities within healthcare (specifically, here, within the administration of CPR). Using a Resusci Anne doll within a public-facing outreach event communicates that men are the norm to attendees. This propagates androcentrism—where '*men are considered typical members of the human category, whilst women are deviant*' [27, 30]. Androcentrism is rife within medicine, and medical education [31], and we should be seeking to challenge this norm, rather than propagate it. There are likely to be few opportunities to challenge the presentation of the Resusci Anne doll within this case study's context—the audience are supermarket passers-by and so there will likely be little-to-no opportunities to provide information to challenge what the passers-by witness from afar. Unfortunately, as it stands, this case study within its current context risks demonstrating that the life-saving skill of CPR is best only performed on men, which may deter onlooker's future CPR efforts for those with breasts.

Considerations for Events

Beyond the hidden curriculum, there are many considerations required for outreach and public engagement events. One model, adopted form psychology, that could be useful is Maslow's hierarchy of needs [32]. Maslow's hierarchy of needs is a theory of human motivation. It states that five categories of human needs dictate an individual's behaviour. Humans are motivated to accomplish their goals. Maslow argued that achieving goals such allows humans to meet their individual wants and needs. Such needs are typically mentally prioritised in order of importance, meaning that less immediate needs have to be met before more important needs can be satisfied. Human actions are focused around meeting their low priority needs before moving on to reach high priority needs. Maslow's model is often applied to educational contexts. In Fig. 11.4, an adaptation of the model is offered in which it is framed within the context of events. The participants in the model could be any stakeholder within an event, whether they are students, members of the public, facilitators, or models. Meeting the physiological needs of an individual is the fundamental principle. Achieving the higher order needs, such as esteem, can only be achieved when such basic needs are met. Our figure proposes the relevance of this hierarchy in achieving individual and organisational goals for any event. As was exemplified in our case studies, comfort and well-being are crucial. Without appreciation of the potential impact of the hidden curriculum, the higher levels of the hierarchy may not be realised.
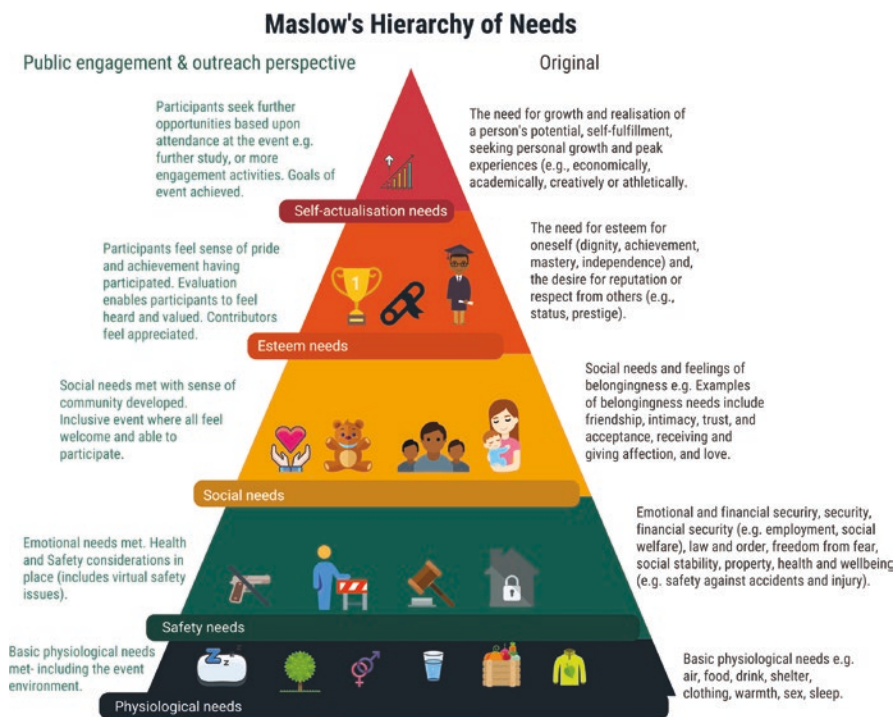
Fig. 11.4 An adaptation of Maslow's hierarchy of needs for public engagement and outreach events

Practice Points for Educators

Here we offer five practice points for educators to consider when organising and facilitating outreach and publication engagement events:

- Define your purpose, outreach or public engagement, and plan accordingly.
- Be aware of the potential hidden curriculum when planning any creative approaches—think about what tacit messaging could occur, be it positive or negative.
- Remember that the hidden curriculum is not a space in which you can teach by stealth, in part due to the fact that it could be experienced differently by everyone.
- Use Maslow's hierarchy of needs as a framework for planning activities, in order to ensure basic and higher order needs are met.
- Enjoy your events, and always remember to evaluate and reflect.

Conclusion

Public engagement and outreach are not synonymous with each other; both serve different purposes. When planning any such event, always be mindful of the potential hidden curriculum. There are a plethora of potential tacit messages that can be hidden, even disguised within the use of creative approaches and activities. Models such as Maslow's hierarchy of needs allow for a framework upon which to plan and build events—remembering basic needs right through to the need for participants to feel they belong and have achieved a level of fulfilment. Use of creative approaches can help build a sense of fun, community, and engagement but without monitoring, there is potential for mixed messaging. The best events involve a two-way process, involving interaction and listening, to achieve the goal of generating mutual benefit.

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Chapter 12
The Fabric of the Human Body

Janet Philp and Joan Smith

Introduction

The marriage between anatomists and artists is an ancient one. For centuries, the human body has been observed and dissected to allow scientists and artists to answer fundamental questions about who and what we are. We cannot think of Vesalius' landmark publication De Humani Corporis Fabrica Libri Septem (*On the fabric of the human body in seven books*) without picturing the illustrations of Jan Van Calcar. And what would Gray's most comprehensive guide to anatomy be without the pictures of Henry Carter? In a subject that has its own special language [1] to aid comprehension, a picture can save a thousand words.

The development of legislation [2] and attacks on medical schools [3] drove the act of anatomy behind closed doors in the nineteenth century. The insufficient supply of cadavers led to the creation of wax models and écorchés that could educate [4] without the continuous need for bodies to dissect. The advances in medical procedures increased the need for accurate anatomical illustrations, and Evans suggests [5] that the collaboration of artist and anatomists is now a thing of the past with the emergence of the medical illustrator.

During mediaeval times, it became popular to have memento mori, objects or art pieces that reminded people that one day everybody would die. The creation of images and objects to help us contemplate that death has continued throughout history [6]. However, in contemporary culture, death has almost vanished from our society behind the doors or hospitals [7], despite the efforts of the death

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positive movement [8]. Contemporary artists continue to find ways to question how we understand our own mortality and to explore and democratise the human body [5, 9].

In this chapter, we will look at a very niche area of this field. In true Vesalian style, we want to disentangle the fabric of the human body and present some of the people who have chosen to represent anatomical structures in fabric, wool or thread. Fabric and thread literally hold things together. Whether it is the fabric of the garments that we wear on our bodies or the thread of the nets that catch our food, textile has woven its way through human history. In fact, the authors of secret language of anatomy [1] tell us that the sheer volume of fabric related anatomical terms is remarkable. We want to look at why some artists and scientists have chosen this medium to explore anatomy engaging new audiences outwith the dissecting room.

The use of these readily accessible materials to portray the hidden wonders of the human body may also play a role in making the internal structures more accessible. Gone is the shine of the visceral elements, the odour, the remembrance of what it once was. These are replaced by the comfort of soft fabric, the reflection of beads and the display of beauty without the gore. Anatomy is often sensationalised [10] with recent displays generating controversy and concern [11]. The use of fabric softens the approach.

Identity

Historically, sewing has often been gendered: a feminine pastime, where embroidery, stitching and mending are seen as essential skills to be learned, as well as a diversion or pastime. But the use of sewing by fishermen, soldiers, surgeons and others contradicts this evocation of sewing as being simply a polite female pastime. It is a craft with a rich and complex multi-cultural history. In traditional knitting such as Aran or Guernsey jumpers [12], a pattern could be associated with a particular village or knitter, although whether the pattern could be used to identify a particular wearer (such as a sailor lost at sea) is uncertain. References to traditional cable patterns can be seen in our first two examples: the DNA scarf by June Oshiro (www.twosheep.com/helix.) *featured on the front cover of Nature Genetics in 2022* and Margaret Mills' DNA gloves and socks (Fig. 12.1).

Both Oshiro and Mills were bench scientists who incorporated the iconic design of the DNA molecule into everyday objects as a natural extension of their work. In both, the designs accurately depict the double helical structure, with the gloves showing how the two strands denature and anneal to allow the genetic material to be duplicated. Perhaps this is a more scientific development of the traditional knitting patterns. We are already seeing companies that have monetarised this development and will print a unique scarf based on your genetic material—are these the Aran sweaters of the twenty-first century?

Fig. 12.1 Denature—knitted socks showing the separation of DNA strands created by Dr Margaret Mills. This project was crated with fingering-weight wool and the pattern can be found at https://www.ravelry.com/patterns/library/denature. Her other designs can be found at https://www.ravelry.com/designers/margaret-mills

Lifting the Veil

Some art works have been produced by scientists to help them explain an aspect of the body which may be hidden due to its scale or its internality. The complexity of certain processes within the body can make them difficult to teach [13], and three-dimensional (3D) models can help in explaining these processes. The tactile softness and mutability of models made of cloth and stitch allow for them to be manipulated and handled, so enforcing the learning process both when making and handling the objects. Here theory and craft align, combining 'thinking through making' and 'making through thinking' [14]. This can be seen in the work of Sarah McConnell who has used crochet to produce a teaching tool that allows students to understand the complex procedure of embryonic folding ([15], Fig. 12.2

A video of the folding activity can be seen at https://www.youtube.com/watch?v=sqlNGr_GyMY.)

Discussing the effectiveness of the project, McConnell states, '*Not only did the model activity effectively facilitate students' learning, but students also found it to be enjoyable, reporting that the nontraditional modality and hands-on, playful approach rendered the daunting content more approachable. Thus, the crocheted*

Fig. 12.2 Complicated
embryonic folding model
created by Dr Sarah
McConnell. The individual
pieces are connected
together and folded to
represent an embryo at
week 4. The piece is 4
inches by 2 inches made
from worsted weight yarn
and a 5 mm crochet hook

medium enabled production of dynamic, reusable, affordable models that help medical students understand embryology'.[1]

Karen Norberg has created a whole knitted brain, (Fig. 12.3) a structure that is usually hidden from view, and even when seen is a uniform grey colour. Norberg's detailed model uses coloured cotton to differentiate the regions of the brain, to create a flexible brain model which can be manipulated, allowing students to appreciate the three-dimensional positioning of regions and their relationship to each other.

> *'Building a 3D model is a very good way to understand a complicated physical structure. Knitting is also very adaptable, as personal challenges go: a) interesting things can happen, even if you are a beginner; b) it is portable, inexpensive, non-toxic, easy to pick up and then put down; and c) a very ancient craft, also, I admit, it was fun to have hit on a difficult-but-feasible challenge that no one else had done before'.* Karen Norberg.[2]

Whilst McConnell and Norberg's works are aimed at anatomy students, Luca Hodgins (Fig. 12.4) and Shanell Papp (Fig. 12.5) have each used wool to make skeletal structures that explain to the general public the placement of the organs within the body. The individual parts can be moved and handled; the familiar feel of wool helps to make a difficult subject more approachable.

This is echoed by Laura Cameron (Fig. 12.6) who combines an anatomically accurate crocheted human heart with an anatomical museum style glass display dome. The human heart that would normally be contained within the dome, and therefore only available for some to see, has been replaced with a fabric object which is accessible to all.

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[1] Personal communication.

[2] Personal communication.

Fig. 12.3 Knitted brain
demonstrating many of the
different sections of the
brain which are hard to
identify on a real specimen
created by Dr Karen
Norberg. This is used as a
teaching tool at Skidmore
college

Fig. 12.4 Life size
crocheted skeleton
showing bones and major
ligaments created by Luca
Hodgins using cotton.
More of their work can be
seen at www.
anatomicalcrochet.com

Fig. 12.5 6ft tall, crocheted skeleton containing representations of the major organs created by Shanell Papp using yarn, crochet, 2004-2006. More of their work can be seen at www. Shanellpapp.com

Fig. 12.6 A life size anatomically correct crocheted heart with needle felted details, presented in a museum style glass dome, created by Laura Cameron (Lost in the Wood). More of their work can be seen at www. lostinthewood.co.uk

Not all anatomical textiles have been made to explain human anatomy to others. Sometimes the making process helps the maker understand. Daniel Lam's creations were produced to assist his own understanding of anatomy whilst training as a medical student (Fig. 12.7)

In his low-tech handmade models, he brings esoteric subject matter into the everyday, helping him to clarify and learn complex information.

Fig. 12.7 A representation of the Circle of Willis (cerebral arterial circle), the blood supply to the brain, created by Dr Daniel Lam to aid in his own medical studies. More of their work can be seen at www.masculiknity.com

Net/working

There is something about the use of fabric and thread that allows people to be drawn together, whether this is in the construction of fishing nets, the 'waulking' of wool, the weave of a tartan that signifies a family or the community work that produces large union or religious banners or quilts. When a project revolves around a skill that is held by many or is easy to learn, such as knitting or sewing, then there is the possibility for community involvement.

In 2020, Cathy Abbott and Jane Haley from the University of Edinburgh started a collaborative project to celebrate the centenary of the Cajal Institute in Spain (Fig. 12.8).

Nobel prize laureate Santiago Ramón y Cajal is renowned for his intricate drawings of neurons. Abbott and Haley envisaged a large piece constructed with embroideries of nine of his famous drawings. As the project was launched, the world entered a global lockdown due to COVID-19 and participants commenced a period of working from home, producing intricate needlework.

In the Cajal tapestry, many parts combine to make a whole. The shared experience of embroiderers, working individually but with a collected ambition, brought together a disparate community of 71 people (including artists and scientists) from across the globe. Using embroidery encouraged close examination of the detail and sensitivity of line in Cajal's drawings, as participants used stitching to replicate the drawn marks. The completed work, easily to transport and display due to its lightweight fabric, helped bring his drawings to a wide audience and gained further recognition via the front cover of the Lancet Neurology—vol 20 (12) 2021.

Another community was created by Liz Granger and Caroline Finnigan from the University of Central Lancaster in 2016 when they asked volunteers to knit body parts to create life sized models that could be handled. These were then used to teach primary aged school children about their bodies. They decided to share their pattern online so that anyone who could knit could make these teaching models, further extending the scope of the project and its aims. By using this craft, Granger

Fig. 12.8 To honour the insights of Santiago Ramón y Cajal, the Cajal embroidery project brought together 71 embroiderers from seven countries (including Europe, North and South America and Australia) to recreate nine of his iconic drawings (creating 9 versions of each), spanning an array of cell types in the brain. Participants used their own materials, which included old cotton bed-sheets, Irish linen, handmade felt, embroidery-, wool-, silk- and metallic- threads, plus beads and gauze. Final size of the 81 panel 'tapestry' will be approx. 2.2 m × 2.2 m
Top or (left to right): Paula Urrutia, Noah Stypidou, Melanie Stefan
Middle Row: Carol Coleman, Liz Ribchester, Jane Haley
Bottom Row: Alison Todd, Rebecca Devon, Janet Philp
Project coordinated by Prof. Cathy Abbott and Dr Jane Haley MBE. Full details of the project can be found at https://www.edinburghneuroscience.ed.ac.uk/cajal-embroidery-project-2020

and Finnigan were able to tap into a somewhat hidden but prolific community of knitters to help expand knowledge about the human body (https://www.ravelry.com/patterns/library/the-knitted-body-project?set=&_rfoff=1).

The Tapestry of Life

In contemporary art, there are numerous examples of artists who have used the body and its matter as an expression of what it means to be human. Artists exploring the body can choose what they wish to emphasise as, unlike in anatomical illustration, the artist's ideas and intentions dictate the direction that the work is to take.

In Marc Quinn's 'Self' series (1996 to present), the artist has made a number of casts of his head using his own frozen blood. Here, Quinn challenges the idea of art as illusion by making a self-portrait from the material of his own anatomy. By making new iterations every five years, he maps his ageing process, reminding us of his own mortality [16]. Performance artist Stelarc uses his body as an interface between the human body, technology, and science [17]. In 'Ear on Arm' (2006 to present), a cell-grown prosthesis of an ear grows on his own arm. Stelarc uses the anatomical form to explore the limits of the 'natural' body.

In both examples, the artists have found unique ways to utilise the material of their own bodies; their artworks repel and fascinate in equal measures. They tap into our basic human instincts of revulsion and morbid fascination in the body [18]. By contrast, anatomical textiles rarely engender feelings of revulsion. The materials emphasise dryness, softness and warmth, allowing artists to approach difficult subject matter in a way that can make it both accessible and reassuring. Anatomy can be, literally, 'softened' by the use of familiar materials that can be recognised and handled but artists can still use textiles to provoke us to consider other meanings within the work.

An example of this is found in Laura Bundesen embroideries which focus on the brain. Unlike Karen Norberg's representations of the brain, Bundesen's work moves away from accurate representation to express something intangible and unseen. Bundesen was commissioned to produce a piece for someone whose child had undergone a hemispherectomy at the age of 11. The piece illustrated in Fig. 12.9 shows Bundesen's representation of the missing half of the child's brain, showing something that is not seen but which expresses its thoughts and actions. The colourful, embroidered work is intentionally appealing and beautiful; it aims to reassure.

Katharina Sabernig has produced large knitted anatomical structures which confront people by questioning what is hidden inside them (Fig. 12.10). To these structures she has added models of coronavirus particles. The particles are not restricted to the respiratory pathway, perhaps suggesting that coronavirus has permeated entire beings during the pandemic. The disproportionate size between the anatomical structures and the virus hints at the way a tiny virus has dominated our lives. The 'cuddly' quality of the knitted virus somehow makes it more sinister; a wolf in sheep's clothing.

Correlations can be made between stitching in embroidery and in surgery; in both, tissues are pulled together by needle and thread using dexterity and precision. Kriota Willberg uses the form of the embroidery sampler as a framework for her oophorectomy piece (Fig. 12.11).

The sampler shows a space where an ovary has been removed and the stitches pucker the fabric like scar tissue. The void created by the removal of the ovary is implied by the alteration on the body's surface, challenging us to look internally.

Discussing her work, Willberg states, '*I create narratives of the body: its history; how it works mechanically and chemically; its structure; its connection to the mind*

Fig. 12.9 Starry Night—A brain embroidery created by Laura Bundesen to represent the half of Monica's brain missing from a hemispherectomy due to uncontrollable epileptic seizures. The full story behind the piece can be accessed at https://www.laurabundesen.com/blog. 'Starry Night' represents a brain, mapped by functions using fabric collage, embroidery thread, beads and acrylic paint 10 × 10 inches on canvas
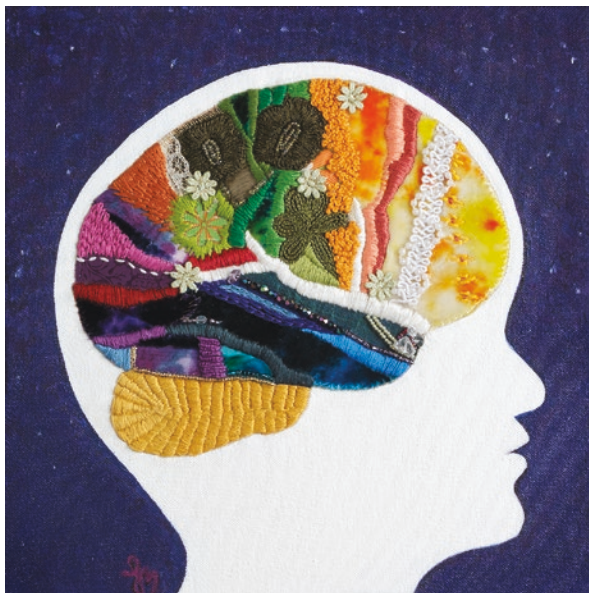

Fig. 12.10 COVID-19 and the gastrointestinal system. A knitted and crocheted piece created by Katharina Sabernig Mag. PhD, MD, showing life size internal organs punctuated with large than life corona virus structures causing us to think about the effect the microscopic virus has had on us all. More of their work can be seen at www.knitted-anatomy.at/

Fig. 12.11 Oophorectomy—a piece created by Kriota Willberg. Where the ovary has been removed on the one side, the threads are pulled together in a similar way to the actions of scar tissue on the body, prompting us to think about the internal effects of surgery. More of their work can be seen at www.kriotawelt. blogspot.com

and spirit; its erosion and destruction. Research and the development of narrative are the foundations of my practice… The imagery created in my needlework is intended to connect and intermix the emotional attachment one feels to family heirlooms, portraiture, and ephemera, with the desire for attachment and intimacy we often experience when gazing upon the clinical digital image of a beloved unborn child or a loved one's internal structures'.[3]

Similarly, Sally Hewitt's work on mastectomy (Fig. 12.12) focuses our attention on the raw scar in skin-like fabric that is stitched together like a surgical suture. Here, a dichotomy is explored: stitching as both an invasive act upon the body and a process that helps to mend and heal. The work's realism has proved challenging for some viewers. However, Hewitt demands that we look at and accept this representation of the female body as being normal and beautiful, empowering women who have undergone similar surgery.

Embedded in the tradition of sewing samplers, Cath Janes uses embroidery as a challenging, contemplative act that also allows her to express her knowledge of anatomy, gained from hands-on experience. (Fig. 12.13)

'I started stitching anatomy several years ago while recovering from surgery to help rectify my Bell's Palsy. I already enjoyed sewing but it struck me that the muscle fibres in my face could be perfectly replicated as straight stitches….. I love depicting anatomy in thread because it combines my love of anatomy and slow stitching. It also creates such tactile results. Bobbly French knots perfectly replicate fat and gland surfaces and straight stitches make beautifully lean and smooth muscles, for example. It's also a joy to be challenged to replicate uniquely biological surfaces with what can be an unforgiving medium with a limited colour palette'.[4]

All the works included in this chapter cross between anatomical learning and teaching, precision and artistic expression allowing them to be appreciated on multiple levels. Exemplified in our final piece, Janet Philp's 'A Brachial Plexus plant holder' (Fig. 12.14) it can be appreciated as a practical piece of decorative braiding, a simple demonstration of how structures can come together and separate or a complex representation of the nerve fibre plexus in the upper limb.

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[3] Personal communication.

[4] Personal communication.

Fig. 12.12 Petals—a creation by Sally Hewett prompting people to confront the reality of surgery and its effects on the body. More of their work can be seen at www. sallyhewett.co.uk

Fig. 12.13 Hand embroidery of the human heart. An intricate anatomically correct heart which hints at the glossy surface of the real organ, embroidered by Cath Janes at Kraken Kreations www. krakenkreations.co.uk. It was produced using DMC thread on calico, is on a 9-inch hoop and consists of straight and split stitches as well as French knots, often in single strands of thread
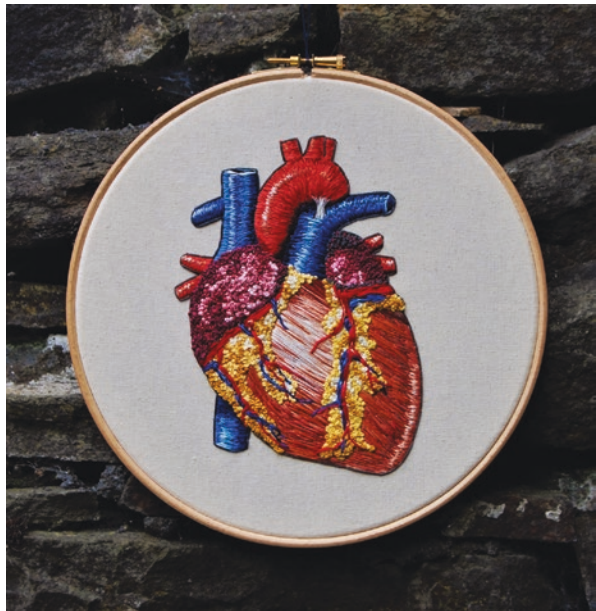
Fig. 12.14 Braided plant holder based on the brachial plexus created by Janet Philp. The construction can be appreciated for a practical piece of decorative knotting or a representation of the complex structure and distribution of the nerves of the upper limb. More of their work can be seen at https://anatomyfundamentals.com

Epilogue

In all the works discussed, the aim is to encourage people to find out more about their bodies by using even fairly basic textile craft techniques; models can be made that can help both teachers and learners analyse and explain anatomical structures. In more complex and subtle textile pieces, the properties of the fabric bring about other questions about human existence and mortality. The act of making brings theory and skilful practice together to promote an understanding of the human body.

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Chapter 13
Quilts 4 Cancer: Quilting the Chemical Sciences for Pancreatic Cancer Patients

Kirsty S. Ross and Clare Hoskins

Introduction

Pancreatic cancer has a 5-year survival rate after diagnosis of just 3.7% [1–3]. Pancreatic cancer is the 4th most aggressive cancer in the world, hard to diagnose, and is frequently discovered, at an advanced stage of development, during an emergency admission to hospital [4, 5]. Survival rates have remained stubbornly poor and there have been no major advancements in diagnosis, treatment, or prognosis in the past forty years. It is the fifth most common cause of cancer death in the UK [6] and the fourth most common in the US [7]. 80% of patients diagnosed with pancreatic cancer will die within a year of diagnosis. Chemotherapy is one method of treatment that frequently leaves patients feeling cold. This observation of patient experience became the inspiration for our project.

Every day, chemistry researchers across the United Kingdom (UK) and Ireland are working relentlessly to identify new technologies and treatments to battle this disease. However, the Royal Society of Chemistry's 'Public attitudes to chemistry' survey discovered that, when the public are asked to describe a chemist, they frequently describe those working in pharmacies [8]. This survey was the first national, in-depth study on how the UK public thinks and feels about chemistry, chemists, and chemicals [9]. It also revealed that people were interested in finding out more about chemistry, especially how it relates to their everyday life, although overall interest in and engagement with chemistry was low [10]. This is likely due to the

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Quilts 4 Cancer – Logic Model

Situation	Priorities	Aim	Quilts 4 Cancer: To bring together quilters and chemistry researchers to create research-inspired quilts for pancreatic cancer patients					
				Outputs			Outcomes - Impact	
		Inputs	Audience or participants	Activities	Outputs or direct products	Short term Learning	Intermediate Changing action	Long term Changing conditions
Patients undergoing chemotherapy for pancreatic cancer are frequently cold during their treatments. General knowledge of pancreatic cancer signs and symptoms is low. Knowledge of chemistry research in UK and Irish Universities into new diagnostic and therapies for pancreatic cancer are also low.	• Provide quilts for pancreatic cancer patients to keep them warm during treatment • Provide a novel opportunity for chemistry researchers to share their work with the wider world • Provide quilters with a novel source of inspiration for their quilts, whilst also improving their knowledge of pancreatic cancer signs and symptoms	• Funding for consumables, events, and travel • Time (researchers) • Time (quilters) • Time (project leads) • Online platforms for hosting virtual info session • On site venues for meetings with quilters • Scheduling tools for digital content on social media	**Participants** • Quilters • Chemistry researchers studying pancreatic cancer • Chemistry Clinic staff and students, Strathclyde **Audiences** The wider crafting community Pancreatic cancer patients	• Develop products, curriculum, resources • Deliver content and services • Conduct workshops, and meetings • Train • Counsel/ Advise • Facilitate • Creation of images inspired by chemistry research • Creation of a booklet combining all submitted images, along with information about pancreatic cancer signs and symptoms • Posters of pancreatic sign and symptoms made by the Chemistry Clinic at Strathclyde • Online sessions for quilters to find out more about the project and how they could contribute • On site visits to quilting workshops from Dr Hoskins • Exhibitions of the completed quilts in Scotland and London	• Logic models • Individual inspiration images • Posters of pancreatic cancer signs and symptoms • Booklet of collated resources • Evaluation postcards for participants and audiences • Social media channels • Quilts for pancreatic cancer patients • More confident researchers • More connected researchers • Evaluation report of impact of project for funders	• Pancreatic cancer patients are warmer during their chemotherapy • Public have increased knowledge of pancreatic cancer signs and symptoms • Public have increased knowledge of chemistry research into pancreatic cancer • Researchers have learnt a novel mechanism for engaging others with their research • Researchers have built connections with others outwith academia	• Increased follower counts for the social media channels • Researchers continue to engage the public with their research • Researchers engage in other forms of engagement and impact • New connections outwith academia have led to other forms of impact	• Increased awareness that researchers are people too! • Increased understanding of chemistry • Recognising signs and symptoms of pancreatic cancer in friends or family members, leading to swifter treatment • Increased investment in pancreatic cancer chemistry research
		Assumptions **To be checked!**				**External factors**		
		• Researchers will want to participate in the project • Quilters will respond to the inspiration material • Quilters can afford to be involved in the project, from a financial or time perspective • Hospitals can accept quilts for vulnerable patient				• Project reliant on receiving external funding • Reliant on sufficient material supplied by time-poor researchers • Quilters have time to get involved • Unforeseen circumstances		
		Monitoring				**Evaluation**		
		Number of researchers involved, number of quilters involved, quilts made, number of attendees at events, where quilts are distributed, social media metrics				Evaluation postcards for exhibition attendees, evaluation postcard for participants		

Logic Model adapted and modified from UW Extension (2003). Program Development and Evaluation Logic Model. Available at: http://www.uwex.edu/ces/pdande/evaluation/pdf/LMHvent.pdf (Retrieved 6/22/2013)

Fig. 13.1 Logic model for the Quilts 4 Cancer project [11]

finding that most people struggled to think of chemistry beyond their school days. This lack of an emotional connection to chemistry and knowledge of the chemists behind the research was something that we wanted to change through the delivery of our project

To plan the project, we used an outcomes-based approach called logic modelling. Logic modelling enables you to work backwards from what you are seeking to change (the outcomes) to identify the resources, activities, and audiences that will be needed to obtain your desired outcome(s). It also allows you to surface any assumptions that you may be making, alongside external factors that could affect the progress of the project. Evaluation and monitoring are embedded into the process. Please see Fig. 13.1 below for a summary of our logic model [11]. The logic model enabled us to plan our project systematically, whilst also leaving sufficient space for serendipitous outcomes.

Methodology

To successfully deliver the project, it was necessary to recruit two groups of participants: chemistry researchers working in Higher Education Institutions (HEIs) studying pancreatic cancer; and those with an interest in quilting.

Recruitment of Researchers

Our researchers were primarily recruited directly by our subject matter expert, Dr Hoskins. These researchers worked at five Higher Education Institutions (HEIs) across the UK and Ireland, namely University of Glasgow, Keele University, Robert Gordon University (RGU) Aberdeen, University of Strathclyde, and Ulster University, as well as ClinSpec Dx, a spinout from the University of Strathclyde, now known as DxCover Ltd. We also received permission from the Royal Society of Chemistry (RSC) and the charity Purple Rainbow to incorporate their logos into the project. All researchers were invited to provide a simple image based on their research, which was then used to create A4 summaries suitable for public consumption (Fig. 13.2).

These images were combined with information about the signs and symptoms of pancreatic cancer into a downloadable booklet that we distributed via our social media channels [19].

Recruitment of Quilters

Our original plan for the project involved Dr Hoskins delivering in person talks about the research and the project to quilting groups. However, the COVID-19 pandemic hit and prevented all on site events until the very end of the project. It became necessary to switch to a purely online format. We were heavily reliant on social media and word of mouth to spread the word about the project. We had a Facebook group (https://www.facebook.com/Quilts4C) and Instagram channel (https://www.instagram.com/quilts4cancer/), however we found that the most effective mechanism for reaching quilters was via our personal Tweets about the project. We also partnered with Fun Palaces Scotland to run an online Fun Palace in October 2020. Fun Palaces aim to spread the word that '*everyone an artist, everyone a scientist*'

Name of researcher(s)	Reference associated with their submitted image
Matthew Baker and Alexandra Sala	(12)
Bridgeen Callan	(13)
Lynn Dennany	(14)
Ross Forgan	(15)
Clare Hoskins	(16)
Clare Hoskins and Adeolu Oluwasanmi	(17)
Paul Kong Thoo Lin	(18)

Fig. 13.2 Sources for pancreatic cancer chemistry research inspired images.

[20]. To minimise barriers to involvement in our Fun Palace, we offered to provide free materials by post to those unable to make it to their local fabric stores or facing financial barriers to their involvement. Each pack contained sufficient fabric for a 12" square, as well as additional pieces of cotton fabric for creating applique designs.

Evaluation & Monitoring

To make evaluation as simple as possible, we designed two postcards for use at our events. One was based on the RSC 'Public attitudes towards chemistry' survey and consisted of a subset of the questions most relevant to our project [9]. This card was designed to be used before and after members of the public visited our exhibition to measure changes in attitudes (Fig. 13.3). It also ensured that pre- and post-visit answers were physically linked together. The data was plotted as individual data points before and after the visitors attended the exhibition. A two-tailed paired t-test was performed using GraphPad Prism version 8.0.0 for Windows (GraphPad Software, San Diego, California USA, www.graphpad.com) and individual values were plotted.

The second card was aimed at those who were directly involved in our project (researchers, quilters, longarm quilters, charities) who attended our final exhibition at the Technology and Innovation Centre, University of Strathclyde, Glasgow. It

Fig. 13.3 (**a**) Pre-survey for exhibition visitors (**b**) Post-survey for exhibition visitors

b

Quilts for Cancer: Post-event survey

Please circle your response to each statement

	Strongly disagree 1	2	3	4	5 Strongly agree
I believe chemistry plays an important role in medicine	1	2	3	4	5
I am aware of the signs & symptoms of pancreatic cancer	1	2	3	4	5
I believe chemists can help pancreatic cancer patients	1	2	3	4	5
I believe chemistry is unnatural	1	2	3	4	5
I believe chemists make a valuable contribution to society	1	2	3	4	5
I believe chemists are unapproachable	1	2	3	4	5
I believe chemists are compassionate	1	2	3	4	5
I believe that chemists don't care about patients	1	2	3	4	5

Do you have any comments you'd like to share with us?

University of Strathclyde   University of Glasgow   DXCOVER   ROBERT GORDON UNIVERSITY ABERDEEN   Keele UNIVERSITY   Ulster University

Fig. 13.3 (continued)

was designed to capture anonymous demographic information about those who took part as well as qualitative feedback on their experience during the project (Fig. 13.4).

Both evaluation cards are available for reuse online [19]. Visitors were at liberty to take part in our evaluation process and experienced no detriment should they decline to provide feedback. As no individually identifiable information was collected, ethical approval was not sought.

Submission of Quilts

Quilts were submitted by post or dropped off in person. These came in a variety of forms: completed quilts, including quilting and binding; quilt tops, without backing, quilting, or binding; and individual quilt blocks ready to be assembled into quilts. These quilts came from across the UK and Ireland. Those that were submitted as quilt blocks were assembled by Dr Ross into aesthetically pleasing quilt tops. These tops were then submitted to Dastardly Line, a micro enterprise in Glasgow who specialises in digital longarming (quilting tops, batting, and backing together on a large frame). Dastardly Line also created a bespoke digital quilting pattern based on the Royal Society of Chemistry logo. Once quilted, they were returned to Dr Ross who bound them and added Quilts 4 Cancer labels to the back.

Fig. 13.4 Quilts 4 Cancer feedback cards for participants

Exhibitions

Although COVID-19 made in person visits impossible during lockdown, we experienced a narrow window of opportunity in late 2021 which allowed us to mount two exhibitions with the completed quilts. The first was at the Scottish Event Campus (SEC) in Glasgow as part of The Creative Craft Show in October 2021. The second and final exhibition was held in the Technology and Innovation Centre at the University of Strathclyde, Glasgow in November 2021. Quilts were mounted vertically on boards to enable visitors to examine the quilts at close range.

Results

Monitoring Impact of the Project

Using Dr Ross's Twitter statistics, content about Quilts 4 Cancer reached the timelines of 31,805 people from October → November 2021 and 1136 individuals were motivated to engage with the content (by liking, commenting, retweeting, or clicking on the content or user profile). In addition, those who liked the Facebook page grew from zero in October 2020 to 63 in November 2021 and on Instagram from 0 to 91 in the same timeframe. Twitter was a much more effective platform for communicating with our audience. The above numbers are extremely likely to be an underestimate of the overall reach of the project.

The two exhibitions, at The Creative Craft Show and at the University of Strathclyde involved the display of all the completed quilts in one place. The Creative Craft Show was relatively quiet due to the lingering impact of COVID-19, but we still managed to interact with more than 500 individuals over the course of the four days of the event. The University of Strathclyde event was restricted to those who had contributed to the overall success of the project, and we had 40 guests in attendance.

We also took part in the Fun Palaces weekend in 2020. We received one request from Perth and Kinross Library Service for 50 fabric packs to hand out to their users. We were also invited to record a Fun Palaces TV spot, which was shared on their Facebook page [21]; join Lesley Goodburn, the founder of the charity 'Purple Rainbow', on her podcast [22]; and invited to write a blog post for the Stitching Together Network [23]. Lauren Evans, Dr Hoskins's PhD student, also happened to be a Guide Leader out with Glasgow and so we also provided her and her Guides with an additional 50 fabric packs.

Completed Quilts

We received the equivalent of 16 quilts over the course of the project, more than we were expecting. These quilts can be seen in Fig. 13.5 below:
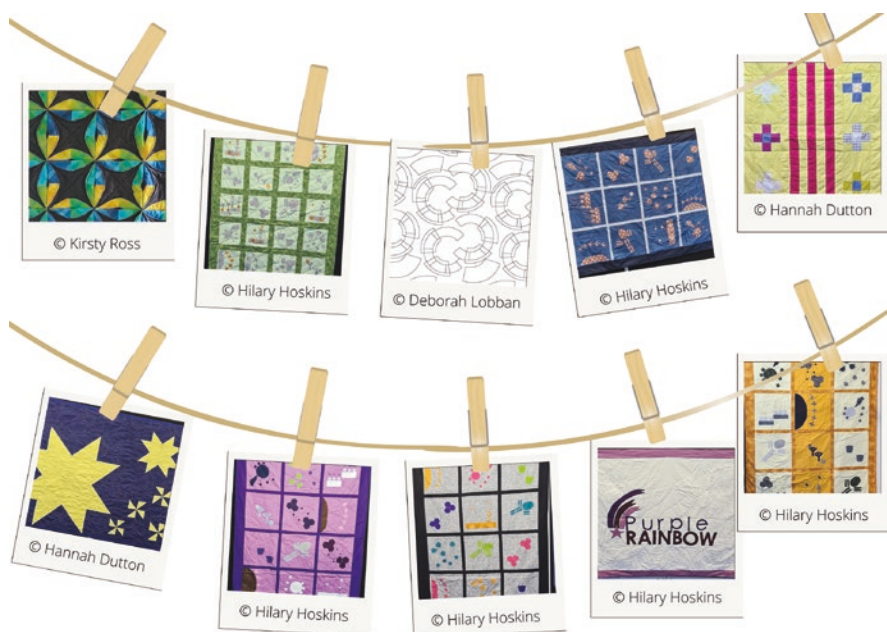

Fig. 13.5   Completed quilts submitted to the Quilts 4 Cancer project

We also benefited from support from the Chemistry Clinic staff and students to create informational posters that were printed on fabric and accompanied our exhibition. This provided our audiences with additional information about the signs and symptoms of pancreatic cancer.

Evaluation Results

At the Creative Craft Show, we kept a tally of those that we engaged with over the course of each day. This included those who stopped and looked but did not speak to us (aware); those who spoke briefly to us (interested); and those who engaged for an extended period and were willing to fill out our evaluation cards (engaged). Of the 500+ individuals, we interacted with at the event, 12.4% completed our evaluation card. 87% of those we interacted with were women. We received several unprompted qualitative comments from our visitors. These are summarised in Fig. 13.6 below.

In addition to the qualitative comments, we were absolutely delighted with the quantitative results from our feedback cards. As shown in Fig. 13.3a, b, we asked our visitors identical questions before and after they engaged with us and the exhibition. As shown in Fig. 13.7, there was a significant positive change in response to most questions when the pre- and post-responses were compared using a two-tailed paired *t*-test. Those questions with responses that did not change after the event were strongly negative questions (I believe chemistry is unnatural, I believe chemists are unapproachable). The respondents strongly disagreed with these statements before viewing the exhibition and continued to disagree afterwards.

Those who attended our final exhibition in the Technology and Innovation Centre were predominantly active participants in our project (i.e. funders, researchers

Fig. 13.6 Word cloud of qualitative comments from visitors

Quilts 4 Cancer Audience Evaluation
The Creative Craft Show, 14th-17th October

Visitors were asked to complete an evaluation card before they examined the Quilts 4 Cancer exhibition. The cards used a subset of questions from the RSC 'Attitudes to chemistry survey'. Visitors then answered the same questions once they had seen all the quilts and spoken to those on the stand. These results represent their responses before and after visiting the exhbition. 3 questions showed no change before and after; those questions were negative statements about chemists, and the audience strongly disagreed with them before and after visiting the exhibition.

Fig. 13.7 Individual responses pre- and post-visit to our exhibition at The Creative Crafting Show, Scottish Exhibition Centre

Fig. 13.8 Word cloud of qualitative comments from participants

contributing images, or those who crafted the quilt responses). The response rate to our evaluation cards was 44%. 90% of those who attended were women or girls. Figure 13.8 below is a word cloud of the qualitative comments we received from those who actively participated in our project.

Finally, we offered the guide group the opportunity to design a badge for the Quilts 4 Cancer project. The winning design was made into a woven badge and presented to each Guide as a thank you for their involvement in the project.

Discussion

This project fully met our original aims and exceeded our expectations. Our objectives were to raise awareness of chemical research into pancreatic cancer; inspire quilters with that same research, as well as raising awareness of pancreatic cancer symptoms; and to keep patients with pancreatic cancer warm during their treatments with the resulting quilts.

We recruited 11 researchers who were able to provide 15 different images relating to their research. Those images were used by 33 quilters, from Girl Guides to retired women, to create quilts or individual quilt blocks. Our original goal was 6 quilts by the end of the project, so we were absolutely thrilled to collect 16! It demonstrates the kindness and willingness of our quilters who were very impressed by our project. We established Facebook and Instagram accounts to invite people to find out more and share the progress of the project. This resulted in individuals from across the UK getting involved in the project.

Our communication about the project was predominantly through online channels such as social media (Twitter, Facebook, Instagram), pre-recorded broadcasts (Fun Palaces TV), and podcasting (Purple Rainbow, RSC). We were featured in the local press (Glasgow Times) and institutional blog posts. On the downside, we were unaware that you are unable to gather social media data from your personal accounts that is more than 6 months old without paying external parties for that historical data. This is definitely a learning point for future projects!

Our original plan was to travel to in person quilting groups around the UK to talk about the project and our key messages about chemistry. The pandemic rapidly put paid to those plans! Our pivot to online delivery and communication successfully overcame this barrier and enabled us to reach our target audiences. We had not planned to engage with young people, as quilters tend to be working age and retired women, but involving a guide unit allowed us to reach an even younger audience. This was amazing and, based on their feedback, it may inspire the next generation of chemists. It is extremely common for a crafting related project such as this to be dominated by women and girls. It would be an interesting follow up to the project to investigate mechanisms to broaden the reach and involve more men, boys, and those who do not identify with binary genders in the project.

We released the quilt pattern inspirations in November 2020 during Pancreatic Cancer Awareness Month and used Facebook advertising to increase the impact of the launch. This allowed us to integrate our message into the narrative in social media. We brought all 16 quilts together during Pancreatic Cancer Awareness Month 2021 at the Technology and Innovation Centre as a bookend to the launch. We had attendees from Girl Guiding Scotland, the RSC, Cancer Research UK, Pancreatic

Cancer UK, Purple Rainbow as well as the scientific community, quilters, and pancreatic clinicians.

We worked closely with a micro enterprise to create a digital, edge to edge (E2E) quilt design based on the Royal Society of Chemistry logo that was used to quilt 6 out of the 16 quilts. We piloted creative evaluation methodologies, from online surveys to postcards and received highly detailed feedback and complementary feedback from our quilters and those who attended our exhibitions. We used a subset of questions from the RSC 'Attitudes towards chemistry' and saw statistically significant improvements in the scores in our post-event evaluation. These evaluation tools are now publicly available on Dr Ross's Figshare for others to use. The original data is available on request.

On a more personal note, it is hard to put into words the emotional impact that a project like this can have. We are giving hope to people who have had family members suffer, die, or who are currently undergoing treatment for pancreatic cancer. Meeting face-to-face meant that we heard how devastating the disease is to families, how they felt that nobody cared or was actively working towards a brighter future, and how they really valued our project. One week before our final exhibition, we received a Facebook message from a lady in Canada (her father is currently undergoing treatment for pancreatic cancer). She asked if she was eligible for a quilt as her father had lost so much weight and couldn't keep warm. This was very emotional for us and confirmed that our assumptions about quilts and treatment were accurate. We sent the lady the album of quilt pictures so he could pick his favourite, which just so happened to be the quilt that Dr Ross made! This quilt, along with a box of Scottish shortbread, was posted to him and we were delighted and moved when we subsequently received a video of her father receiving the quilt. The remaining quilts are being distributed via a Glasgow based pancreatic cancer surgeon and the Purple Rainbow organisation in Staffordshire, for those patients currently undergoing treatment or palliative care. Lastly, we would like to thank all who devoted time and energy to supporting our project as it would not have been possible without their help.

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Chapter 14
Reframing Heritage Delivery and Engagement

Kirsty Earley and Ross McGregor

Introduction

Change is an inevitability of life feared by some and welcomed by others. For heritage institutions, change is a fine balance of communicating history in societies that are constantly evolving. It is essential for heritage delivery and engagement to be reviewed and reframed in order to ensure that stories are told to their fullest, rather than through a single restrictive lens.

The past two years, since 2020, have seen incredible challenges for the cultural sector. The COVID-19 pandemic resulted in national lockdowns, in the United Kingdom, a decline in travel and tourism, and ultimately a decrease in visitor footfall. In addition to this, heritage institutions were facing calls to address structural racism, inequality, and discrimination within their collections, influenced by the death of George Floyd and the subsequent Black Lives Matter protests [1].

This chapter will review the development of heritage delivery and engagement at the Royal College of Physicians and Surgeons of Glasgow (RCPSG) from March 2020 to the present day, highlighting changes in digital activity in response to the COVID-19 pandemic and issues of Equality, Diversity, and Inclusion (EDI).

Digital Change

Every sector is impacted by and benefits from the presence of digital technology. This has never been more evident than during the initial stages of the COVID-19 pandemic, where museums across the United Kingdom were affected financially by

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government restrictions and limited visitor footfall. What once was a debate is now non-negotiable; museums and heritage institutions alike need some form of digital presence, not only for public engagement, but for relevance.

The start of 2020 presented museums and galleries with a unique challenge; how to stay open when everything shuts down. For some this would prove very difficult, near impossible, with 90% of heritage institutions worldwide closing within one month of the pandemic [2]. Many institutions in the United Kingdom were impacted financially; some were able to benefit from government furlough schemes, whilst, unfortunately, others were not able to return to work again [3].

For those that were able to remain open in some capacity, engagement became fully digital, the authors included. With entire countries under lockdown restrictions, it was only natural for cultural institutions to either increase their pre-existing digital presence or try to establish one [4]. Digital activities included, but were not limited to, increased sharing of digitised collections via social media channels, the creation of virtual museum tours, and the production of virtual event programmes [5]. This surge in digital products made museums more accessible than ever before, becoming an important respite from the stresses of the pandemic [6, 7]. However, an increase in online digital collections has highlighted the need for and challenge of accessibility and inclusion within collections [8].

With financial support through funding schemes provided by Museums Galleries Scotland (MGS), the online presence of the College's heritage collections has multiplied and has been a key aspect of our outreach and engagement for several years. From 2017 to 2019, the College undertook a project through MGS to digitally visualise the heritage collections and shared the outcomes of the project through a series of public engagement events. Products created during this project included three-dimensional (3D)-scanned digital models, two-dimensional (2D) animations, augmented reality (AR) and virtual reality (VR) experiences, and even a Minecraft model [9, 10].

This digital work was of course impacted by the COVID-19 pandemic with the College closing in March 2020. However, activity did not cease entirely, but instead adapted to the uncertain times. We were able to utilise digital products that were created previously of which we had a plentiful supply. These products proved to be a valuable resource; instead of having to create digital products in response to the pandemic closures, we were able to build on the resources that were already there.

In this chapter, we will focus on three strands of digital work carried out by the heritage department during the COVID-19 pandemic: bitesize videos, digital exhibitions, and virtual events.

Bitesize Videos

The initial stages of lockdown in the United Kingdom saw restrictions being placed on the lives of every resident. Individuals were asked to stay at home, only allowed to leave if it was essential, for example to go food shopping or to seek medical

assistance. Thus, one of the only means of connecting with communities and the outside world was through social media.

There was a considerable increase in social media usage during the early stages of the pandemic. Twitter gained a record number of users as a result of global lockdowns, as did Facebook and TikTok [11, 12]. Online social interactions became the major source of public engagement for cultural institutions worldwide. Akin with other institutions, our social media activity increased, predominantly on Twitter, where we shared tweets and threads showcasing key items from our heritage (Fig. 14.1).

Hashtag trends on Twitter were particularly popular during the initial lockdown periods, with museums across the world inviting their audiences to engage with and even contribute to their heritage [13, 14]. One such hashtag was #MuseumFromHome, which was initiated by museum freelancer, Sacha Coward, as a way to bring culture to the home [15]. The challenge of this trend was to share stories of heritage and culture through short videos that could be used as online learning resources for home-schooling. In response to this trend, we created a series of short 'bitesize' videos covering several stories and themes of the College's heritage, including Joseph Lister's discovery of antisepsis and William Macewen's first successful removal of a brain tumour in history (Fig. 14.2).

Although originally posted on Twitter, the collection of bitesize videos was collated to form a digital exhibition on the College's heritage website. This would become one of several digital exhibitions created as part of the College's refreshed digital activity.

Digital Exhibitions

With government restrictions forcing museums to close their doors, and ultimately close access to physical collections, many turned to digital to display their exhibitions. Once an added bonus, the digital exhibition is now a staple practice for museums, enabling them to remain accessible to audiences and relevant in a technology-driven world [16].

Although a selection of digital exhibitions was available on the heritage website prior to the pandemic, the production of digital exhibitions was not as regular a practice. Over the course of the past two years, 8 new digital exhibitions have been created and published on the College's heritage website. Exhibitions were developed using the Omeka web-publishing platform, each containing several webpages focusing on different aspects of the exhibition theme, as well as images, videos, and visualisation products to accompany text (Fig. 14.3).

One example is the digital version of the College's 2021 annual physical exhibition, 'Words of Hope and Kindness'. This exhibition was inspired by the words of the College's founder, Peter Lowe, who wrote of hope and humanity being his motivators to improve standards of healthcare in sixteenth century Scotland [17]. The aim of the exhibition was to give voice to members of the healthcare community and
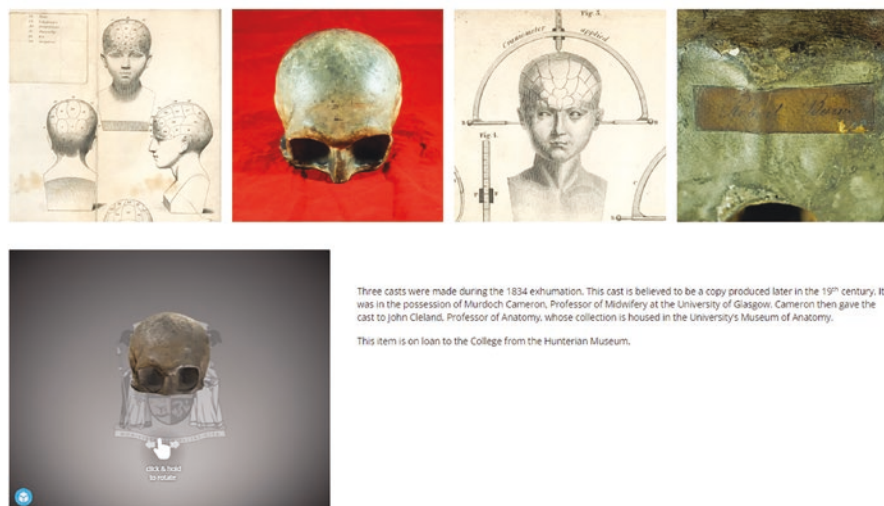
Fig. 14.1 Example of a twitter thread showcasing heritage collections

Fig. 14.2 Selection of bitesize videos available on the heritage website

Fig. 14.3 Example of visualisation content in a digital exhibition

highlight moments of hope they had experienced during the pandemic. This form of crowd-sourcing has been adopted by cultural institutions worldwide to record the response of different communities to the pandemic [18, 14]. Donations included books, inspirational quotes, and even a teddy bear and were all digitised for incorporation into the online version of the exhibition.

The digital exhibitions have been well-received by the College community along with its wider public audience, being ranked within the top 10 best UK online museum exhibitions by Museum Crush in May 2020 [19]. Although digital exhibitions cannot replace the experience of attending a physical exhibition, they can act as an easily accessible resource available to more audiences. The challenge in the post-pandemic world will be to continue the production of digital exhibitions alongside the return of physical in-person exhibitions, especially in a sector that has limited financial resources [6].

Virtual Events

Another strand of our heritage activity that had to be transferred to the digital medium was the outreach programme.

The heritage team at the College has collaborated with a wide range of professionals from different specialties over the years and decided to celebrate these relationships through the release of a new heritage podcast, 'Body of Work' [20]. Each episode featured conversations with one of these professionals focusing on their career, how they came to be in their chosen profession, and how they had interacted with the College's collections. Episodes of the podcast had been scheduled to be released from September 2020 and quickly became incorporated into our digital outreach programme.

Alongside the podcast episodes ran a series of virtual events hosted by the heritage team at the College. Although originally planned to be in-person events, COVID-19 restrictions forced us to carry out the programme online via Microsoft Teams and thankfully planned collaborations could continue. A virtual tour of the historic College building, part of which was designed by Glasgow architect John James Burnett, was produced and released for Glasgow Doors Open Day 2020. This annual festival encourages residents to explore the buildings of Glasgow and adapted to COVID-19 concerns by allowing institutions to open their digital doors for excited visitors [21]. As of 2022, part of the festival remained virtual as businesses see the benefit of keeping digital options open post-pandemic [22]. This allowed those buildings taking part to reopen their physical doors whilst encouraging continued digital creativity.

2020 was a year of change for museums and cultural institutions alike. Change was required to adapt to the barriers put in place during the COVID-19 pandemic. Heritage stories had to adapt not just in format, but also in content and scope.

Reframed—Conversations about Heritage and Inclusion

During 2020, the RCPSG programmed a monthly series of events titled 'Reframed—Conversations about Heritage and Inclusion'. The aim of these events was to reveal the College's heritage collections in new ways—reframing the organisation's

heritage to address issues of equality, diversity, and inclusion. The #MeToo movement and increased profile of Black Lives Matter campaign following the murder of George Floyd in 2020 hugely increased the volume of discourse in the cultural sector relating to inequalities and inclusion. In the United Kingdom particularly, the public debate around addressing historical inequalities often took centre stage, in both populist and liberal commentary [1].

While the RCPSG's Reframed programme was influenced by this surge in public debate about race and gender equality issues, and the impact on museum activism [23], its 'Heritage and Inclusion' programme was conceived in 2017 when it elected its first female president in its (then) 418 year history.

So why did this singular jolt of equality cause us to reframe our heritage at RCPSG?

Inequalities exist in every aspect of society, in every period of history. Institutions are often built on foundations of inequalities and exclusion, and they play a role in the structural inequalities of society. While we celebrate RCPSG's great history, we also accept that it is an organisation founded on white, male privilege. Prestigious institutions often cultivate exclusion through the establishment of their identity and their sense of authority. Heritage has a complex role to play in this. Anciently established institutions have often used their heritage to create prestige and exclusivity as part of their identity, and as part of their brand. The RCPSG has been doing this since its very early days in the 1600s when it began to use its 1599 Royal Charter to distinguish, promote, and protect itself. In the Victorian period, the idea of prestige was amplified further by the value placed on antiquity, whether real or imagined.

In initiating our Heritage and Inclusion programme, we first had to step back from our organisation's established practice, and look in from the outside. In other words, we had to reframe our view of the heritage we work with every day. To really address inequalities, we have to change the way we think, talk, and act regarding our heritage. The Reframed series of events was a start in this process.

Conversation and Collaboration

Conversations about heritage and inclusion help change the way we communicate heritage, interpret it, and engage people with it. In other words, it will lead to changes in heritage practice. As a small, specialist museum (and archive and special collections library), we see great value in taking a collaborative approach to our heritage and collections. Collaboration helps open up the questions and stories in our collections, engaging with different viewpoints outside of the RCPSG, and opening up opportunities for how people interact with our heritage in ways that otherwise would not be possible. This approach is even more essential when tackling historical inequalities that collections reveal, or sometimes do not reveal.

The Reframed series began with two events that challenged perceptions of two of the most celebrated figures in the RCPSG's history—Joseph Lister and David Livingstone. While Lister's massive contribution to medical science will always be celebrated, we wanted to have a conversation about his outspoken opposition to

women's access to surgical education. Discussing the legacy of this exclusion with two leading female clinicians working at the Glasgow Royal Infirmary, where Lister developed his famous antiseptic practice, was essential to make the conversation relevant. While rooted in the exclusion of women from surgical education in the nineteenth century, the event also connected this legacy to inequalities in twenty-first century surgery.

In the event about David Livingstone and the white saviour complex, we were joined by Zandra Yeaman, activist and campaigner with the Coalition for Racial Equality and Rights (CRER) and Curator of Discomfort at the Hunterian Museum, University of Glasgow. This discussion focused on how heritage organisations can address the racism that is embedded within society, collections, and knowledge. The change in practice emerging from the conversation informed new displays and interpretation, enabling better engagement with Livingstone's legacy for clinicians in Malawi and Zambia.

A History of the First South Asian Licentiates

Part of the 'Reframed' approach is to shift the focus of the stories we tell in our heritage. For example, in the above examples we reframe the familiar stories of figures such as Lister and Livingstone, addressing EDI issues relevant to their histories and to contemporary medicine. A further shift is to change the focus of the heritage itself. Which heritage do we focus on? Whose heritage do we ignore?

In 2021, the RCPSG was invited to participate in the project 'EDI in Scottish Heritage', hosted by the University of Strathclyde in partnership with Museums Galleries Scotland (MGS), and funded by the Arts and Humanities Research Council (AHRC). 'EDI in Scottish Heritage' aimed to create new opportunities for young people of colour in Scotland to engage with heritage organisations, and to build capacity in anti-racist approaches to heritage.

The RCPSG's placement project focused on researching the first doctors from South Asia to be licensed by the College in the nineteenth century. We were aware that our archives recording College licentiates in the nineteenth century, the licentiate registers, included names from South Asia. These registers contain the names of doctors who passed College examinations, allowing them to hold post-nominals and practice medicine and/or surgery. However, the licentiates from South Asia had never been recorded in any published College history, and we were unaware of any research into these doctors. This results in a significant gap in our knowledge of the College's nineteenth century history, particularly in relation to its emerging global community. It is also an omission in our heritage—how we interact with that history, provide access to it, and engage audiences with it. This is particularly relevant given that in 2021, approximately 30% of the College's international membership was based in India and Pakistan.

The research carried out by the project's placement student was an invaluable start to addressing South Asian doctors' exclusion from the organisation's heritage.

It established a timeline and profiles of the first doctors from South Asia to be licensed by the College from the 1870s. This allowed us to begin to tell their story, and the story of the College's connection to South Asian doctors stretching back 150 years.

This initial research was integrated into a Reframed event—one of the project's agreed outputs. The event provided us with an opportunity to connect the research with the RCPSG's current community of South Asian doctors. As a digital event, we were able to schedule it at a time accessible to audiences in South Asia, as well as editing, recording, and captioning the event for YouTube. The event also featured contributions from South Asian doctors at different career stages, in addition to the placement student (who was a medical student). These contributions linked the historical issues of exclusion, such as racism and empire, with contemporary issues of medical migration and racism in the NHS.

The project was limited in time, resource, and scope, but allowed us to make a marked shift in focus across our understanding and knowledge of our history, and in our heritage practice and engagement.

Conclusion

Since 2020, the RCSPG has been actively reframing its heritage delivery and engagement. The embedding of digital visualisation practice from 2017 to 2019 helped lay the groundwork for a more agile and flexible approach to medical heritage [10]. This chapter has shown how increased, multi-faceted digital delivery, together with the shift to inclusion-focused practice, can ensure medical heritage remains relevant and engaging during significant societal change. Rather than considering how these changes will affect our post-pandemic futures, we could consider post-2020 to be an indefinite period of flux. During this present/future, we must strive to find new ways of telling new stories, and have the courage to reframe old stories. In doing so we must ensure innovation in medical heritage foregrounds people—the beating heart at the centre of health and its histories.

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